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Water and survival in war: Upholding IHL's protective purpose and documenting the hidden toll

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Abstract

Water is essential to life, dignity and recovery in armed conflict. Increasingly targeted, manipulated or incidentally damaged, it has become both a casualty and a weapon of war, with impacts that are often undocumented or unattributed. While there are multiple protections for water under international humanitarian law (IHL), legal indeterminacies, operational constraints and weak implementation undermine their effectiveness. This article examines patterns, drivers and types of harm relating to water in armed conflict, including reverberating effects and cumulative impacts, alongside

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the relevant legal frameworks. It advocates a protective interpretation of IHL and proposes measures including the establishment of a collaborative inter-agency mechanism to link field realities with the law, strengthening civilian protection where survival is at stake.

Keywords: armed conflict, international humanitarian law, water systems, civilian harm, cumulative impacts, monitoring mechanisms

Background and objectives

Water lies at the heart of human survival, dignity and recovery in times of armed conflict. Its availability is critical for life, health, sustaining livelihoods and ensuring community resilience. Attacks on water systems are, in effect, attacks on entire ways of life.[1] The United Nations (UN) has aptly described water as a "matter of life and death".[2]

Water resources and water systems[3] face escalating threats, in that deliberate attacks, strategic sabotage and incidental damage are becoming increasingly common.[4] Water systems rely on infrastructure, skilled personnel and consumables, yet those who operate and maintain them face growing risks, including injury and death, while the destruction of storage facilities and essential treatment chemicals has undermined operability.[5]

1 See International Committee of the Red Cross (ICRC), "Having Access to Water Is Increasingly a Matter of Survival in Conflict Zones", 21 March 2024, available at: www.icrc.org/en/document/having-access-water-increasingly-matter-survival-conflict-zones (all internet references were accessed in December 2025); Zemmali Ameur, "Dying for Water", in ICRC, *Forum: War and Water*, Geneva, 1998.

2 UN Relief and Works Agency for Palestine Refugees in the Near East, "A Matter of Life and Death: Water Runs Out for 2 Million People in Gaza", 14 October 2023, available at: www.un.org/unispal/document/a-matter-of-life-and-death-water-runs-out-for-2-million-people-in-gaza-unrwa-statement/.

3 For the purposes of this article, "water systems" refers to the full chain required to provide safe water and sanitation. This includes natural water resources (such as aquifers, rivers, springs and catchments) as well as the built components of abstraction, treatment, storage, distribution and wastewater management. It also encompasses the human, technical and energy elements necessary for service continuity, and their interdependence with the natural environment. See, for example, World Health Organization (WHO), *Guidelines for Drinking-Water Quality*, 4th ed., Geneva, 2022, pp. 49–51.

4 Peter Gleick and Morgan Shimabuku, "Water-Related Conflicts: Definitions, Data, and Trends from the Water Conflict Chronology", *Environmental Research Letters*, Vol. 18, No. 3, 2023.

5 See Michael Talhami and Mark Zeitoun, "The Impact of Attacks on Urban Services II: Reverberating Effects of Damage to Water and Wastewater Systems on Infectious Disease", *International Review of the Red Cross*, Vol. 102, No. 915, 2021; Erika Weinthal and Jeannie Sowers, "Targeting Infrastructure and Livelihoods in the West Bank and Gaza", *International Affairs*, Vol. 95, No. 2, 2019.

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The impacts are both immediate and long-term.[6] Even a single incident can trigger cascading effects across interconnected systems, revealing complex feedback loops that magnify the harm. Understanding the full scale of these cascading consequences is vital for resilient civilian protection strategies.[7] During armed conflicts, the inaccessibility, scarcity and inconsistency of data on incidents and their consequences drastically hinder protection and humanitarian action, and are further compounded by contexts of weak or collapsing local governance, overlapping climate-induced or natural disasters, and the inherent challenges of determining causation in complex emergencies.[8]

International humanitarian law (IHL) and other branches of international law provide layers of protection for water systems in both international armed conflicts (IACs) and non-international armed conflicts (NIACs).[9] However, legal indeterminacies in the interpretation and application of certain rules governing the conduct of hostilities, specifically the principles of proportionality and precaution, coupled with the operational constraints of contemporary armed conflicts, can limit their effectiveness.[10]

This article pursues three objectives: to analyze the patterns, motives and impacts of harm to water systems and the broader relationship between conflict, water and civilian vulnerability; to examine legal frameworks governing water in armed conflict and identify legal indeterminacies that hinder effective protection; and to advocate for a protective reading of IHL and for operational measures such as a World Health Organization (WHO)-style surveillance system to document

6 See Alfredo Malaret Baldo and Francesca Batault, *Second Menu of Indicators to Measure the Reverberating Effects on Civilians from the Use of Explosive Weapons in Populated Areas*, UN Institute for Disarmament Research (UNIDIR), 2022; ICRC, *War in Cities: Preventing and Addressing the Humanitarian Consequences for Civilians*, Geneva, 2023.

7 See *Protection of Civilians in Armed Conflict: Report of the Secretary-General*, UN Doc. S/2025/271, 15 May 2025 (PoC Report 2025), paras 61–65; *Protection of Civilians in Armed Conflict: Report of the Secretary-General*, UN Doc. S/2024/379, 14 May 2024 (PoC Report 2024), para. 70.

8 See PoC Report 2025, above note 7, para. 63; PoC Report 2024, above note 7, paras 56, 57; UN Environment Programme (UNEP), Res. 6/12, "Environmental Assistance and Recovery in Areas Affected by Armed Conflict", 5 March 2024, para. 4; Bárbara Morais Figueiredo and Katherine Young, *Understanding Civilian Harm from the Indirect or Reverberating Effects of the Use of Explosive Weapons in Populated Areas: Strengthening Data Collection to Implement the Political Declaration*, UNIDIR and Explosive Weapons Monitor, 15 October 2024, pp. 18, 28, 32–33, available at: https://unidir.org/wp-content/uploads/2024/10/UNIDIR-Explosive-Weapons-Monitor-Understanding-civilian-harm-from-the-indirect-or-reveberating-effects-of-the-use-of-EWIPA.pdf.

9 Geneva Water Hub (GWH), *The Geneva List of Principles on the Protection of Water Infrastructure*, Geneva, August 2019.

10 See ICRC, *International Humanitarian Law and the Challenges of Contemporary Armed Conflicts: Building a Culture of Compliance for IHL to Protect Humanity in Today's and Future Conflicts*, September 2024, pp. 7–8; Abby Zeith, "Protecting Critical Infrastructure Enabling Essential Services during Armed Conflict", in International Institute of Humanitarian Law (IIHL), *Proceedings of the 46th Round Table on Current Issues of International Humanitarian Law: Strengthening IHL Compliance: The Conduct of Hostilities, the Protection of Essential Services and Humanitarian Assistance in Contemporary Armed Conflict*, 2023, p. 56; Cordula Droege, "War and What We Make of the Law", *Humanitarian Law and Policy Blog*, 18 July 2024, available at: https://blogs.icrc.org/law-and-policy/2024/07/18/war-and-what-we-make-of-the-law/; Adil Ahmad Haque, "Indeterminacy in the Law of Armed Conflict", *International Law Studies*, Vol. 95, 2019, pp. 118–160.

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damage to water systems, harm to personnel, and the resulting humanitarian and environmental consequences.

The analysis draws on treaty law, customary IHL, practice from recent conflicts and operational insights from humanitarian action. The focus lies on IHL but is enriched by complementary legal regimes. Particular attention is paid to protracted urban conflicts, where interdependence, complexity and cumulative harm intensify both risks and responsibilities.

Water in armed conflict: A lifeline under threat

The essential role of water for civilian survival

Water is life… and death!

Water is essential to human survival and dignity. Water, sanitation and hygiene (WASH) are vital to prevent outbreaks of deadly diseases and to maintain public health, especially during emergencies. "Water is life"[11] is a phrase so often repeated that it risks becoming an empty truism, but for billions of people around the world, it remains a stark truth. In 2025, 3.5 billion people still lacked safely managed sanitation, and 2.2 billion had no access to safely managed drinking water, a global development gap with persistent effects in everyday life.[12] Within this wider crisis, a much smaller but far more urgent subset of people faces humanitarian emergency; of the roughly 300 million people requiring humanitarian assistance,[13] 177 million needed life-saving WASH support.[14] These acute needs sit within the wider global deficit but are driven, and often sharply worsened, by armed conflict, where damage to water systems, displacement and insecurity transform chronic water challenges into life-threatening conditions.[15]

"Water is death" may in fact be a more accurate motto in many places today. According to an estimate from 2019, the use of safe WASH services could have prevented at least 1.4 million deaths per year, including nearly 400,000 children under 5 years old.[16] In 2023, the UN Children's Fund (UNICEF) reported that

11 See Ban Ki-moon, "Water is Life", UN, 17 March 2008, available at: www.un.org/sg/en/content/former-secretary-general/articles/2008-03-17/water-life; GWH, *A Matter of Survival: Report of the Global High-Level Panel on Water and Peace*, Geneva, 2017, p. 11.

12 See UN-Water, "Water Facts", January 2025 (overall Sustainable Development Goal figures), available at: www.unwater.org/sites/default/files/2025-01/UN-Water_Water_Facts_one_pager_January_2025.pdf.

13 See UN Office for the Coordination of Humanitarian Affairs (OCHA), *Global Humanitarian Overview 2025*, June 2025 (humanitarian needs figures), available at: https://humanitarianaction.info/document/hyper-prioritized-global-humanitarian-overview-2025-cruel-math-aid-cuts.

14 Global WASH Cluster, Humanitarian Needs and Response Plans Dashboard 2024, available at: www.washcluster.net/GWC_Dashboards.

15 Global WASH Cluster, "2025 Call to Action for Survival and Resilient WASH", 11 July 2025, available at: www.washcluster.net/node/32886.

16 WHO, *Burden of Disease Attributable to Unsafe Drinking-Water, Sanitation and Hygiene: 2019 Update*, 2019, available at: www.who.int/publications/i/item/9789240075610.

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4,000 people die from diseases attributable to inadequate WASH every day, and over 1,000 of these deaths are among children under 5.[17] Such figures are staggering, but likely conservative. Assessing the true burden of WASH-related mortality is challenging anywhere, but in conflict settings, it becomes exceedingly difficult – data are scarce and health surveillance systems often collapse.[18] Similarly, accurate records on attacks or damage to essential services are often lacking, and thousands of deaths linked to WASH failures remain unnoticed and unattributed.[19]

Counting the hidden costs of water disruption in armed conflicts

Despite long-standing knowledge linking unsafe water and sanitation to deadly disease, dating back to Louis Pasteur's work or the engineering of modern sewer systems in Paris and London, deaths from contaminated or inaccessible water are still treated as invisible collateral.[20] When infants die from dehydration and diarrhoea in a conflict zone, their deaths rarely make headlines or, even less, are mentioned in any courtrooms.[21] The causal link between disrupted water services and civilian deaths may be obvious and intuitive to those on the ground, but in the absence of data and safe access for personnel to document incidents and their impacts or determine which actors are responsible (legal attribution), these outcomes fall through the cracks of international concern and accountability and become, at best, a little-known and soon forgotten statistic.[22]

Even though other drivers, such as under-development, water mismanagement or climate change, all contribute to water insecurity, armed conflict remains a cause of acute WASH needs.[23] This is especially true in urban areas, where populations are heavily reliant on complex essential service networks run by professional service providers or utilities.[24] In such contexts, damage or disruption

17 UNICEF, *Triple Threat: How Disease, Climate Risks, and Unsafe Water, Sanitation and Hygiene Create a Deadly Combination for Children*, March 2023, p. 6, available at: www.unicef.org/media/137206/file/triple-threat-wash-EN.pdf.

18 See Barry S. Levy and Victor W. Sidel, "Documenting the Effects of Armed Conflict on Population Health", *Annual Review of Public Health*, Vol. 37, 2016.

19 See B. Morais Figueiredo and K. Young, above note 8, pp. 13, 28; UN, *Letter Dated 8 July 2025 from the Permanent Representative of the Republic of Slovenia to the United Nations Addressed to the Secretary-General: Annex: Chair's Summary – United Nations Security Council Arria-Formula Meeting: Freshwater Resources and Related Infrastructure under Attack: Protecting Water in Armed Conflict – Protecting Civilian Lives*, UN Doc. S/2025/453, 9 July 2025, pp. 4–7, 56, 92, available at: https://documents.un.org/doc/undoc/gen/n25/183/40/pdf/n2518340.pdf.

20 See Jamie Bartram and Paul Hunter, "Bradley Classification of Disease Transmission Routes for Water-Related Hazards", in Jamie Bartram (ed.), *Routledge Handbook of Water and Health*, Routledge, Abingdon, 2015; Valia Marou *et al.*, "The Impact of Conflict on Infectious Disease: A Systematic Literature Review", *Conflict and Health*, Vol. 18, No. 1, 2024.

21 UNICEF, *Water under Fire*, Vol. 3: *Attacks on Water and Sanitation Services in Armed Conflict and the Impacts on Children*, May 2021, pp. 1–5.

22 See M. Talhami and M. Zeitoun, above note 5.

23 See Juliane Schillinger, Gül Ozerol and Michiel A. Heldeweg, "A Social-Ecological Systems Perspective on the Impacts of Armed Conflict on Water Resources Management: Case Studies from the Middle East", *Geoforum*, Vol. 133, No. 2–3, 2022.

24 See ICRC, above note 6, pp. 8–9.

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to these systems is not easily compensated for by local coping strategies, as they often lack the means or technical capacity to repair complex critical services, leaving the population without basic services and increasing health and socio-economic vulnerabilities.[25]

Critical vulnerability also stems from the nature of most water systems themselves. Like all essential services, water systems resemble vast, living organisms. They are not static in size or shape; they expand, shrink and reconfigure in response to needs and constraints. They are deeply interconnected with other systems and rely on an array of factors to function – infrastructure, but also a continuous flow of consumables such as treatment chemicals, spare parts, lubricants and fuel. Most importantly, they depend on people: in large cities, hundreds or thousands of skilled technicians and engineers work daily to operate, maintain and repair these systems.[26]

Beyond the intrinsic vulnerabilities of water infrastructure, armed conflicts significantly impact water resources.[27] For example, during the Gulf War, oil spills and the bombing of wastewater facilities contaminated surface and groundwater in Iraq and Kuwait.[28] In the conflict in eastern Ukraine, fighting near industrial sites has led to the leaching of heavy metals and toxic chemicals into the Siverskyi Donets River, the region's primary water source.[29] In Gaza, repeated damage to wastewater treatment plants has resulted in the discharge of untreated sewage into the Mediterranean and seepage into coastal aquifers.[30]

Patterns and drivers of harm to water systems in armed conflicts

The harm that befalls water systems in conflict zones does not occur in a vacuum. It stems from a range of interrelated drivers, some rooted in the behaviour of belligerents during the conduct of hostilities, and others in the intrinsic fragilities and operational dependencies of water systems.[31] The reasons driving the behaviour

25 See ICRC, *Urban Services during Protracted Armed Conflict: A Call for a Better Approach to Assisting Affected People*, Geneva, 2015, p. 14; Tadesse Kebebew, "The Imperative to Protect Water and Water Systems during Armed Conflict", *Humanitarian Law and Policy Blog*, 24 April 2025, available at: https://blogs.icrc.org/law-and-policy/2025/04/24/the-imperative-to-protect-water-and-water-systems-during-armed-conflict/.

26 See ICRC, above note 25; ICRC, *Keeping the Lights On and the Taps Running: Protecting and Facilitating Safer Access for Essential Service Providers in Armed Conflict: Executive Summary*, Geneva, 7 October 2024.

27 See ICRC, *Bled Dry: How War in the Middle East Is Bringing the Region to the Brink of a Water Catastrophe*, Geneva, 2015.

28 UNEP, *Protecting the Environment during Armed Conflict: An Inventory and Analysis of International Law*. Nairobi, November 2009, available at: https://wedocs.unep.org/rest/api/core/bitstreams/4219ddc5-8e7b-43aa-ad9d-f347ff033918/content.

29 Bohdan Vykhor and Andreas Beckmann, "Assessing the Environmental Impacts of the War in Ukraine", World Wide Fund for Nature, 20 March 2022, available at: https://wwfcee.org/our-offices/ukraine/assessing-the-environmental-impacts-of-the-war-in-ukraine.

30 UNEP, *Environmental Impact of the Conflict in Gaza: Preliminary Assessment of Environmental Impacts*, 2024.

31 See Stephanie Savell, *How Death Outlives War: The Reverberating Impact of the Post-9/11 Wars on Human Health*, Watson Institute for International and Public Affairs, Brown University, 15 May 2023.

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of belligerents vary by context but often fall into overlapping categories: tactical advantage, political control and psychological pressure.[32]

Conduct of hostilities and behaviour of parties to armed conflict

The weaponization or targeting of water sources, including diversion or control of rivers, can exacerbate water scarcity and undermine legal protections afforded to civilians and civilian infrastructure. Such actions, arising from a complex mix of tactics and broader political or military strategies, can cause multiple forms of harm: direct, indirect and cumulative.[33]

Some attacks on water systems appear intentional,[34] and facilities may indeed be targeted deliberately under various rationales: tactical, such as invoking military necessity or classifying a pumping station or reservoir as a military objective, or strategic, such as aiming to deny resources to enemy forces. In some cases, though rarely acknowledged openly, attacking water systems or cutting water supply serves as a means to force displacement or punish a population.[35] Furthermore, even when water systems are not directly targeted, they often suffer through repeated incidental damage, particularly in protracted urban fighting. Hostilities involving the use of heavy explosive weapons in populated areas cause widespread destruction that renders infrastructure inoperable.[36]

Beyond questions of intent, neglect or permissive legal interpretations also drive harm.[37] For example, reverberating effects and cumulative impacts, often unfolding over days, weeks or even months, are frequently excluded from proportionality assessments or precautionary planning.[38] This is partly because proportionality assessments are commonly applied in an atomic or isolated fashion, treating each individual attack as a discrete event. Such omissions may also stem from a genuine lack of operational data, the recognized difficulty of forecasting complex cascading effects, or deliberate disregard, under-appreciation or bad faith.[39] The long-term consequences of damaging essential service systems are often

32 See ICRC, *Explosive Weapons with Wide Area Effects: A Deadly Choice in Populated Areas*, Geneva, January 2022, p. 42; Marwa Daoudy, "Water Weaponization in the Syrian Conflict: Strategies of Domination and Cooperation", *International Affairs*, Vol. 96, No. 5, 2020, p. 1351; Tobias von Lossow, "The Rebirth of Water as a Weapon: IS in Syria and Iraq", *International Spectator*, Vol. 51, No. 3, 2016.

33 See A. Zeith, above note 10, p. 53; David Kaelin, "Consideration of Essential Services in the Planning and Conduct of Military Operations", in IIHL, above note 10, pp. 128–129.

34 See Cassandra Burns, *Protecting Water Infrastructure during War*, United States Institute of Peace, 6 December 2024; ICRC, above note 10, pp. 40, 84.

35 See e.g. Geneva Academy of International Humanitarian Law and Human Rights (Geneva Academy), *Weaponizing Water and Humanitarian Collapse in Sudan: An International Humanitarian Law Assessment*, IHL in Focus Spot Report, July 2025, pp. 6–8.

36 See ICRC, above note 32, pp. 41–48.

37 ICRC, above note 10, pp. 7–8.

38 See ICRC, *Preventing and Mitigating the Indirect Effects on Essential Services from the Use of Explosive Weapons in Populated Areas: ICRC Recommendations*, Geneva, June 2024, pp. 4–9; Isabel Robinson and Ellen Nohle, "Proportionality and Precautions in Attack: The Reverberating Effects of Using Explosive Weapons in Populated Areas", *International Review of the Red Cross*, Vol. 98, No. 1, 2016.

39 See e.g. Geneva Academy, above note 35, pp. 14–15.

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underestimated, whether sincerely or strategically, sometimes under the pretext that modelling such complex effects is not feasible. Moreover, the dual-use nature of many water-related assets further complicates assessments, increasing the risk of difficult or flawed targeting decisions.[40]

In practice, precautionary measures required by IHL, such as verifying targets or minimizing civilian harm, may be inadequately integrated into planning processes, poorly resourced, or at times de-prioritized by treating them "more as a policy option than a legal obligation".[41] In urban warfare, force protection concerns drive commanders to rely on tactics and weapon systems designed to minimize risk to their own forces.[42]

Operationally, insufficient intelligence preparation of the battlespace, limited coordination mechanisms or dialogue with humanitarian actors, and a lack of civilian expertise among planners and commanders can result in ill-informed or oversimplified assumptions about the criticality of water systems.[43] When infrastructure complexity and interdependencies are not visible to those making decisions, the likelihood of causing unintended harm rises sharply.

Lastly, and beyond military actors, a systemic lack of awareness and attention to the consequences of conflict on essential services also constitutes a driver of harm. This is both caused by and contributes to the absence of surveillance, data generation and epidemiological tracking.[44] Deaths resulting from unsafe water or damaged infrastructure are rarely captured by real-time conflict monitoring; no number of newborns dying quietly from diarrhoeal disease competes for visibility with the more immediate and graphic toll of bullets and shrapnel.[45]

Inherent vulnerabilities of water systems

Modern water and sanitation systems are complex, centralized and deeply interdependent.[46] Built for efficiency, they are vulnerable to disruption from single

40 See ICRC, *Global Initiative to Galvanize Political Commitment on International Humanitarian Law: Progress Report*, Ref. 4887, 2025, pp. 34, 42; Oona A. Hathaway, Azmat Khan and Mara R. Revkin, "The Dangerous Rise of 'Dual-Use' Objects in War", *Yale Law Journal*, Vol. 134, 2025, pp. 2699–2704; Michael N. Schmitt, "Targeting Dual-Use Structures: An Alternative Interpretation", *Articles of War*, 28 June 2021, available at: https://lieber.westpoint.edu/targeting-dual-use-structures-alternative/; Geneva Academy, above note 35, pp. 16–17.

41 See e.g. ICRC, above note 10, p. 8. See also Loren Voss, "The Overlooked Importance of Intelligence Analysis in IHL", *International Review of the Red Cross*, Vol. 107, No. 928, 2025, pp. 289–291; D. Kaelin, above note 33, p. 129.

42 ICRC, above note 6, pp. 42–48.

43 See *ibid.*, pp. 21–23; D. Kaelin, above note 33, pp. 129–130; Sahr Muhammedally, "Preparedness in Urban Operations: A Commander's Planning Checklist to Protect Civilians", *Humanitarian Law and Policy Blog*, 11 May 2021, available at: https://blogs.icrc.org/law-and-policy/2021/05/11/preparedness-in-urban-operations/.

44 Paul H. Wise, "The Epidemiologic Challenge to the Conduct of Just War: Confronting Indirect Civilian Casualties of War", *Daedalus*, Vol. 146, No. 1, 2017.

45 UNICEF, above note 21.

46 See ICRC, above note 25, p. 8.

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points of failure: a damaged pump, severed pipe, missing chemical or absent technician can disable an entire network.[47] Water systems are complex and depend on continuous flows of power, parts, staff and supplies, all of which can be interrupted by conflict-related conditions such as insecurity, sieges, fuel shortages or administrative paralysis. In urban areas, the interdependence of water, electricity, health care and sanitation amplifies these effects, where failure in one sector cascades into others.[48] Without protection, access or spare parts, even minor disruptions accumulate, leading to a gradual, systemic breakdown. Over time, the degradation can cross a tipping point beyond which recovery is impossible without peace, major investment or outside support.[49]

Types of impact

The deliberate targeting or disruption of water systems inflicts far-reaching harm,[50] with the consequences unfolding over time as a continuum of direct and indirect impacts.[51] Direct impacts occur when water infrastructure is deliberately targeted or incidentally physically damaged during hostilities. Attacks that destroy a water tower, shell a treatment plant or prevent access to a pumping station through sniper fire can instantly halt supply to entire communities. Because these systems rely on a handful of critical components, such as power lines, control systems or pumps, the destruction of a single node can paralyze an entire network.

Indirect impacts or reverberating effects are the cascading consequences that emerge following the initial physical damage to water systems. They may not be immediately visible, but their consequences unfold progressively, contributing to prolonged humanitarian crises, weakening resilience and deepening the overall civilian toll of war.[52] Indirect effects begin with the disruption of services, such as the inability to treat or distribute water due to damaged pumping stations, power outages or obstructed supply lines, and extend to broader impacts on civilians. If power

47 See e.g. PAX, *On Civilian Harm: Examining the Complex Negative Effects of Violent Conflict on the Lives of Civilians*, 2021, pp. 196–206, "Case 12: Weaponizing Drinking Water", available at: https://paxforpeace.nl/wp-content/uploads/sites/2/import/2021-06/PAX-PoC-Book-On-Civilian-Harm.pdf.

48 See ICRC, above note 6.

49 See ICRC, above note 25, pp. 9, 11; ICRC, "The ICRC's Approach to Urban Services during Protracted Armed Conflict: Q&A with Evaristo de Pinho Oliveira", *International Review of the Red Cross*, Vol. 98, No. 901, 2016, available at: https://international-review.icrc.org/sites/default/files/irc_97_901-12.pdf.

50 See ICRC, above note 27, pp. 32–33; ICRC, *When Rain Turns to Dust: Understanding and Responding to the Combined Impact of Armed Conflicts and the Climate and Environment Crisis on People's Lives*, Geneva, 2021.

51 See A. Malaret Baldo and F. Batault, above note 6; GWH, *Fully Foreseeable: The Reverberating Effects of Water and Health in Gaza*, Geneva, 2024, available at: www.genevawaterhub.org/resources/fully-foreseeable-reverberating-effects-water-and-health-gaza; M. Talhami and M. Zeitoun, above note 5.

52 See ICRC, *ICRC Expert Meeting: Preventing and Mitigating the Indirect Effects on Essential Services from the Use of Explosive Weapons in Populated Areas*, Geneva, April 2024, pp. 9–11; World Bank, ICRC and UNICEF, *Joining Forces to Combat Protracted Crises: Humanitarian and Development Support for Water and Sanitation Providers in the Middle East and North Africa*, Washington, DC, 2021, available at: www.icrc.org/sites/default/files/document_new/file_list/joining_forces_to_combat_protracted_crisis.pdf; J. Schillinger, G. Ozerol and M. A. Heldeweg, above note 23.

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to a chlorination plant is cut, treated water cannot be delivered, exposing communities to unsafe water; when water systems fail, hospitals cannot maintain hygiene or deliver safe care; and damage to irrigation networks quickly translates into crop losses and worsening food insecurity. Such interconnectedness of essential services means that the failure of one system triggers failures in others.

Cumulative effects slowly erode system integrity over time. Accumulated damage from repeated small and large incidents and attacks over time – none of which is terminal on its own, yet none of which can be fully repaired – gradually degrades water systems until they eventually fail. Chronic underfunding, deferred maintenance and the loss of skilled staff further accelerate this collapse. Unaddressed leaks, failing pumps and lost institutional memory may seem manageable alone, but together they cripple the system. In protracted conflicts, this can reach a tipping point where recovery is no longer possible, water resources are irreversibly contaminated and technical expertise is permanently lost.[53]

Overall, the humanitarian toll of degrading water systems reaches far beyond the battlefield. The true cost of armed conflict includes not only those who die from bullets or bombs but also those who die from dehydration, cholera or displacement – deaths that frequently remain uncounted and unpunished. These deaths rarely capture headlines, but they do jeopardize long-term recovery and peacebuilding.[54] Responding adequately begins with recognizing and documenting these often overlooked consequences of conflict.

Social dimensions of harm: Disproportionate effects on vulnerable groups

The impacts of armed conflict are most acutely experienced at the local level.[55] The destruction of essential services, particularly water and sanitation systems, magnifies pre-existing inequalities and creates cascading social consequences. Conflict disproportionately affects the most vulnerable members of society: women, children, persons with disabilities and displaced populations.[56] The gendered and intersectional dimensions of civilian harm remain under-documented and insufficiently addressed

53 See ICRC, above note 25, p. 9; World Bank, ICRC and UNICEF, above note 52, p. 9.

54 See North Atlantic Treaty Organization (NATO), *Protection of Civilians: Allied Command Operations Handbook*, 2021, p. 5; Mark Zeitoun, "War on Water Prolongs Misery in Gaza", *Just Security*, 17 October 2023, available at: www.justsecurity.org/89536/war-on-water-prolongs-misery-in-gaza/; C. Burns, above note 34.

55 Alexander H. Hay, Bryan Karney and Nick Martyn, "Reconstructing Infrastructure for Resilient Essential Services during and following Protracted Conflict: A Conceptual Framework", *International Review of the Red Cross*, Vol. 101, No. 912, 2019, p. 1002.

56 See Sara La Vecchia, "The Protection of Women and Girls with Disabilities in Armed Conflict: Adopting a Gender-, Age- and Disability-Inclusive Approach to Select IHL Provisions", *International Review of the Red Cross*, Vol. 104, No. 922, 2022; Ellen Policinski and Jovana Kuzmanovic, "Protracted Conflicts: The Enduring Legacy of Endless War", *International Review of the Red Cross*, Vol. 101, No. 912, 2019, pp. 970–973; OHCHR, *Protection of Economic, Social and Cultural Rights in Conflict*, Report No. E/2015/59, 2015, paras 39–42; UNICEF, above note 21, pp. 38, 43.

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in military operations;[57] for instance, women who must travel farther to obtain water, through insecure and hazardous areas, face heightened risks in conflict.[58] Children, too, face unique vulnerabilities as lack of access to clean water and sanitation exposes them to heightened risks of waterborne disease, undernutrition and hygiene-related infections.[59] Similarly, persons with disabilities face the disproportionate impact of armed conflicts, including barriers to accessing essential services and humanitarian aid.[60]

For displaced populations, particularly those living in informal settlements or overcrowded shelters, the absence of adequate water systems significantly raises the likelihood of disease outbreaks and environmental health crises.[61] In some cases, these impacts cross borders, where an influx of refugees heightens water demand, straining systems and deepening vulnerabilities for both newcomers and host communities.

From a legal standpoint, these realities raise critical questions regarding the application of the principles of proportionality and precaution under IHL. The foregoing social dimensions of harm must be made visible and integrated into the concrete obligations of parties to armed conflict in order to prevent and mitigate them. This requires the systematic collection of disaggregated data, context-specific analysis and the integration of these social dimensions into standard operating procedures, military manuals and training programmes.

Legal frameworks protecting water systems

International humanitarian law

Under IHL, the protections given to civilians and civilian objects are non-negotiable. When it comes to water and water infrastructure, IHL offers layers of protection for

57 See ICRC, *Gendered Impacts of Armed Conflicts and Implications for the Application of IHL*, Report No. 4634, 29 June 2022; Marni Sommer, Suzanne Ferron, Sue Cavill and Sarah House, "Violence, Gender and WASH: Spurring Action on a Complex, Under-Documented and Sensitive Topic", *Environment and Urbanization*, Vol. 27, No. 1, 2015; Alon Margalit, "Still a Blind Spot: The Protection of LGBT Persons during Armed Conflict and Other Situations of Violence", *International Review of the Red Cross*, Vol. 100, No. 907–909, 2018, pp. 242, 264.

58 See UNSC Res. 1325, 31 October 2000; ICRC, above note 57, pp. 18–19; UNICEF and WHO, *Progress on Household Drinking Water, Sanitation and Hygiene 2000–2022: Special Focus on Gender*, New York, 2023.

59 UNICEF, above note 21.

60 See UNSC Res. 2475, 20 June 2019, Preamble. See also *Report of the Special Rapporteur on the Rights of Persons with Disabilities in the Context of Armed Conflict*, UN Doc. A/76/146, 19 July 2021, para. 47; Alice Priddy, *Disability and Armed Conflict*, Geneva Academy Briefing No. 15, 2019; Bogna Ruminowicz, "Advancing Towards Inclusive Peace and Security: Persons with Disabilities and Security Council Resolution 2475", *International Review of the Red Cross*, Vol. 105, No. 922, 2023.

61 See Dieudonne Bwirire, Rik Crutzen, Edmond Ntabe Namegabe, Rianne Letschert and Nanne de Vries, "Health Inequalities in Post-Conflict Settings: A Systematic Review", *PLoS ONE*, Vol. 17, No. 3, 2022; Kate Zinszer and Samer Abuzerr, "Water, Sanitation and Hygiene Insecurity and Infectious Disease Outbreaks among Internally Displaced Populations in Gaza: Implications of Conflict-Driven Displacement on Public Health", *Journal of Water, Sanitation and Hygiene for Development*, Vol. 14, No. 11, 2024.

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water systems and essential services, but a few uncertainties remain. To begin with, a fundamental principle of IHL states that "the right of the parties to the conflict to choose methods or means of warfare is not unlimited".[62] The first layer of protection stems from the general rules governing the conduct of hostilities. IHL requires parties to adhere to the principles of distinction, proportionality and precaution in both IACs and NIACs.[63]

The principle of distinction necessitates discriminating between civilian and military objects and prohibits both direct and indiscriminate attacks against civilian objects.[64] Water systems, in principle, benefit from the presumption and protection accorded to civilian objects and, hence, must be spared from direct attacks, including indiscriminate attacks, reprisals and excessive incidental harm.[65] Even when water systems become a military objective, the principle of proportionality in attack prohibits launching an attack which may be expected to cause excessive collateral damage.[66] In most instances, the extensive consequences outlined above far outweigh any military advantages of targeting water systems.

In addition, IHL obliges parties to a conflict to take constant care to spare water systems and civilians.[67] Those who plan, decide upon and execute attacks must do everything feasible to verify that their targets are military objectives and that it is not prohibited to attack them.[68] Parties to an armed conflict must also take all feasible precautions to protect the civilian population and civilian objects under their control against the effects of attacks, and they should avoid locating, to the maximum extent feasible, military objectives in the vicinity of water systems.[69]

Furthermore, during the conduct of hostilities, the use of certain means of warfare or weapons is prohibited, which is relevant for the protection of water. For example, IHL prohibits the use of poison or poisoned weapons intended or designed to kill or injure humans, which includes the poisoning of wells and water supplies.[70]

62 See Protocol Additional (I) to the Geneva Conventions of 12 August 1949, and relating to the Protection of Victims of International Armed Conflicts, 1125 UNTS 3, 8 June 1977 (entered into force 7 December 1978) (AP I), Art. 35; Hague Regulations concerning the Laws and Customs of War on Land, Annexed to Hague Convention (IV) respecting the Laws and Customs of War on Land, 18 October 1907 (entered into force 26 January 1910) (Hague Regulations), Art. 22.

63 For a detailed analysis of legal protections for freshwater resources and related installations, see GWH, above note 9, which offers a comprehensive list of protections in international law.

64 AP I, Arts 48, 51(2), 52(2); Jean-Marie Henckaerts and Louise Doswald-Beck (eds), *Customary International Humanitarian Law*, Vol. 1: *Rules*, Cambridge University Press, Cambridge, 2005 (ICRC Customary Law Study), Rule 1, p. 3, and Rule 7, p. 25, available at: https://ihl-databases.icrc.org/en/customary-ihl/rules.

65 ICRC Customary Law Study, above note 64, Rule 7, p. 25, Rule 11, p. 37, and Rule 12, p. 40.

66 AP I, Art. 51(5)(b); ICRC Customary Law Study, above note 64, Rule 14, p. 46.

67 AP I, Art. 57; ICRC Customary Law Study, above note 64, Rule 15, p. 51.

68 AP I, Art. 57; ICRC Customary Law Study, above note 64, Rule 16, p. 55.

69 AP I, Art. 58; ICRC Customary Law Study, above note 64, Rules 15–24, pp. 51–76.

70 ICRC Customary Law Study, above note 64, Rule 72; ICRC, *Guidelines on the Protection of the Natural Environment in Armed Conflict: Rules and Recommendations Relating to the Protection of the Natural Environment under International Humanitarian Law, with Commentary*, Geneva, 2020 (ICRC Guidelines), Rule 19, paras 219, 221. See also GWH, above note 9, Principle 5.

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The second layer consists of special protections for certain objects (works and installations containing dangerous forces, and the natural environment) against attacks and reprisals, and the prohibition of some specific methods of warfare. With regard to methods of warfare, IHL prohibits "attack[ing], destroy[ing], remov[ing] or render[ing] useless objects indispensable to the survival of the civilian population", such as "drinking water installations and supplies and irrigation works".[71] The scope of the prohibition is broad and includes acts such as polluting or contaminating water resources (rendering water useless) that are indispensable for the survival of civilians. The only exceptions to the prohibition against attacking such objects are if they qualify as military objectives (i.e., where such objects are used as sustenance solely by members of armed forces, or are used in direct support of military action, and provided that such an attack may not be expected to result in the starvation of the civilian population or force its movement) or if the attack is in defence of a party's national territory against invasion by another "Party to the conflict within such territory under [the defending party's] own control, where required by imperative military necessity".[72] Related to this, IHL prohibits the use of starvation of civilians, including indiscriminate use of starvation as a method of warfare against civilians and combatants alike (when the measure cannot be or is not directed exclusively at armed forces).[73]

When it comes to objects with special protection, IHL prohibits attacking works containing dangerous forces, such as dams and dykes, and other military objectives located at or in their vicinity.[74] These protections are vital because even when such objects become military objectives, they shall not be attacked save for some stringent exceptions – i.e., only if they are used for other than their normal function and in regular, significant and direct support of military operations, and if an attack is the only feasible way to terminate such support.[75] It is interesting to note, however, that the customary IHL rules (though exceptions are discussed in commentaries)[76] and the treaty rules for NIACs do not include the exceptions enshrined under the corresponding treaty provisions for IACs – i.e., Articles 54 and 56 of Additional Protocol I (AP I).

Moreover, water resources benefit from the general and special protections given to the natural environment under IHL.[77] Among other protections, the use

71 AP I, Art. 54; Protocol Additional (II) to the Geneva Conventions of 12 August 1949, and relating to the Protection of Victims of Non-International Armed Conflicts, 1125 UNTS 609, 8 June 1977 (entered into force 7 December 1978) (AP II), Art. 14. See also ICRC Guidelines, above note 70, Rule 10, paras 148, 150–152.

72 AP I, Art. 54(5). For the previous exception, see AP I, Art. 54(3)(a)–(b).

73 See ICRC, above note 10, pp. 45–46; ICRC, *Food Security and Armed Conflict*, October 2022, p. 1, available at: https://shop.icrc.org/food-security-and-armed-conflict-pdf-en.html.

74 AP I, Art. 56; AP II, Art. 15.

75 AP I, Art. 56(2). See also Mara Tignino, Tadesse Kebebew and Caroline Pellaton, "International Law and Accountability for the Nova Kakhovka Dam Disaster", *Articles of War*, 13 July 2023, available at: https://lieber.westpoint.edu/international-law-accountability-nova-kakhovka-dam-disaster/.

76 See ICRC Customary Law Study, above note 64, Rule 42, p. 141, and Rule 54, pp. 192–193.

77 See ICRC Guidelines, above note 70, paras 16–17. The natural environment is also protected by the general IHL rules on the conduct of hostilities by virtue of its civilian character: see *ibid.*, para. 95 and Rules

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of means or methods of warfare (not just attacks) that are intended or may be expected to cause widespread, long-term and severe damage to the natural environment is prohibited.[78] Water systems shall not be made the object of attack, even when they become military objectives, if such an attack is intended or may be expected to cause damage to the environment meeting this threshold.[79] Under the Rome Statute of the International Criminal Court (ICC), intentionally launching an attack in the knowledge that it will cause widespread, long-term and severe damage to the natural environment that would be disproportionate constitutes a war crime.[80]

Specific to the situation of occupation,[81] an Occupying Power must take all measures in its power to restore and ensure, as far as possible, public order and civil life in the occupied territory; to ensure, by all the means at its disposal, the necessities of life for the population in the occupied territory;[82] and to maintain public health and hygiene in the occupied territory.[83] If it cannot do so, a mandatory relief scheme is introduced.[84] In addition to ensuring unhindered access to humanitarian relief, IHL mandates the protection of humanitarian relief personnel and objects.[85] Thus, the Occupying Power must grant rapid and unimpeded passage and access to water-related personnel and consignments used for humanitarian relief operations, including the operation, repair or rehabilitation of water and related facilities. Occupying Powers must also respect the human rights of the population in the occupied territory, including the rights to water and sanitation.[86]

5–9. For more detail on IHL protecting the natural environment and, more specifically, its special protections, see *ibid.*, Rules 1–4; Helen Obregón Gieseken and Vanessa Murphy, "The Protection of the Natural Environment under International Humanitarian Law: The ICRC's 2020 Guidelines", *International Review of the Red Cross*, Vol. 105, No. 924, 2023, pp. 1186–1194.

78 See AP I, Arts 35(3), 55; ICRC Customary Law Study, above note 64, Rules 43–45, pp. 143–158; ICRC Guidelines, above note 70, Rule 2 and commentary.

79 See ICRC Guidelines, above note 70, Rule 2, para. 49; International Law Commission, *Principles on Protection of the Environment in Relation to Armed Conflicts, with Commentaries*, UN Doc. A/77/10, 2022 (PERAC Principles), Principle 13(2)(b); GWH, above note 9, Principle 15.

80 Rome Statute of the International Criminal Court, 2187 UNTS 90, 17 July 1998 (entered into force 1 July 2002) (Rome Statute), Art. 8(2)(b)(iv); ICC Office of the Prosecutor, *Policy on Addressing Environmental Damage through the Rome Statute*, December 2025, para. 36, available at: www.icc-cpi.int/sites/default/files/2025-12/2025-env-eng.pdf; ICRC Guidelines, above note 70, Rule 28, para. 313.

81 Hague Regulations, above note 62, Art. 43.

82 Geneva Convention (IV) relative to the Protection of Civilian Persons in Time of War of 12 August 1949, 75 UNTS 287 (entered into force 21 October 1950) (GC IV), Art. 55. See also International Court of Justice (ICJ), *Obligations of Israel in Relation to the Presence and Activities of the United Nations, Other International Organizations and Third States in and in Relation to the Occupied Palestinian Territory*, Advisory Opinion, 22 October 2025 (Obligations of Israel Advisory Opinion), paras 128–133.

83 GC IV, Art. 56; Obligations of Israel Advisory Opinion, above note 82, paras 128–133.

84 GC IV, Art. 59; Obligations of Israel Advisory Opinion, above note 82, paras 93–109.

85 See ICRC Customary Law Study, above note 64, Rules 31–32, pp. 105–111.

86 ICJ, *Legal Consequences of the Construction of a Wall in the Occupied Palestinian Territory*, Advisory Opinion, 9 July 2004 (Wall Advisory Opinion), paras 111–114, 130.

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Complementary legal regimes and other normative initiatives

Protections for water systems under IHL are reinforced by complementary norms in international human rights law, international criminal law and international environmental law, all aimed at protecting human life and dignity.[87] The human rights to water and sanitation are globally recognized,[88] and water is essential for the realization of all other human rights, including the right to a clean, healthy and sustainable environment.[89] Attacks on water systems violate the human rights to water and sanitation, which are indispensable for leading a life in dignity, and infringe upon other rights, such as the right to life, health and food.[90] The fundamental nature of these rights and the scale and severity of the impacts of their violation on the survival and dignity of civilian populations elevate such attacks to serious human rights violations.[91]

As elaborated earlier, IHL prohibits the use of starvation as a method of warfare against civilians, including by attacking, destroying, removing or rendering useless objects indispensable to the survival of the civilian populations. Under the Rome Statute of the ICC, intentionally using starvation of civilians as a method of warfare, by depriving them of objects indispensable to their survival such as drinking water supplies, is a war crime in both IACs and NIACs.[92] The systematic deprivation of water can amount to the crime against humanity of extermination – i.e., the intentional infliction of conditions of life calculated to bring about the destruction of a population.[93] Such deprivation could constitute an underlying material act of the crime of genocide.[94] The Genocide Convention also obliges States to prevent acts that could create or inflict "conditions of life calculated to

87 See *ibid.*; ICRC Guidelines, above note 70, paras 25–40; UNEP, above note 28; Mara Tignino and Tadesse Kebebew, "The Legal Protection of Freshwater Resources and Related Installations during Warfare", *Journal of International Criminal Justice*, Vol. 20, No. 5, 2022.

88 UNGA Res. 64/292, "The Human Right to Water and Sanitation", 3 August 2010; HRC Res. 15/9, "Human Rights and Access to Safe Drinking Water and Sanitation", 6 October 2010.

89 UNGA Res. 64/292, above note 88, para. 1; HRC Res. 15/9, above note 88, para. 2. See also GWH, above note 9, Principle 3.

90 UN Committee on Economic, Social and Cultural Rights, General Comment No. 15, "The Right to Water (Arts. 11 and 12 of the Covenant)", 20 January 2003 (General Comment 15); UN Human Rights Committee, General Comment No. 36, "Article 6 (Right to Life)", 3 September 2019 (General Comment 36), para. 71.

91 See Wall Advisory Opinion, above note 86, paras 104–113, 130; *Report of the Detailed Findings of the Independent International Commission of Inquiry on the Protests in the Occupied Palestinian Territory*, UN Doc. A/HRC/40/CRP.2, 18 March 2019, paras 80–83; *Progress Towards the Realization of the Human Rights to Water and Sanitation (2010–2020): Report of the Special Rapporteur on the Human Rights to Safe Drinking Water and Sanitation*, UN Doc. A/HRC/45/11, 6 August 2020, para. 5.

92 Rome Statute, above note 80, Art. 8(2)(b)(xvii), 8(2)(e)(xiii); ICRC Customary Law Study, above note 64, Rule 156, pp. 580 (for IAC), 599 (for NIAC). The commentary indicates that "using starvation of civilians as a method of warfare by depriving them of objects indispensable to their survival, including by impeding relief supplies", amounts to a war crime in both IAC and NIAC. See also Mara Tignino, "The Regulation of Crimes against Water in Armed Conflicts and Other Situations of Violence", *International Review of the Red Cross*, Vol. 105, No. 923, 2023.

93 Rome Statute, above note 80, Art. 7(2)(b).

94 *Ibid.*, Art. 6(c).

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bring about the physical destruction of a group",[95] such as poisoning of water and destruction of water systems. In this context, the ICC Prosecutor's 2025 *Policy on Addressing Environmental Damage through the Rome Statute* represents a significant advancement in linking water-related harm with international criminal law.[96] Similarly, the emerging recognition of ecocide as an international crime reflects growing concern over environmental harm, including the destruction of water systems.[97]

The *Principles on Protection of the Environment in Relation to Armed Conflicts* (PERAC Principles), developed by the UN International Law Commission, emphasize that the environment must be respected and protected in accordance with applicable international laws.[98] They combine legal rules, principles and practices of States and non-State actors to strengthen environmental protection, including through prevention, mitigation and remediation measures.[99] They apply across the entire conflict cycle – before, during, and after conflicts, including situations of occupation – and are generally applicable in both IACs and NIACs. Specific to occupation, in its 2024 Advisory Opinion on the Occupied Palestinian Territory, the ICJ reaffirmed that an Occupying Power is obliged to protect the environment and natural resources of the population under occupation.[100] The PERAC Principles recognize the importance of designating areas of environmental importance as protected zones in the event of an armed conflict, and encourage States to do so.[101] As water resources are part of the environment, rules and principles of international law are relevant to their protection.[102]

The International Committee of the Red Cross (ICRC) *Guidelines on the Protection of the Natural Environment in Armed Conflict* (ICRC Guidelines) set out existing IHL rules that protect the natural environment in armed conflicts, and recognize that environmental protection, including of water resources, is reinforced by other applicable rules of international law.[103] Underpinned by the drafting history of AP I, particularly Articles 35 and 55, the Guidelines set out the ICRC's understanding of the notion of the natural environment for the purposes of IHL, as constituting the natural world together with the system of inextricable interrelations

95 Convention on the Prevention and Punishment of the Crime of Genocide, 78 UNTS 277, 9 December 1948 (entered into force 12 January 1951), Art. 2(c).

96 See ICC Office of the Prosecutor, above note 80.

97 See Stop Ecocide Foundation, *Independent Expert Panel for the Legal Definition of Ecocide: Commentary and Core Text*, June 2021, available at: www.stopecocide.earth/legal-definition.

98 See PERAC Principles, above note 79, Principle 13.

99 *Ibid.*, Principle 2. See also ICRC, "Interview with Marja Lehto, Former International Law Commission Special Rapporteur on the Protection of the Environment in Relation to Armed Conflicts", *International Review of the Red Cross*, Vol. 105, No. 924, 2023, p. 1170.

100 ICJ, *Legal Consequences Arising from the Policies and Practices of Israel in the Occupied Palestinian Territory, Including East Jerusalem*, Advisory Opinion, 19 July 2024, para. 124.

101 PERAC Principles, above note 79, Principles 4, 18. For a similar suggestion, see GWH, above note 9, Principle 11(3); H. Obregon Gieseken and V. Murphy, above note 77, pp. 1197–1201.

102 PERAC Principles, above note 79, Principles 13–14.

103 ICRC Guidelines, above note 70, paras 25–40.

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between living organisms and their inanimate environment. The natural environment encompasses everything that exists or occurs naturally, including bodies of water, along with "natural elements that are or may be the product of human intervention", such as drinking water.[104] The ICRC Guidelines emphasize the risks of using water as a method of warfare and the potential indiscriminate harm that this may cause, while commentary on proportionality, precaution and weapons highlights, *inter alia*, threats to reservoirs, aquifers and wastewater systems.[105] Rule 9 and Recommendation 17 of the ICRC Guidelines specifically call for the protection of areas of particular environmental importance or fragility.[106]

Meanwhile, the UN Security Council has recognized the interconnectedness of essential civilian services, condemning unlawful attacks on and the misuse of objects indispensable to the survival of the civilian population in Resolution 2573 of 2021. In its preamble, the resolution specifically refers to "objects critical to the delivery of essential services" as falling within this category of protection. Similarly, Resolution 2417 of 2018, adopted unanimously, highlights the link between armed conflict and conflict-induced food insecurity and affirms the need to protect water resources and infrastructure that support food security and public health.[107] The Security Council's Arria-formula meetings[108] and the UN Secretary-General's annual reports on the protection of civilians have consistently emphasized the grave consequences of damage to or destruction of water systems during armed conflict.[109]

Finally, relevant to NIACs, Geneva Call's Deed of Commitment on the Prevention of Starvation and Addressing Conflict-Related Food Insecurity allows armed non-State actors to commit to respecting water systems.[110] It should be noted that most of the IHL rules discussed in this article also apply to armed groups. The Deed of Commitment explicitly includes drinking water and water installations as objects essential for civilian survival. While uptake has been limited so far,[111] the initiative represents an important way to promote greater ownership of existing legal obligations by armed groups and to reinforce the protection of water in conflict.

104 *Ibid.*, para.16.

105 *Ibid.*, paras 57, 79, 82.

106 *Ibid.*, paras 114, 208. See also ICRC, above note 10, pp. 51–52.

107 UNSC Res. 2573, 27 April 2021, preambular para. 8; UNSC Res. 2417, 24 May 2018, paras 1–2.

108 For example, "Achieving a Better Protection of Water-Related Essential Services and Infrastructure for the Civilian Population during Armed Conflicts", convened by Switzerland and Mozambique on 22 March 2023, and "Freshwater Resources and Related Infrastructure under Attack: Protecting Water in Armed Conflict – Protecting Civilian Lives", convened by Slovenia, Algeria, Panama and Sierra Leone on 23 May 2025.

109 See PoC Report 2025, above note 7; PoC Report 2024, above note 7.

110 Geneva Call, *Deed of Commitment on the Prevention of Starvation and Addressing Conflict-Related Food Insecurity*, Geneva, 2021.

111 To date, only one armed group, Nduma pour la Défense du Congo-Rénové/Guidon, has signed this Deed of Commitment. See Geneva Call, "Deeds of Commitment", available at: www.genevacall.org/deed-of-commitments/.

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From norms to practice: Challenges and avenues for implementation

Legal ambiguities and misuse of protections

The rules on the conduct of hostilities aim to balance military necessity and humanitarian protection, but their interpretation by some States increasingly drifts from this purpose.[112] First, navigating the inherent indeterminacies of some key conduct of hostilities rules and the language used therein, which requires evaluating several legal and factual factors, remains a significant challenge.[113] Such indeterminacies are not inherently problematic but require IHL to be applied in line with its core values, especially the protection of human life.[114]

Second, with regard to the notion of "attacks", IHL primarily regulates *individual attacks* directed at clearly separated and distinct military objectives, or at most, "a specific tactical operation".[115] This focus presents an inherent limitation: the risk of treating complex infrastructure as a collection of discrete or isolated objects, thereby overlooking system-level impacts and failing to account for how the loss of one component can disrupt other essential services. Besides, the cumulative effects of repeated strikes, particularly their long-term impact on the resilience of communities and infrastructure, are not *explicitly* addressed in most legal provisions, and some parties to armed conflicts overlook the factor of cumulative civilian harm.[116] Although an individual attack may not clearly breach IHL, the recurring nature of military operations, when assessed in a broader context, can raise serious legal and humanitarian concerns, as their aggregate impact can exceed the sum of their parts.[117] A caveat is that commanders should not be required to assess operations beyond their control or knowledge, as this could undermine legal and operational predictability.

Third, despite being a central pillar of the law governing the conduct of hostilities, the proportionality rule remains fraught with legal and operational ambiguity. One of the key sources of indeterminacy lies in the definition and application of the notion of the *concrete* and *direct* military advantage anticipated. The ICRC Commentary on AP I clarifies that such an advantage must be substantial and relatively proximate in time, thereby excluding benefits that are merely long-term,

112 See ICRC, above note 10, pp. 36–42.

113 Marco Sassòli, *International Humanitarian Law: Rules, Controversies, and Solutions to Problems Arising in Warfare*, Edward Elgar, Cheltenham, 2nd ed., 2024, pp. 388–390; A. A. Haque, above note 10, pp. 126–135, 145–151; C. Droege, above note 10; Marco Sassòli, "Israel–Hamas 2023 Symposium – Assessing the Conduct of Hostilities in Gaza: Difficulties and Possible Solutions", *Articles of War*, 30 October 2023, available at: https://lieber.westpoint.edu/assessing-conduct-hostilities-gaza-difficulties-possible-solutions/.

114 See C. Droege, above note 10.

115 Yves Sandoz, Christophe Swinarski and Bruno Zimmermann (eds), *Commentary on the Additional Protocols*, ICRC, Geneva, 1987 (ICRC Commentary on the APs), para. 2207.

116 PoC Report 2024, above note 7, para. 59.

117 See Wolfgang Benedek, Veronika Bílková and Marco Sassòli, *Report on Violations of International Humanitarian and Human Rights Law, War Crimes and Crimes against Humanity Committed in Ukraine Since 24 February 2022*, Organization for Security and Co-operation in Europe, 2022, pp. 25–31.

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speculative or political in nature.[118] The International Criminal Tribunal for the former Yugoslavia (ICTY) held in the *Galić* case that the proportionality judgment must be made based on the information reasonably available at the time, not in hindsight, but the line between ignorance and negligence remains difficult to draw.[119] In practice, some military doctrines and State practices have stretched the notion of anticipated advantage to encompass strategic or cumulative benefits achieved over time, raising concerns about the potential for overly broad justifications of otherwise destructive actions.[120] The expansive interpretation has been strongly criticized by others, who reject the linkage between the assessment of proportionality and the overall course of a conflict.[121] Further complicating matters, IHL compliance is increasingly shaped by politicized legal narratives, where civilian harm is too often assessed in light of political interests and the attacker's identity rather than legal standards.[122] Hopefully, current initiatives such as the Global Initiative to Galvanize Political Commitment to IHL can help refocus attention on a culture of compliance, providing practical guidance to strengthen IHL implementation, including effective protection of civilian infrastructure.[123]

Fourth, there is still uncertainty on whether and how to quantify and weigh the reverberating effects of attacks on water. The ICRC and UN bodies assert that all reasonably foreseeable reverberating effects, such as disease outbreaks from water shortages or displacement caused by infrastructure collapse, must be factored into proportionality and precaution assessments, based on available information and past practice.[124] This view is supported by both textual and purposive interpretations of IHL.[125] The scope of what is "reasonably foreseeable" is inherently relative and evolves over time, allowing IHL to adapt as empirical evidence and operational experience grow.[126] Some further argue that "systemic impacts" critical to the functioning of society or the State should be included, though doing so requires interdisciplinary expertise that is not yet consistently incorporated into military practice.[127]

Fifth, with regard to the prohibition of starvation as a method of warfare, there are differing views on whether it applies only to deliberate or purposeful starvation of the civilian population, or whether it also extends to situations where,

118 ICRC Commentary on the APs, above note 115, para. 2209.

119 ICTY, *Prosecutor v. Galić*, Case No. IT-89-29-T, Judgment (Trial Chamber), 5 December 2003, para. 58.

120 Sigrid Redse Johansen, "Military Necessity and the Scope and Nature of Military Advantage", in Sigrid Redse Johansen, *The Military Commander's Necessity: The Law of Armed Conflict and Its Limits*, Cambridge University Press, Cambridge, 2019.

121 See M. Sassòli, above note 113, pp. 388–393.

122 PoC Report 2025, above note 7, para. 53.

123 ICRC, *Global Initiative to Galvanise Political Commitment to International Humanitarian Law*, December 2024, p. 7, available at: www.icrc.org/sites/default/files/media_file/2024-12/Global_initiative_to_Galvanise_pol_commitment_to_IHL_Web.pdf.

124 ICRC Guidelines, above note 70, paras 120–121; PoC Report 2024, above note 7, paras 54, 59; ICRC, above note 52.

125 See I. Robinson and E. Nohle, above note 38.

126 ICRC, above note 38, paras 3.2, 3.9; PoC Report 2024, above note 7, paras 64–66.

127 See Joshua Joseph Niyo, "Systemic Impacts of War in Protracted Conflicts", *Articles of War*, 22 October 2024, available at: https://lieber.westpoint.edu/systemic-impacts-war-protracted-conflicts/.

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although not intended, the starvation of civilians is a "foreseeable consequence of a particular course of action".[128] As per the ICRC, to "use starvation as a method of warfare means to provoke it deliberately" – such as by depriving a population of water or destroying water supplies – and is not confined to acts taken with the *specific purpose* of starving civilians.[129] Thus, cutting off the water supply and other essentials necessary for the survival of civilians and restricting humanitarian access as a method of warfare may constitute violations of the prohibition, even if the measures were not taken for the specific purpose of starving civilians. It has to be noted that the prohibition does not require waiting until civilians are *actually* starved, nor does it cover all starvation, such as that arising from the disruption of transport systems as an incidental result of the armed conflict, unless a party to the conflict was seeking to provoke starvation via such means.[130]

Finally, the treatment of dual-use objects – those serving both civilian and military purposes – remains an unresolved issue.[131] Key questions include whether their civilian components must be considered in proportionality assessments or treated as wholly military in nature. The ICRC emphasizes that in planning attacks against critical infrastructure used simultaneously by civilians and armed forces, decisions on target selection, proportionality and precautions must be based on robust, multidisciplinary intelligence.[132]

In general, addressing the above-mentioned issues requires that the interpretation and application of IHL be guided by its core objectives, foremost upholding humanity in war. Overly permissive readings of the rules on the conduct of hostilities risk eroding the balance between military necessity and civilian protection.

Practical barriers to effective compliance

Beyond challenges with the legal doctrine, a range of practical and operational challenges obstruct effective compliance with IHL to protect water systems during armed conflict. A critical gap lies in the scarcity of both direct and indirect data on the impacts of attacks on water systems. While some data exist for health infrastructure, most notably through WHO-supported systems such as the Surveillance System for Attacks on Healthcare (SSA) and the Health Resources and Services Availability Monitoring System (HeRAMS),[133] comparable mechanisms for water systems are lacking. The SSA collects and verifies data on attacks on health-care facilities (e.g., bombings, killings, looting) across multiple countries, providing a

128 See e.g. Dapo Akande and Emanuela-Chiara Gillard, "Conflict-Induced Food Insecurity and the War Crime of Starvation of Civilians as a Method of Warfare: The Underlying Rules of International Humanitarian Law", *Journal of International Criminal Justice*, Vol. 17, No. 4, 2019, p. 761; Sean Watts, *Under Siege: International Humanitarian Law and Security Council Practice Concerning Urban Siege Operations*, Research and Policy Paper, Counterterrorism and Humanitarian Engagement Project, May 2014, p. 10.

129 See ICRC, above note 10, p. 45.

130 See *ibid.*, pp. 45–46.

131 ICRC, above note 123.

132 *Ibid.*, p. 42.

133 The SSA is available at: https://extranet.who.int/ssa/Index.aspx. HeRAMS is available at: www.herams.org.

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standardized global record and supporting advocacy and protection measures, while HeRAMS monitors the availability and functionality of health facilities and services in fragile and conflict-affected settings, offering real-time information to facilitate humanitarian response and resource allocation. A similar mechanism is needed to document and verify attacks on or disruptions of water systems, which have been under-reported to date, and to support operational responses and enable stronger assessments of compliance with IHL obligations.

The lack of data in this area hampers humanitarian response planning, limits awareness among belligerents that would impact their planning and execution of military operations, and weakens post-conflict accountability and legal analysis. Compounding this is the chronic scarcity of epidemiological data that can link water system damage to public health outcomes.[134] Epidemiological data refers to the systematic collection and analysis of information on disease incidence, mortality, causes of death and related health trends over time. Such longitudinal datasets allow researchers to identify patterns, establish correlations or causation, and quantify the public health consequences of disrupted water services. Without these data, it is difficult to measure increases in waterborne diseases, malnutrition or other health crises that may result from damage to or failures in water systems.

These gaps are exacerbated by institutional and operational dynamics. Military and humanitarian actors alike tend to prioritize immediate life-saving operations, such as food and emergency drinking water distribution, often at the expense of systemic or preventive water interventions.[135] Operational risk aversion, security constraints and donor preferences further narrow attention to short-term results. In parallel, the coordination among legal advisors, WASH specialists and militaries during armed conflicts is not that strong.[136] Protection concerns are frequently siloed, and WASH actors lack access to military decision-making structures or legal channels that seek to influence targeting and precautionary measures.[137]

Another key barrier is the low visibility of water-related harm. While the kinetic effects of warfare, such as deaths from air strikes, are relatively better documented and publicized, indirect consequences receive far less attention. This "invisibility" reduces public and political pressure to address violations.

Finally, evolving military doctrines such as "total defence", "smart warfare", "whole-of-society" and "large-scale combat operations" (LSCO) increasingly risk

134 See V. Marou *et al*., above note 20; Catarina de Albuquerque and Virginia Roaf, *On the Right Track: Good Practices in Realising the Rights to Water and Sanitation*, 2012.

135 See Edoardo Borgomeo, "Delivering Water Services during Protracted Armed Conflicts: How Development Agencies Can Overcome Barriers to Collaboration with Humanitarian Actors", *International Review of the Red Cross*, Vol. 101, No. 912, 2019, pp. 1068–1070.

136 See D. Kaelin, above note 33, pp. 128–130; ICRC, "ICRC President: All Parties to an Armed Conflict Have Non-Negotiable Legal Obligations to Ensure Water Remains Accessible during War", speech given during the UN Security Council Arria-Formula Meeting "Protecting Water in Armed Conflict – Protecting Civilian Lives", 23 May 2025, available at: www.icrc.org/en/statement/icrc-president-all-parties-armed-conflict-legal-obligations-ensure-water-accessible.

137 See ICRC, *Keeping the Lights On*, above note 26, pp. 24–27; OCHA and Inter-Agency Standing Committee, *Civil-Military Guidelines and Reference for Complex Emergencies*, New York, 2008.

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blurring the line between civilian and military infrastructure.[138] When water networks function as dual-use objects, they are more likely to be treated as lawful military objectives, raising complex challenges for applying the IHL principles of distinction and proportionality, especially under the strain and tempo of high-intensity LSCO. The operational scale and velocity of such campaigns can overwhelm existing protection frameworks and impair the conduct of effective civilian harm mitigation measures.[139] Addressing these structural and doctrinal barriers is essential to ensure the law's effectiveness in practice.

The case for a protective interpretation of IHL

Civilian harm in contemporary conflicts has multiple sources and is complex and overlapping.[140] This section makes the case for a protective and context-sensitive interpretation of IHL, one that remains faithful to IHL's foundational purpose of avoiding or reducing human suffering. In an era of increasingly urban and protracted warfare, such an approach calls for the inclusion of indirect, reverberating and cumulative effects in the interpretation and application of key rules governing the conduct of hostilities.

IHL is a living body of law, capable of evolving to reflect current operational realities and accumulated knowledge.[141] The principle of humanity and the obligation to interpret IHL in good faith reinforce its protective purpose. For example, unlike the requirement that military advantage be concrete and direct, incidental harm under the proportionality principle need not be direct; foreseeable indirect effects must also be considered.[142] Similarly, the obligation to take "constant care", though not precisely defined, provides a flexible basis for accounting for longer-term or cumulative harm, including impacts on essential civilian services and infrastructure and on the natural environment. Such a reading does not expand commanders' legal obligations beyond what is feasible, but rather supports more informed decision-making.

All reasonably foreseeable reverberating effects, based on operational context, past patterns and available intelligence, must inform targeting decisions. Advanced technologies such as satellite imagery, drone surveillance and predictive analytics offer new tools for strengthening compliance. This is particularly important in urban settings and protracted conflicts, where attacks on critical infrastructure

138 See e.g. Ruben Stewart, "From 'Total War' to 'Total Defence': Tracing the Origins of Civilian Involvement in Armed Conflict", *Humanitarian Law and Policy Blog*, 30 April 2025, available at: https://blogs.icrc.org/law-and-policy/2025/04/30/total-war-total-defence-civilian-conflict/; O. A. Hathaway, A. Khan and M. R. Revkin, above note 40, pp. 2666–2676; Kristin Ljungkvist, "Participatory War and Its Challenges for Total Defense", Carnegie Endowment for International Peace, 13 August 2025, available at: https://carnegieendowment.org/research/2025/08/participatory-war-and-its-challenges-for-total-defense?lang=en.

139 See Abby Zeith and Lakmini Seneviratne, *Reducing the Human Cost of Large-Scale Military Operations*, 20 May 2025, available at: https://ssrn.com/abstract=5172527.

140 See A. M. Baldo and F. Batault, above note 6; PoC Report 2024, above note 7, para. 54.

141 ICRC, above note 57, p. 37.

142 See I. Robinson and E. Nohle, above note 38.

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often result in cascading humanitarian impacts.[143] Civilian dependency on essential services must not be exploited, nor should attacks be used to provoke overreaction by the adversary, as such conduct risks eroding the hard-won balance between military necessity and humanitarian protection at the heart of IHL.

Besides, some argue that the assessment of "concrete and direct" overall military advantage under the proportionality principle should not be confined to a narrow, target-by-target basis but may, in certain cases, reflect the broader context of coordinated military actions aimed at achieving specific operational objectives.[144] Where such actions are clearly part of an integrated campaign, it may be legal and more realistic to assess military advantage in light of the specific military operation as a whole. By the same logic, civilian harm should also be considered cumulatively, and when foreseeable and within the scope of the operation, it ought to be factored into the proportionality analysis. It is important to note, however, that while the law clearly requires the anticipated military advantage to be concrete and direct, no such limitation exists regarding collateral damage.

Many cities today rely on centralized civilian infrastructure with limited redundancy.[145] The broader goal of the conduct of hostilities rules, protecting civilians against the effects of hostilities, must guide the interpretation and application of proportionality and precaution, taking into account and giving serious consideration to those foreseeable and compounding cascading effects.

With regard to dual-use objects, including water systems when used for both civilian and military purposes, the concept of internal proportionality is particularly relevant. Rather than treating such objects as wholly military once used for military purposes, this approach advocates for giving appropriate weight to their civilian components in proportionality assessments.[146] Factoring in the civilian component, if not shifting the balance toward avoiding targeting the object at all, at least helps to anticipate and limit collateral damage, thereby resulting in a more humane application of the law.

The protections given to water systems, including the special protections, should be extended to essential services personnel responsible for their operation and maintenance.[147] Growing legal and moral recognition of the life-saving role

143 ICRC, above note 38, pp. 4–11; and PoC Report 2024, above note 7, para. 59.

144 See Kevin S. Coble, "An Operational Perspective of Military Advantage and Proportionality", *Articles of War*, 11 July 2025, available at: https://lieber.westpoint.edu/operational-perspective-military-advantage-proportionality/; Jeffrey Lovitky, "The Application of the Principle of Military Advantage in Determining Proportionality", *Articles of War*, 23 January 2024, available at: https://lieber.westpoint.edu/application-principle-military-advantage-determining-proportionality/; Noam Lubell and Amichai Cohen, "Strategic Proportionality: Limitations on the Use of Force in Modern Armed Conflicts", *International Law Studies*, Vol. 96, 2020.

145 See ICRC, above note 38, pp. 4–5; ICRC, above note 6, p. 69.

146 See Robert Kolb and Margaux Germanier, "The Internal Proportionality Assessment in Cyberspace", *Articles of War*, 31 October 2025, available at: https://lieber.westpoint.edu/internal-proportionality-assessment-cyberspace/.

147 See UNSC Res. 2730, 24 May 2024; Marnie Lloydd, Peter Herby, Caroline Baudot and Tobias Ehret, "Protecting Essential Service Personnel Is a Vital Part of Humanitarian Action", *Humanitarian Law and Policy Blog*, 10 October 2024, available at: https://blogs.icrc.org/law-and-policy/2024/10/10/protecting-essential-service-personnel-is-a-vital-part-of-humanitarian-action/; ICRC, *Keeping the Lights On*, above note 26.

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of these personnel stems from their vital contribution to ensuring safe water system operation.[148] Essential service providers must have safe, sustained access to affected areas in order to operate, maintain and repair critical infrastructure.[149] Parties to armed conflict should collect and assess data on how military operations impact essential service personnel and the availability of critical resources, ensuring this informs both political and military planning.[150] Where possible, advancing engagement with these providers can help to identify their needs and enhance protections.[151]

As noted, damage to water systems has disproportionate social impacts. A protective interpretation of IHL responds to the lived realities of affected populations, acknowledges how disruptions worsen inequalities and promotes inclusive civilian protection.[152]

Operational strategies for enhanced protection

Operationalizing the protection of water systems during armed conflict requires proactive strategies that go beyond legal compliance and engage the planning, targeting and logistical dimensions of military and humanitarian-development operations. One effective measure is the integration of water systems into military operational planning, including intelligence preparation of the battlefield or operating environment. This involves mapping interdependencies between water systems and other civilian services, identifying choke points and incorporating critical infrastructure into no-strike lists or restricted target lists.[153] While no-strike lists are a long-standing practice in many professional armed forces, their application to water systems remains inconsistent. Stronger results can be achieved by drawing on remote sensing technologies, open-source mapping and the knowledge of technical specialists and local actors.[154] In this vein, the ICRC's guidance on urban warfare stresses the need to understand infrastructure systems holistically and to anticipate cascading failures across interconnected services.[155]

Critically, structured interaction between humanitarian agencies, armed forces and legal experts can help translate legal norms into concrete operational behaviour. There is a growing consensus on the need for military planners and engineers to engage directly with WASH actors, local water authorities, and environmental and public health experts in order to better anticipate both the immediate and long-term consequences of attacks.[156] This engagement helps assess the

148 UNSC Res. 2573, above note 107, para. 3; UNSC Res. 2417, above note 107, para. 1.
149 ICRC, above note 38, para. 4.18.
150 *Ibid.*, para. 3.9.
151 *Ibid.*, para. 29.
152 ICRC, above note 57, p. 4.
153 See US Department of Defense, *Law of War Manual*, 2016, § 5.10.3, pp. 247–248.
154 See GWH, above note 11.
155 ICRC, above note 6, pp. 23, 35–37.
156 ICRC, above note 38, paras 2.10–2.11.

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foreseeability of public health crises arising from the destruction or degradation of water systems, an essential element in evaluating the legality of attacks under IHL.[157] Importantly, such multidisciplinary engagement should not be limited to State armed forces; it must also extend to non-State armed groups, taking into account the specificities of each group. Enhancing their understanding of the operational, legal and humanitarian consequences of damaging essential services is critical to reducing harm to civilians, which tends to be particularly important in protracted and asymmetric conflicts.

Infrastructure damage in protracted conflicts has shown how water system failure can lead to widespread disease outbreaks, displacement, and system-wide collapse of public health services.[158] Integrating the expertise of water and health professionals into targeting processes enables more accurate forecasting of these impacts and more ethically and legally sound decision-making. Moreover, intelligence preparation of the battlefield (IPB) and military risk assessments must evolve to account not only for tactical objectives but also for long-term systemic impacts on infrastructure, such as cumulative degradation of water networks over months or years.[159] In practical terms, this would entail expanding the analytical scope of IPB to include interdependencies among critical infrastructure systems – water, power, sanitation and health – and the effects that their disruption may trigger. Incorporating expertise from WASH engineers, epidemiologists and civil infrastructure specialists would allow planners to model potential cascading failures and better anticipate civilian harm. Good practices can be drawn from multidisciplinary assessment frameworks such as the North Atlantic Treaty Organization's (NATO) Comprehensive Approach[160] and the ICRC's work on urban services during armed conflict, which emphasize systems-based analysis and cross-sectoral input in operational planning.[161]

In parallel, negotiating water-related ceasefires, protected zones and humanitarian access arrangements, such as demilitarized areas or temporary pauses in hostilities, can mitigate damage and enable emergency repairs or delivery of treatment supplies. These arrangements must be grounded in respect for the neutral, impartial and independent role of humanitarian actors, and supported by operational coordination.[162] Finally, the protection of water sector personnel and supply

157 M. Sassòli, above note 113, pp. 388–393.

158 See M. Talhami and M. Zeitoun, above note 5; P. H. Wise, above note 44; Maia C. Tarnas, Najwa Al-Dheeb, Muhammad H. Zaman and Daniel M. Parker, "Association between Air Raids and Reported Incidence of Cholera in Yemen, 2016–19: An Ecological Modelling Study", *The Lancet Global Health*, Vol. 11, No. 12, 2023, available at: www.thelancet.com/journals/langlo/article/PIIS2214-109X(23)00272-3/fulltext; Ruby Tabor *et al.*, "Disruption to Water Supply and Waterborne Communicable Diseases in Northeast Syria: A Spatiotemporal Analysis", *Conflict and Health*, Vol. 17, No. 4, 2023, available at: https://doi.org/10.1186/s13031-023-00502-3.

159 ICRC, above note 6, pp. 8–9.

160 See NATO, "A 'Comprehensive Approach' to Crises", 7 March 2024, available at: www.nato.int/en/what-we-do/partnerships-and-cooperation/a-comprehensive-approach-to-crises; NATO, *Allied Joint Doctrine*, Allied Joint Publication 01, Edition F, Version 1, NATO Standardization Office, 2022, pp. 88–89.

161 ICRC, above note 25, p. 8.

162 See ICRC, *Fundamental Principles of the Red Cross and Red Crescent Movement*, Geneva, 2015.

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chains remains a critical concern. Local security guarantees, deconfliction tools and the safeguarding of chlorine or spare parts in transit are essential for the continuity of water services. Collectively, these strategies demonstrate that with foresight and coordination, the humanitarian impacts of conflict on water systems can be significantly reduced.

Time for a collaborative system to gather and share data?

Enhanced protection of water systems and essential services during armed conflict demands more than legal compliance. Despite growing recognition of the harm caused by attacks on critical infrastructure, humanitarian and legal responses are often hampered by the absence of timely, reliable data. Establishing an integrated and collaborative system for data collection, analysis and cross-sectoral coordination could significantly strengthen this effort.

Two complementary streams of information are essential to close this gap. First, incident-based reporting of attacks, disruptions and other violations, linked to conflict dynamics and infrastructure types, is vital for assessing compliance with IHL and triggering protective measures.[163] One promising model is WHO's SSA, launched in 2018 under the mandate of UN Security Council Resolution 2286, which systematically tracks and verifies attacks on health facilities and personnel in conflict zones. Early experience with the SSA indicates promising results: it has improved visibility of attacks and generated information useful for operations and advocacy. While it is too early to assess its overall impact, initial signs suggest clear added value.[164] Second, public health and epidemiological data are needed to quantify the severity and duration of impacts on affected populations, including mortality, malnutrition and disease outbreaks related to water disruption. These data streams remain fragmented and under-resourced, with few shared platforms linking military, humanitarian and legal actors. Outbreaks of cholera, diarrhoeal diseases, or spikes in child malnutrition often trace back to disruptions in water systems, but without reliable, granular health data, these links remain anecdotal or delayed.[165] A systematic collection of epidemiological data is urgently needed to understand the full scope and consequences of water-related harm.

163 See ICRC, *Explosive Weapons in Populated Areas: Humanitarian, Legal, Technical and Military Aspects: Expert Meeting Report*, Geneva, June 2015.

164 See e.g. WHO, "WHO Director-General's Opening Remarks at the UN Senior Management Group – Protection of Health Care in Conflict", June 2025, available at: www.who.int/news-room/speeches/item/who-director-general-s-opening-remarks-at-the-un-senior-management-group—protection-of-health-care-in-conflict—5-june-2025; Benjamin Mason Meier, Hannah Rice and Shashika Bandara, "Monitoring Attacks on Health Care as a Basis to Facilitate Accountability for Human Rights Violations", *Health and Human Rights Journal*, Vol. 23, No. 1, 2021; Rohini Haar and Susannah Sirkin, *Strengthening Data to Protect Healthcare in Conflict Zones*, International Peace Institute, 21 November 2022, available at: www.ipinst.org/2022/11/strengthening-data-to-protect-healthcare-in-conflict-zones?.

165 See Aurélie Jeandron *et al*., "Water Supply Interruptions and Suspected Cholera Incidence: A Time-Series Regression in the Democratic Republic of the Congo", *PLoS Medicine*, Vol. 12, No. 10, 2015, available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC4624412/pdf/pmed.1001893.pdf.

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Although developed independently, the SSA complements WHO's HeRAMS, which has tracked the availability and functionality of health facilities since 2008. While HeRAMS provides a baseline of system capacity, the SSA captures incidents of violence and damage, with the two systems together offering a more complete picture of the status and vulnerability of health systems in emergencies. Other models, such as the Health Information System Programme used in WHO-led Health Cluster responses,[166] the Integrated Disease Surveillance and Response system developed across Africa[167] or the Global Task Force on Cholera Control coordinated by the International Federation of Red Cross and Red Crescent Societies and WHO,[168] show that even in fragile settings, robust multisectoral coordination is possible when backed by political will.

The present authors are of the view that a comparable mechanism for the water sector to document damage to or destruction of water systems, harm to water personnel and the broader consequences for civilians and the environment is vital. Such a system could, for instance, integrate technical assessments from WASH specialists, humanitarian access reports, and satellite-based monitoring to capture both immediate impacts and the cumulative degradation of water systems over time. To ensure protection of sensitive information, data management could be coordinated by a neutral body, in partnership with technical agencies and local authorities, with tiered access protocols to balance transparency and security. Establishing clear safeguards for privacy and compliance with humanitarian principles would be essential to maintain trust and facilitate operational use across actors. Such activities are part of the Global Alliance to Spare Water from Armed Conflict, initiated by the Geneva Water Hub (GWH) and the governments of Slovenia and Switzerland.[169]

A more systematic approach would not only improve the quantification of harm, anticipation of secondary impacts, and advocacy for the protection of essential services when prioritizing emergency responses but would also support the effective implementation of the law, strengthen accountability processes and guide cross-sector policy reform.

Conclusion and recommendations

Protecting water systems, services and personnel is protecting civilians. This article has demonstrated that damage to or destruction or misuse of water systems during armed conflicts can have severe and far-reaching consequences. Such actions deprive

166 WHO, *Health Cluster Guide: A Practical Handbook*, 2nd ed., 2020, p. 117, available at: https://healthcluster.who.int/home/9789240004726.

167 WHO Regional Office for Africa, *Technical Guidelines for Integrated Disease Surveillance and Response in the African Region*, 3rd ed., 2019, available at: www.afro.who.int/publications/technical-guidelines-integrated-disease-surveillance-and-response-african-region-third.

168 Global Task Force on Cholera Control, *Ending Cholera: A Global Roadmap to 2030*, 2017, available at: www.gtfcc.org/wp-content/uploads/2025/02/gtfcc-ending-cholera-a-global-roadmap-to-2030.pdf.

169 GWH, "Global Alliance to Spare Water from Armed Conflicts", 2025, available at: www.genevawaterhub.org/GASWAC.

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civilians of essential resources, fuel public health crises, drive displacement and cause lasting environmental harm.

The continuity of water services, the integrity of infrastructure and the safety of personnel must be fully integrated into military planning and operations. This includes recognizing and accounting for the cumulative effects of repeated or indirect damage, which can slowly erode system functionality, institutional capacity and resilience of essential services. Over time, such degradation, especially when compounded by insecurity or access restrictions, can have consequences as severe as those resulting from a single large-scale attack.

To translate legal obligations into real-world protection and meet the urgent needs of affected populations, legal compliance must go hand in hand with practical measures. A critical step in this regard is the systematic collection and sharing of data on damage to or destruction or misuse of water systems and the humanitarian and environmental impacts that these can cause. Such data must inform proportionality and precautionary assessments, particularly where prior harm has already heightened the vulnerability of water systems. This information is also essential to guide humanitarian responses.

Based on the foregoing, the authors recommend the following:

- To establish a neutral and collaborative mechanism to systematically record, verify and analyze incidents of damage or destruction to water systems. In line with UN Security Council Resolution 2573's call for strengthened reporting on the protection of objects indispensable to civilian survival, such an initiative would benefit from high-level multilateral backing. It could be championed in relevant international fora, considered as part of a future Security Council resolution, and integrated formally into the agenda of the newly appointed UN Secretary-General's Special Envoy on Water.[170]
- To integrate water systems and service continuity considerations into military planning, legal reviews and operational decision-making. This will help to minimize harm and improve understanding of civilian harm patterns in contemporary conflicts.
- To adopt national policies that assign clear institutional responsibilities for the protection of civilians, civilian objects and essential services during hostilities.
- To strengthen peer-to-peer legal and operational engagement in order to promote compliance, exchange lessons learned and disseminate best practices.

170 UN, "Personnel Appointments: Mrs. Retno L.P. Marsudi of the Republic of Indonesia – Special Envoy on Water", 13 September 2024, available at: www.un.org/sg/en/content/sg/personnel-appointments/2024-09-13/mrs-retno-lp-marsudi-of-the-republic-of-indonesia-special-envoy-water.

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