© Woman collecting water in a dry river bed in Kajado, Kenya, WHH, 2019

DISCUSSION PAPER 08/2025

Climate Resilience and WASH

Pathways to Climate-Resilient WASH Programming

About this Discussion Paper - Summary

The growing pressure of climate change increasingly undermines the reliability and equity of water, sanitation and hygiene (WASH) services. Reactive approaches focused on immediate needs are no longer sufficient. Climate-resilient WASH interventions must be designed to anticipate, absorb, and adapt to climate-related shocks to protect public health and ensure service continuity—especially in crisis-affected settings.

Bridging WASH and climate resilience requires a sound understanding of climate-related risks and the use of context-sensitive strategies that address both urgent humanitarian needs and long-term systems strengthening.

This Discussion Paper outlines how climate resilience can be integrated into WASH programming across the full spectrum - from humanitarian response to long-term development. It is intended to serve as internal guidance for WASH practitioners within Welthungerhilfe[1] and provides a conceptual foundation and practical orientation for preparing, planning, and implementing projects and programmes that aim to deliver climate-resilient WASH services. The focus lies on rural populations in fragile and developing country contexts, where climate risks and systemic service challenges intersect most acutely. The paper supports teams in aligning interventions with global good practice and introduces a conceptual framework that bridges the organisation's dual mandate, linking emergency action with systems strengthening.

1 Welthungerhilfe, one of Germany's largest multisectoral NGOs, aims to strengthen the climate resilience of people, systems, and institutions by integrating climate risk awareness, anticipatory action, and adaptive solutions across its humanitarian and development work. This includes a strong focus on locally led adaptation, ecosystem restoration, and the transformation of service delivery systems—particularly in fragile and climate-vulnerable rural contexts. The organisation seeks to align immediate crisis response and long-term development with climate action to safeguard livelihoods, water and food security, and community well-being.

1. WASH and Climate Resilience – what's the issue?

Climate change is fundamentally reshaping the landscape of humanitarian response and development co-operation. Among the sectors most affected is Water, Sanitation, and Hygiene (WASH), where both sudden and slow-onset climate events are disrupting access, infrastructure, and service continuity. Periods of low rainfall cause boreholes, springs, and other water sources to dry up, while intense rainfall and flooding damage infrastructure and spread pathogens, contaminants, and waste into rivers, lakes, and other surface waters. As water becomes scarcer, financial and logistical barriers to access grow - disproportionately affecting low-income and vulnerable populations, and undermining both the reliability and equity of services.

Climate hazards	impacts on the WASH sector
Decrease in precipitation, drought	Reduction in raw water availability for drinking water supplies, reduced flow in rivers, less dilution/increased concentration of pollutants in water, challenge to hygiene practices.
Increase in precipitation, flooding, cyclones	Pollution and inundation of wells, inaccessibility of water sources, flooding of latrines, damage to infrastructure, landslides around water sources, sedimentation and turbidity, challenges to sustainability of sanitation and hygiene ehaviours and spread of waterborne diseases.
Increase in temperatures, heatwaves	Damage to infrastructure such as treatment plants, increase in pathogens in water leading to increased risk of disease.
Melting and thawing of glaciers, snow, sea ice and frozen ground	Seasonality of river flows affected leading to a reduction in water availability in summer, threatening the water supply of downstream communities, affecting agriculture and hydropower production. Melting glaciers also increase the risk of landslides and floods and contribute to sea level rise.
Sea level rise	Saline intrusion, riverine flooding, displacement.

Table 1: Examples of climate change and climate variability impacts on WASH (adapted from UNECE, 2022)

Climate projections suggest that these pressures will intensify, leading to increased water scarcity, greater competition between users (e.g. agriculture, households, industry, ecosystems, and energy), and growing risks to water, food, and energy security. WASH infrastructure will face further destruction, and displacement will increase, making safe water and sanitation access more uncertain. At the same time, the WASH sector itself contributes to the climate crisis through greenhouse gas emissions - particularly from energy-intensive water services and unsafe sanitation practices—while also offering untapped mitigation potential.

Traditional approaches centred on static infrastructure and short-term service delivery are no longer sufficient in the face of escalating climate shocks.

The sector must shift towards climate-resilient WASH systems that can anticipate, absorb, and adapt to a changing risk landscape. This requires risk-informed planning, flexible delivery models, and the systematic integration of resilience into governance, financing, and monitoring - key aspects that will be further explored in this paper.

What is WASH?

Water, Sanitation and Hygiene (WASH) refers to the integrated delivery and governance of safe drinking water supply, adequate sanitation services, and the promotion of hygiene practices that are essential to human health, dignity, and well-being. WASH is a foundational component of public health and plays a critical role in reducing disease, supporting education and livelihoods, and enabling climate-resilient and equitable development.

What is Climate Resilience?

The capacity of social, economic and environmental (or ecological) systems to cope with a (climatic) hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation" (IPCC, 2022).

What is a WASH System?

The social, technical, institutional, environmental and financial factors, actors and interrelation-ships that influence WASH service delivery in a given context. (FCDO)

What are Climate Resilient WASH systems?

In the WASH-sector, climate resilience refers to the capacity of WASH systems and services to withstand, adapt to, and recover from climate-related stresses and shocks while continuing to provide sustainable access to safe WASH services (SWA Climate Task Team, COP29, 2024).

Box 1: Definitions

2. Climate-Resilient WASH Framework

To effectively integrate Climate Resilience (CR) across Welthungerhilfe's dual mandate - spanning humanitarian action and long-term systems strengthening interventions – an integrated conceptual framework is needed.

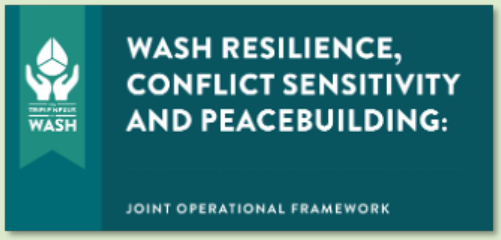
Two publications are currently widely recognised as sector-level references for mainstreaming resilience into WASH programming: The 2022 GWP/UNICEF Strategic Framework provides a robust reference for development-oriented WASH programming (Box 2). While its principles can inform approaches in fragile or crisis-prone settings, the framework itself does not explicitly address humanitarian WASH contexts.

To close this gap, this Discussion Paper complementing the GWP/UNICEF framework with the Joint Operational Framework: WASH Resilience, Conflict Sensitivity and Peac building (JOF), developed under the Triple Nexus in WASH Initiative co-led by GWC, GWN, SWA and UNICEF. The JOF, see box 3, brings in the necessary focus on fragile settings, enabling collaboration across humanitarian, development, and peace actors and ensuring relevance in crisis-affected contexts.

Key strengths of the GWP/UNICEF Strategic Framework for Climate Resilient WASH (2022) [1 that make it fit to serve as the primary reference for a dual mandate CR framework are:

- **Clear Conceptual Logic and Structured Process**
  Provides a step-by-step approach - risk analysis, option appraisal, solution delivery, and adaptive monitoring - offering a coherent structure for programme design.
- **Focus on System Strengthening**
  Integrates climate resilience into WASH systems, including governance, finance, and service delivery, to support long-term sustainability.
- **Alignment with National Systems and Planning Cycles**
  Supports integration into national policies, budgets, and sector coordination mechanisms, ensuring government ownership and scalability.
- **Integration of Climate Risk into WASH Diagnostics**
  Promotes climate-informed system assessments as a foundation for resilient planning and prioritisation.
- **Emphasis on Option Appraisal and Strategic Decision-Making**
  Guides the selection of climate-resilient interventions through evidence-based, context-specific analysis of technical and financial feasibility.
- **Support for Iterative, Adaptive Management**
  Encourages learning and flexibility by embedding monitoring and feedback mechanisms across all implementation stages.
- **Scalable and Flexible Application**
  Designed for development settings but adaptable to diverse programmatic entry points and operational levels.

Box 2: key strengths of the GWP/UNICEF framework



The WASH Triple Nexus Joint Operational Framework (JOF) [15] explicitly addresses the operational and institutional realities of humanitarian and fragile contexts. Its key strengths, which help fill critical gaps in the GWP/UNICEF framework, include:

- **Explicit Application in Fragile and Crisis-Affected Settings**
  The JOF is designed for contexts marked by conflict, displacement, and weak state capacity—ensuring that resilience strategies are applicable even under acute humanitarian conditions.
- **Integration of Humanitarian–Development–Peace (HDP) Nexus Principles**
  It operationalizes the nexus by promoting coordination and coherence across sectors, enabling resilience-building that bridges immediate needs and long-term risk reduction.
- **Conflict Sensitivity and Risk-Informed Design**
  The JOF embeds conflict sensitivity and promotes tools that integrate climate and social risk factors—ensuring WASH interventions do not exacerbate tensions.
- **Area-Based and People-Centered Approaches**
  It emphasises inclusive, locally led solutions that serve both displaced and host populations, reinforcing social cohesion and equitable access.
- **Adaptive Delivery in Volatile Contexts**
  The JOF supports flexible delivery models suited to unstable environments, including dual-use infrastructure and phased approaches linking relief and recovery.
- **Multi-Stakeholder Coordination and Institutional Bridging**
  It strengthens coordination between humanitarian and development actors, helping to navigate institutional fragmentation and align efforts where governance is weak.
- **Focus on Localisation and Inclusive Governance**
  The framework promotes local ownership, inclusive decision-making, and the active participation of women and marginalised groups in WASH resilience efforts.

Box 3: key strengths of the JOF

The GWP/UNICEF framework is grounded in risk-informed and adaptive programming, ensuring that WASH infrastructure and services can anticipate, absorb, and adapt to climate-related shocks and stresses. The framework entails embedding resilience considerations from the outset of response planning - such as through climate-sensitive siting, technology selection, and early recovery strategies. In development contexts, the framework reinforce systems strengthening approaches by embedding climate risk assessments into WASH governance, finance, and monitoring structures.

Structurally, an integrated, dual framework can be organised around four iterative pillars, each representing a critical dimension of climate-resilient WASH. The model presented below integrates the GWP/UNICEF Strategic Framework for Climate Resilient WASH with the JOF, preserving the four-pillar logic of GWP/UNICEF while explicitly embedding principles and mechanisms relevant to humanitarian, fragile, and development contexts. This hybrid framing provides a practical and coherent conceptual architecture for Welthungerhilfe's dual mandate.

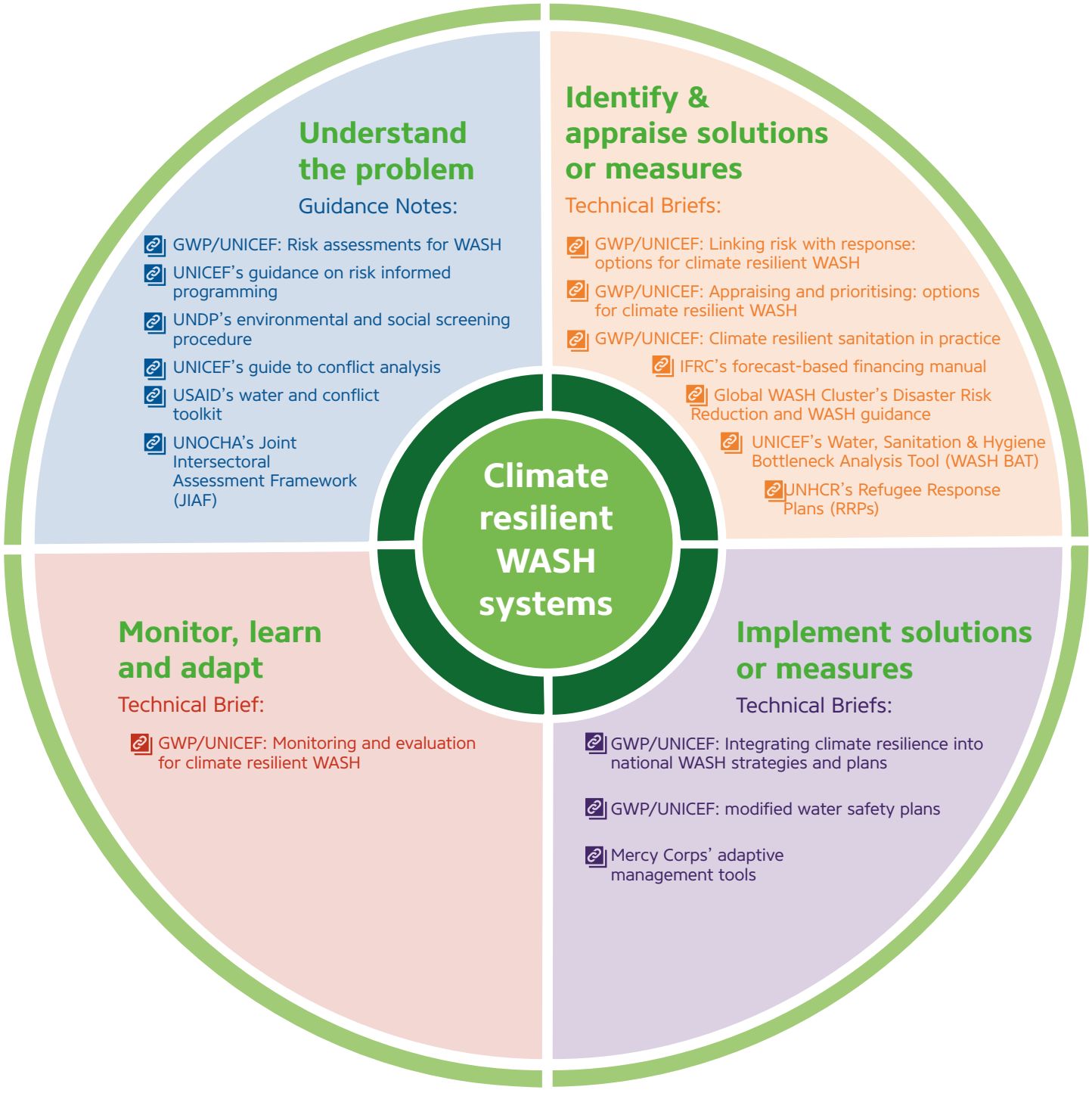


Fig. 1: The 4 pillars of the strategic WASH/CR-framework based on GWP/UNICEF, 2022 with recommended resources from GWP/UNICEF and the JOF, Annex 2

Pillar 1: Understand the Problem

In both stable and fragile settings, climate resilience begins with a clear understanding of the interconnected risks that affect WASH services. This includes environmental hazards (e.g. drought, flooding, salinisation), exposure and vulnerability, and - critically in fragile settings - conflict drivers, displacement dynamics, and institutional breakdown.

In development settings, this risk understanding typically involves climate assessments, hydro-meteorological data, and vulnerability analyses aligned with WASH system diagnostics. In humanitarian and crisis-affected contexts, this must be complemented by multi-risk analysis, conflict sensitivity assessments, and real-time context scanning. The WASH Triple Nexus JOF contributes here by embedding resilience analysis within humanitarian needs overviews (HNOs), Recovery and Peacebuilding Assessments (RPBAs), or Integrated Context Analyses (ICAs). Likewise highlighting the need for integration into equivalent assessments conducted by WHH.

Key adaptation in humanitarian settings: Risk analysis in fragile contexts must also factor in protection risks, power imbalances, and peacebuilding opportunities, in line with the JOF and the Humanitarian–Development–Peace (HDP) Nexus logic.

Welthungerhilfe Environmental and Climate Screening Tool (ECS)

WHH Environmental and Climate Screening (ECS) tool is a practical, Excel-based instrument designed to help project teams systematically identify environmental and climate risks, as well as potential unintended environmental impacts, at an early stage of project planning. Adapted for both humanitarian and development contexts—including WASH and other sectoral areas—it supports users in identifying and prioritising risk reduction measures and SMART indicators. The tool covers key domains such as land use, water resources, waste, emissions, biodiversity, and climate risk exposure, and also highlights opportunities to reduce greenhouse gas emissions. Based on user inputs, it generates a qualitative risk profile and provides tailored recommendations for adaptation, design improvement, and environmental safeguards. Informed by tools such as NEAT+ and the IFRC Green Response Guide, it promotes risk-informed, do-no-harm programming.

Box 4: How to assess risks: WHH's ECS tool

Pillar 2: Identify & appraise solutions or measures

Once risks are identified, the next step is to develop measures for climate-resilient WASH interventions that are technically feasible, contextually appropriate, and socially inclusive.

In development settings, the GWP/UNICEF framework promotes structured tools such as cost-benefit analysis, environmental screening, and systems diagnostics to appraise a range of technological, behavioural, and institutional options. In humanitarian settings, such processes must be faster and more adaptive—but no less rigorous in principle. Here, the JOF offers guidance on applying a "no-regrets" and "dual-use" logic: interventions should both respond to immediate needs and contribute to long-term recovery and systems strengthening wherever possible.

Key adaptation in humanitarian settings: Option appraisal in fragile settings must emphasise conflict sensitivity, inclusive governance, and flexibility under uncertainty. For example, choosing mobile or modular infrastructure may provide both life-saving functionality and adaptive potential in volatile environments.

The **GWP/UNICEF Technical Brief Appraising and Prioritizing Options for Climate Resilient WASH** outlines a structured, step by-step methodology to guide WASH actors in selecting the most appropriate interventions in response to climate risks. The process begins with gathering a broad range of potential options—technical, institutional, and behavioral—then appraises these using performance criteria such as effectiveness, efficiency, equity, legitimacy, and feasibility under uncertainty. Options are initially screened through simplified assessments and, where feasible, refined using more advanced techniques such as cost-benefit analysis, multi-criteria analysis, or real-options analysis. The approach emphasizes inclusive, evidence-based decision-making and encourages participatory engagement with affected communities and sector stakeholders. Importantly, the brief also highlights the need for "no-regrets" and "low-carbon" options and links the appraisal process to national WASH planning and budgeting cycles, ensuring ownership, scalability, and sustainability.

Box 5: Identifying solutions and measures

Pillar 3: Implement solutions or measures

This pillar translates strategies into action. In development contexts, this means strengthening each building block of the WASH system to ensure delivery systems are robust and adaptive, key attributes of resilience. In humanitarian and nexus contexts, however, delivery must be anchored in dual-purpose interventions: those that meet urgent needs while contributing to medium-term stability and long-term sustainability.

The JOF brings in critical insights here: it calls for area -based, people-centred, and locally led delivery models that foster community trust, prevent conflict over resources, and promote equity. In particular, it supports integrated WASH delivery for displaced and host communities, climate-sensitive hygiene promotion, and participatory infrastructure planning—even in volatile settings.

Key adaptation in humanitarian settings: Delivering climate-resilient WASH in crisis settings means linking short-term emergency action with system-aware, inclusive recovery processes—for example, by coordinating humanitarian partners with local service authorities, where feasible.

Nexus-Based WASH for Conflict-Affected Communities in the Democratic Republic of the Congo (DRC)

In eastern DRC, where communities are affected by both conflict and climate variability, a triple nexus approach was applied to deliver WASH services that simultaneously enhance peacebuilding and resilience. WHH and partners implemented water supply systems and sanitation facilities that serve both displaced populations and host communities. Participatory water committees were established to manage shared infrastructure and reduce resource-related tensions—an approach that has proven essential in settings where climate shocks and fragility overlap [15].

Box 6: Practice Example DRC

Pillar 4: Monitor, learn and adapt

True resilience requires dynamic systems that learn and adapt. The strategic framework emphasises iterative monitoring, institutional feedback loops, and governance mechanisms that respond to evolving climate risks like the monitoring of rainfall, groundwater levels, surface flows, water abstraction, and water quality . In humanitarian and fragile settings, this must be reinforced by mechanisms that ensure accountability to affected populations, integrate early warning and conflict tracking, and support adaptive planning under uncertainty.

Here, the JOF adds important operational modalities: cross-sector coordination structures, shared context monitoring, joint outcome measurement (across HDP actors), and flexible financing mechanisms (e.g. multi-year humanitarian-development funding). These are essential to ensure that climate resilience is not only mainstreamed but also operationalised in crisis contexts.

Key adaptation in humanitarian settings: Adaptive monitoring in fragile settings should be embedded in multi-actor governance platforms and enable mid-course corrections in both humanitarian and development delivery.

The **GWP/UNICEF Technical Brief Monitoring and Evaluation for Climate Resilient WASH** offers practical guidance on how to select and use indicators to track the effectiveness and sustainability of WASH interventions under climate stress. The Brief introduces a simplified Results Framework covering national, sub-national, and local levels, with example indicators aligned to specific outputs and outcomes. The focus lies on integrating climate resilience into existing M&E systems, using both quantitative and qualitative indicators, and adapting them to different hazard contexts and implementation scales. Key challenges - such as uncertainty, an shifting baselines - are addressed with recommendations to ensure that M&E remains a continuous, learning-oriented process that informs adaptive management and investment decisions.

Box 7: Monitoring climate resilient WASH

Even in low-capacity settings, these 4 pillars can guide WASH actors in conducting climate risk assessments or climate-informed risk assessments, prioritizing resilient infrastructure (e.g., flood-proof sanitation, drought-resistant water supplies), and integrating contingency planning into WASH operations [1]. Moreover, the 2017 Risk Assessment Guidance Note by GWP and UNICEF emphasizes the need to map exposure, vulnerability, and system capacity - even under data-poor or time-constrained conditions where incorporating local and traditional knowledge, early warning indicators, and basic scenario modelling can significantly enhance response quality and relevance [11]. This is often a more cost-effective approach as prevention and preparedness is less costly than response and recovery to disasters.

3. Concrete Solutions and Good Practice Approaches

Numerous organisations, including UNICEF, GWP, and WaterAid, have developed guidance and case-based insights to support practitioners in embedding climate resilience into WASH systems. The following overview highlights concrete and field-tested solutions for each domain drawing from these organizations as well as WHH own projects.

3.1 Solutions in Humanitarian WASH, Recovery and Rehabilitation

In emergency settings, where WASH services are deployed under volatile conditions, integrating climate resilience means ensuring continuity and safety despite climate-induced disruptions. Key approaches include:

- **Climate-informed risk assessments:**
  In humanitarian and fragile contexts, climate-informed risk assessments are essential to ensure that WASH and other life-saving interventions are not only responsive to immediate needs but also resilient to future shocks and environmentally sustainable. Tools such as Welthungerhilfe's Environmental and Climate Screening (ECS) Tool (Box 4) and the GWP/UNICEF Risk Assessment for Climate Resilient WASH guidance enable project teams to systematically assess hazards and vulnerabilities—such as displacement and land degradation—at an early stage of the project cycle. Integrating conflict analysis into climate risk assessments further ensures that WASH interventions do not exacerbate existing tensions, but instead contribute to peace and stability. The recommendations generated through this process should inform programme design, site selection, and environmental safeguards, offering actionable entry points for building resilience.
- **Application of the WASH-BAT with a climate lens:**
  The Water, Sanitation and Hygiene Bottleneck Analysis Tool (WASH-BAT) offers a structured approach to identifying systemic constraints within the enabling environment of WASH service delivery. When applied with a climate lens, it enables stakeholders - particularly in humanitarian and fragile contexts - to assess vulnerabilities in policies, institutions, financing, and service delivery that may be amplified by climate-related risks. In crisis-affected settings, the tool can reveal gaps in adaptive planning, integration of early warning systems, and coordination with water resource management and disaster risk reduction actors [4].
- **Flood-resilient and drought adapted sanitation and water supply systems:**
  In fragile contexts, the selection of context-specific, technically sound, and socially inclusive solutions is essential to maintaining service continuity under climate stress. In countries such as Bangladesh and South Sudan, elevated latrine platforms, sealed containment systems, and raised water points have been implemented to ensure safe and reliable sanitation and water services during periods of flooding [7, 10] In Ethiopia and Somalia, solar-powered boreholes and flexible water trucking plans are used in anticipation of dry seasons, ensuring continued access for displaced populations and host communities [1].
- **Use of renewable energy and low-carbon technologies:**
  Humanitarian WASH actors are increasingly deploying solar pumping systems, gravity-fed networks, and fuel-efficient desludging methods to reduce environmental impact, reduce GHGs and improve system reliability [4].
- **Integration of early warning systems:**
  Linking WASH emergency preparedness with climate and health early warning systems enables faster and better targeted responses as well as preventative measures—especially in cholera-prone or flood-exposed areas [4, 11]. WHH has a large portfolio on Anticipatory Action (AA) co-creating Impact based Forecasting systems and community based early warning systems linked with contingency plans to prevent or mitigate the humanitarian impact.

Fig. 2: Collapsed School Toilet Building after Heavy Rains, Tanzania (Photo: source unknown)

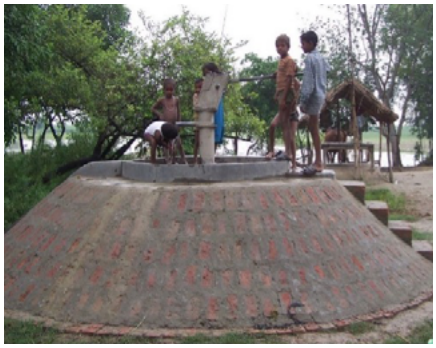


Fig. 3: Flood-proofed handpump in Bahraich, India: the apron is elevated one meter high and the slope of the base gradual enough to prevent damage during flash floods (Photo: District Administration, Uttar Pradesh, India)

Fig. 4: Stoneridge community project, Welthungerhilfe, Harare Zimbabwe

3.2 Opportunities in Development-Oriented WASH Programming

In recent years, the WASH sector has increasingly acknowledged the limitations of fragmented, project-based interventions and the importance of shifting toward nationally and locally driven efforts that reinforce entire WASH systems. This shift has given rise to a growing consensus around what is now commonly known as the WASH systems strengthening approach

Welthungerhilfe adopted this approach 2017 under its Sustainable Services Initiative (SSI). The conceptual framework used by WHH builds on the concept of strengthening WASH systems through nine interconnected building blocks (Fig. 5). These building blocks reflect a holistic view of the WASH system and serve as entry points for targeted improvements. Integrating climate resilience into this framework is not merely a technical add-on, but a necessary evolution as climate change poses multifaceted challenges to all factors of the WASH system. Therefore, each building block must be reviewed, adapted, and monitored through a climate lens.

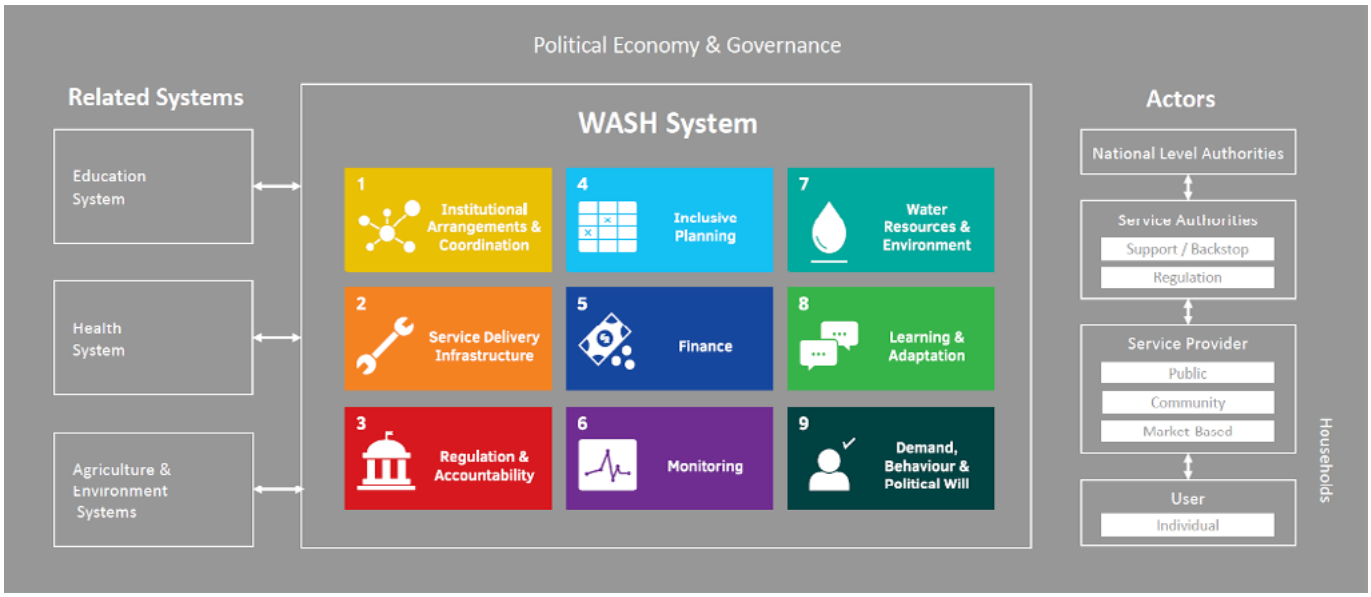


Fig. 5: WASH Systems conceptual framework applied by Welthungerhilfe

The following pages explore how the nine building blocks can be enhanced to embed climate resilience more deeply into WASH systems strengthening, informed by a research conducted by the University of Bonn, the United Nations University and WHH, (2025) [28] and IRC's foundational work [27].

The research paper Integrating Climate Resilience into the WASH Systems Strengthening Conceptual Framework (United Nations University, University of Bonn, Welthungerhilfe 2025), explores how climate resilience can be integrated into the conceptual framework of WASH systems strengthening. The findings include targeted recommendations for adapting each of the building blocks of the systems strengthening framework and propose a set of parameters to monitor climate resilience in WASH programming.

Box 8: Research Publication WHH, UNU, 2025

Integration of CR into the Building Blocks of a WASH System

1. Institutional Arrangements & Coordination

Effective institutions are the backbone of a climate-resilient WASH system. This includes clear mandates for climate change adaptation and mitigation across national, subnational, and community-level actors. Climate resilience should be integrated into WASH coordination platforms, and dedicated units or focal points for climate risk management should be established. Regular training, policy coherence, and knowledge-sharing across institutions enhance collective adaptive capacity. Cross-sector coordination with environmental, climate and disaster risk, and other planning bodies is also critical.

Building Block	Suggested outputs and outcomes for successful integration of climate resilience into WASH Systems Strengthening Building Blocks [28]
Institutional Arrangements & Coordination	A lead ministry/agency coordinates the work on the national/local level.
	Institutions and agencies have the capacity to address climate change (e.g. by having climate change officers).
	Inter-ministerial/cross-agency climate change working groups meet regularly.
	The national and local governments provide guidance, support, and training on aspects relevant to climate change (e.g. support to service providers for the development of operational plans for different extreme event scenarios).
	Governance arrangements that support adaptive decision-making processes for climate resilience in the context of the uncertainties presented by climate change are developed.

2. Service Delivery Infrastructure

WASH infrastructure must be designed and maintained to withstand extreme weather, long term changes in climate such as temperature increase, increased water salinity, environmental degradation, combined with demographic shifts. Risk-informed planning using climate projections can ensure appropriate siting, construction, and redundancy in critical systems.

Climate-smart solutions include solar-powered water pumping, elevated latrines in flood zones, decentralized treatment options, and systems that reduce vulnerability to drought, floods or contamination.

Building Block	Suggested outputs and outcomes for successful integration of climate resilience into WASH Systems Strengthening Building Blocks [28]
Service Delivery nfrastructure	Risk assessments inform service delivery infrastructure design, siting, and appraisal.
	Operational plans have been developed to ensure the provision of services during and after extreme events (e.g. preventive emptying).change officers).
	Risk is spread, and access to services is diversified (e.g., better storage capacities, multiple water points or service providers).
	Guidelines and standards for design and construction consider climate impacts and climate projections.

3. Regulation & Accountability

Climate resilience should be embedded in national WASH standards, construction codes, and environmental regulations. Environmental impact assessments and strategic environmental assessments should be used to systematically evaluate the environmental implications of the proposed policies, plans and projects on climate resilience. Regulatory agencies must be empowered and resourced to enforce climate-adapted norms, including risk-based water abstraction limits, sanitation safety planning, and resilience-linked tariff structures. A lifecycle approach must account for long-term climate scenarios and ensure flexibility in technology choices. Social accountability mechanisms should include climate-related service monitoring and grievance redress procedures to ensure equity and transparency under climate stress.

Building Block	Suggested outputs and outcomes for successful integration of climate resilience into WASH Systems Strengthening Building Blocks [28]
Regulation & Accountability	Regulations and norms are risk-informed and consider climate change (e.g. water abstraction, siting, FSM, land use planning, zoning laws & building permits).
	Mechanisms are in place to monitor progress on NDCs/NAPs.
	Budget allocations are transparent and tracked.

4. Inclusive Planning

Risk-informed, climate-sensitive planning processes must involve vulnerable and marginalized groups, including youth, women, persons with disabilities, and displaced populations. Climate scenarios and traditional knowledge should inform infrastructure investment and emergency preparedness. Inclusion of WASH in National Adaptation Plans (NAPs), Nationally Determined Contributions (NDCs), and other climate related national and local policies and vice versa, inclusion of climate resilience within WASH policies and plans can best align financing and policy with resilience goals. Decentralized planning tools and participatory risk assessments help localize decision-making under uncertainty.

Even in humanitarian engagements, climate-resilient humanitarian WASH response must also engage with national disaster risk reduction (DRR) frameworks and climate adaptation strategies, especially in protracted crises where emergency programming transitions into recovery or development. Aligning with NAPs and sectoral DRR efforts can unlock synergies and pave the way for more sustained, systems-oriented approaches.

Climate-Responsive WASH Planning in Ghana

Ghana has taken initial steps to mainstream climate resilience into WASH programming at the district level. Some district plans now include dedicated adaptation budgets and resilience indicators to track progress over time (Int J Environ Res Public Health, 2017). Additionally, Ghana's WASH Compact aligns climate-resilient WASH systems with its National Adaptation Plans, emphasizing sustainable water management and embedded WASH–climate integration. (Wateraid, 2024)

These developments point toward growing coherence between WASH and national climate adaptation strategies, though deeper operationalization at the local level remains an opportunity for further advancement.

Box 8: Inclusive WASH planning in Ghana

Building Block	Suggested outputs and outcomes for successful integration of climate resilience into WASH Systems Strengthening Building Blocks [28]
Inclusive Planning	Communities participate in the planning, design, and management of WASH programs and interventions, and the needs of marginalized groups are prioritized.
	Risk assessments inform planning and policies and integrate local knowledge and climate projections.
	WASH integrated into NAPs/NDCs.
	Climate change considerations are integrated into WASH planning and policy, and the needs, experiences, and issues on the local level inform national-level policies.

5. Finance

Climate-smart budgeting is key to resilient WASH systems. Climate resilience considerations must be integrated into public financial management (e.g. budget tagging and expenditure reviews, financial protection strategies, subsidy and tax reforms). This includes cost analyses of adaptation and risk mitigation, mainstreaming climate criteria into sector financing, and mobilizing international climate finance (e.g., Green Climate Fund – GCF - , Adaptation Fund -AF - , Global Environmental Facility – GEF, etc.). Blended finance models, risk insurances and contingency funds can support proactive and reactive resilience measures. Financial planning should consider both short-term response needs and long-term system transformation to withstand climate shocks.

Building Block	Suggested outputs and outcomes for successful integration of climate resilience into WASH Systems Strengthening Building Blocks [28]
Finance	The government has the capacity to mobilize international climate financing.
	Investments are risk-informed.
	National budget is allocated for climate adaptation and disaster response.

6. Monitoring

Robust monitoring systems should track climate risks[2], system and actors´ vulnerabilities, and adaptive performance. Indicators need to go beyond service coverage to include system functionality under stress, early warning triggers, disaster response timelines, and adaptive capacities. Data must be disaggregated to reveal differential climate impacts across populations and geographies. Integrated platforms combining hydrological, health, and infrastructure data can provide real-time feedback loops for adaptive management.

Building Block	Suggested outputs and outcomes for successful integration of climate resilience into WASH Systems Strengthening Building Blocks [28]
Monitoring	Context-specific climate resilience indicators have been developed and are monitored.
	The development and implementation of climate resilience strategies and processes is monitored.
	EWS are operational, integrate data from other sectors, and the public and service providers receive timely warnings.

7. Learning & Adaptation

Continuous learning underpins climate resilience. Mechanisms such as after-action reviews, resilience audits, and scenario-based planning should be institutionalized. Knowledge generated through pilot projects and local innovations must be systematized and scaled. Platforms for horizontal learning between districts, countries, and organizations foster innovation diffusion and build long-term adaptive capacity.

Building Block	Suggested outputs and outcomes for successful integration of climate resilience into WASH Systems Strengthening Building Blocks [28]
Learning & Adaptation	Post-disaster reviews and evaluations are conducted.
	Communities, practitioners, and other relevant stakeholders are involved in reflection and learning processes.

8. Water Resources & Environment

Fig. 5: Surface water catchment in Sudan, WHH 2016

The “Water Resources and Environment” building block is the foundation of any climate-resilient WASH system, as it deals with the physical availability, quality, and long-term sustainability of the water sources on which all services depend. No matter how strong the institutional or financial architecture, a WASH system will ultimately fail if its source dries up, becomes contaminated, or collapses under climate stress.

Climate-resilient WASH requires alignment with sustainable water resource management. This includes groundwater protection, catchment-based planning, water use efficiency, and pollution control. Environmental flows and integrated water resource management (IWRM) approaches must be integrated into WASH policies and operations.

Ecosystem-Based Adaptation (EbA) – Nature-Based Solutions for Water Resilience

Ecosystem-based adaptation (EbA) is a nature-based approach that uses ecosystem services - such as wetlands, forests, and watersheds - to help communities adapt to the impacts of climate change. Within the WASH sector, EbA contributes directly to water security by enhancing recharge, regulating flows, reducing erosion, and buffering against floods and droughts. Measures such as wetland conservation, upstream reforestation, and the restoration of degraded catchments strengthen both the quality and quantity of water resources that WASH systems depend on. EbA also supports integrated water resource management and complements infrastructure-based solutions by offering low-regret, cost-effective, and sustainable climate adaptation pathways.

Examples of EbA in practice include watershed protection and nature-based flood control measures in Uganda, Tajikistan, and the Caribbean (Haiti, the Dominican Republic, and Cuba). In fragile and climate-vulnerable settings, these approaches offer a valuable contribution to building long-term resilience at the source.

Box 9: Ecosystem Based Adaptation

[2] For example, it is important to monitor rainfall, groundwater levels, surface flows, water abstraction, and water quality because it provides an indication of emerging threats to water resources. Thereby helping to identify drivers of water insecurity and can help to identify long-term trends (WaterAid, 2021).

To further adapt this building block to a climate resilience agenda, WASH programmes must systematically integrate catchment-based water resource management, source protection, and environmental risk reduction. This includes conducting climate-informed hydrological assessments, monitoring groundwater recharge and depletion trends, and mapping water source vulnerability to drought, flooding, and salinisation. WASH actors must collaborate with water resource and land-use authorities to define and enforce protection zones, regulate upstream activities, and promote nature-based solutions such as reforestation and wetland restoration. Moreover, the environmental footprint of WASH services - particularly sanitation and wastewater - must be actively managed to avoid degrading the very ecosystems that support safe and sufficient water as well as avoid further contributing to the problem, i.e. emitting GHG, favoring low carbon WASH options.

Building Block	Suggested outputs and outcomes for successful integration of climate resilience into WASH Systems Strengthening Building Blocks [28]
Water Resources & Environment	Water resource databases and climate risk assessments exist and inform decision-making.
	Plans exist that detail water allocation during and after extreme events, are based on equity concerns, and prioritize water for domestic consumption.

9. Demand, Behavior & Political Will

Behavioral change strategies should promote water conservation, climate-aware hygiene practices, and collective responsibility for resilience. Public campaigns and school-based education can embed climate awareness from an early age. Political commitment is essential to secure sustained investment and regulatory backing for climate-smart WASH, requiring targeted advocacy, political economy analysis, and evidence-based communication.

Building Block	Suggested outputs and outcomes for successful integration of climate resilience into WASH Systems Strengthening Building Blocks [28]
Demand, Behaviour & Political Will	Communities, officials, and agencies are aware of climate change impacts and the cost of inaction.
	Households are incentivized to use water efficiently and to take actions that increase climate resilience

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Contact

wash@welthungerhilfe.de
www.welthungerhilfe.org/wash

WHH global climate team:
alicianatalia.zamudio@welthungerhilfe.de