

RESILIENT WATER SERVICES

From risk assessment to action

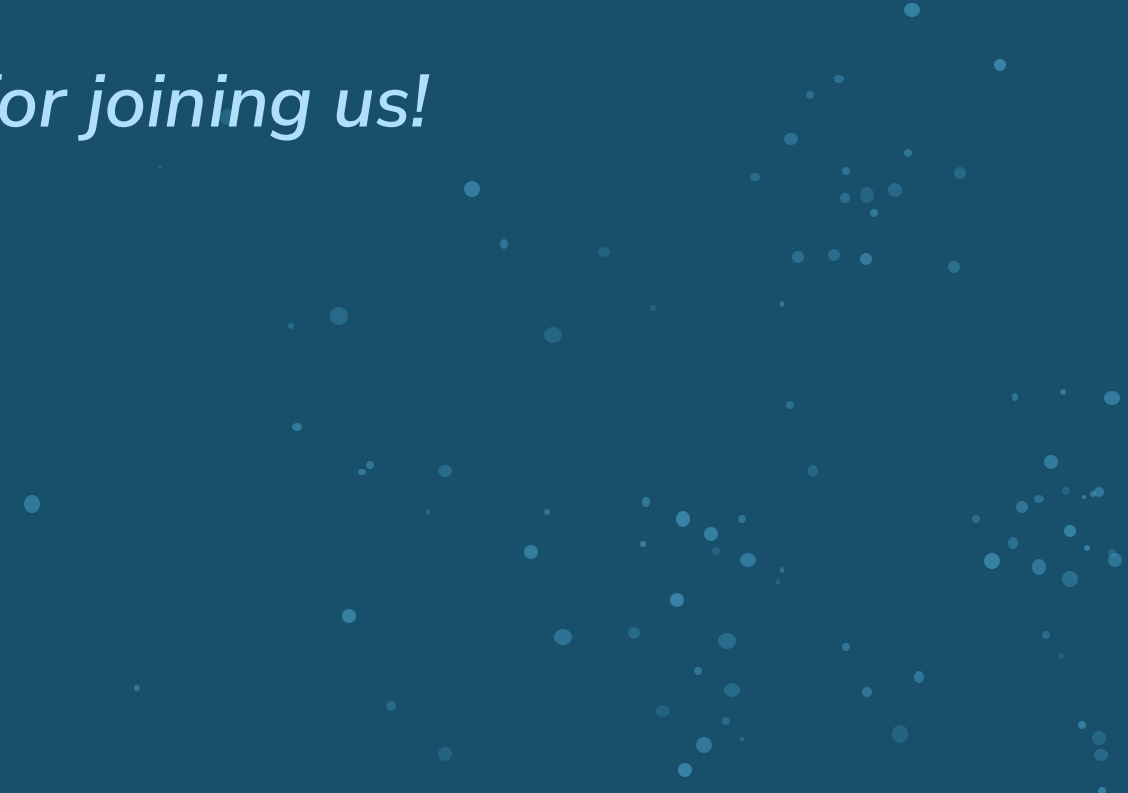
Convened by 1001fontaines & Institute of Sustainable Futures (UTS)

25 August 2026



Welcome!

We'll get started shortly — thanks for joining us!



TODAY'S PROGRAMME

Climate-Resilient WASH

1

Indicators

Global Indicators for Climate-Resilient WASH

JMP & GLAAS

2

Resilience in Practice

Cambodia & West African WASH SMEs — Climate Risk Assessment in the field

100fontaines/Teuk Saat 1001, ISF/UTS, Aqua for All & FLUSH

3

Panel Discussion

Questions & Financing the Transition

All Speakers — moderated by UTS





Audience Q&A

Defining the Terms: Global Indicators for Climate-Resilient WASH

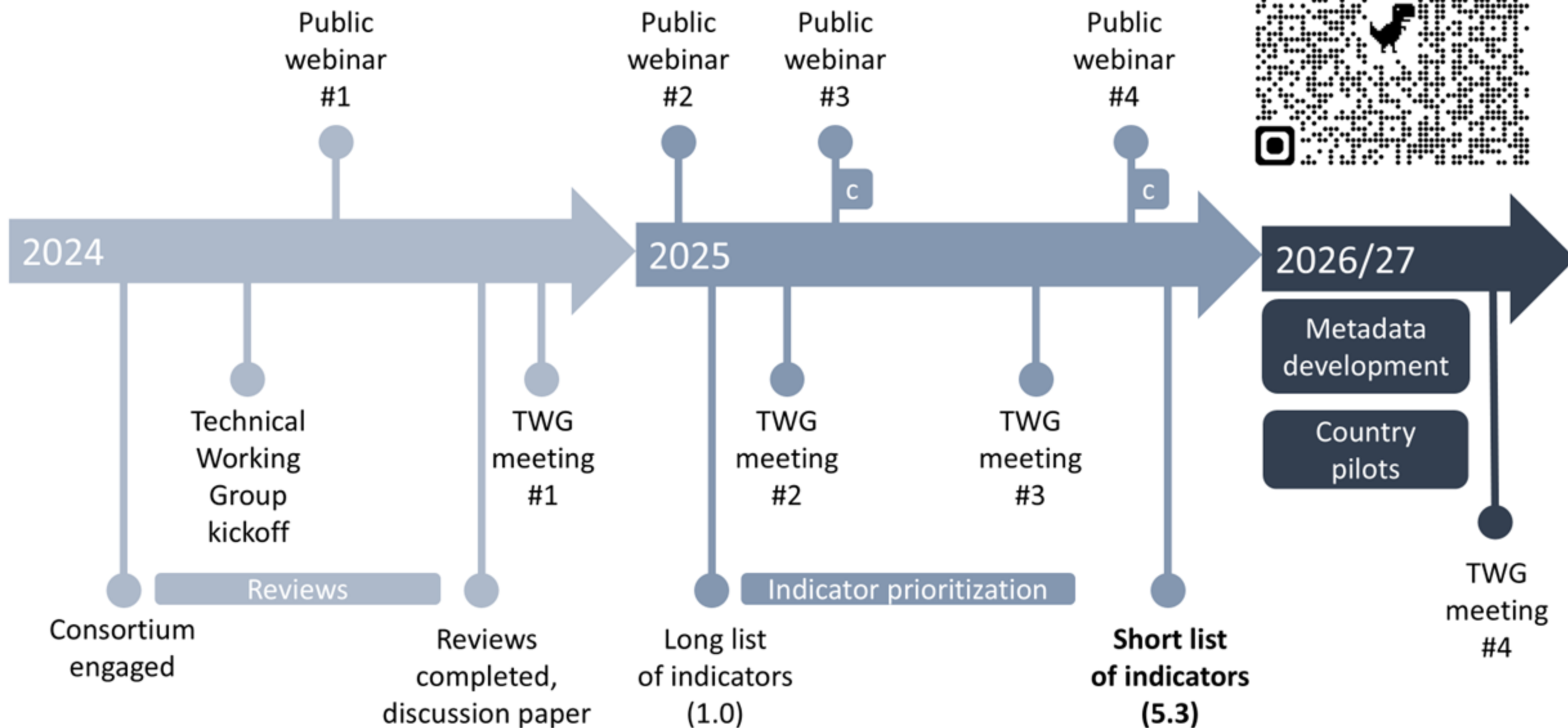
Setting the analytical frame — the emerging indicator set (v5.3) and its link to the Global Goal on Adaptation (GGA)



Rick Johnston

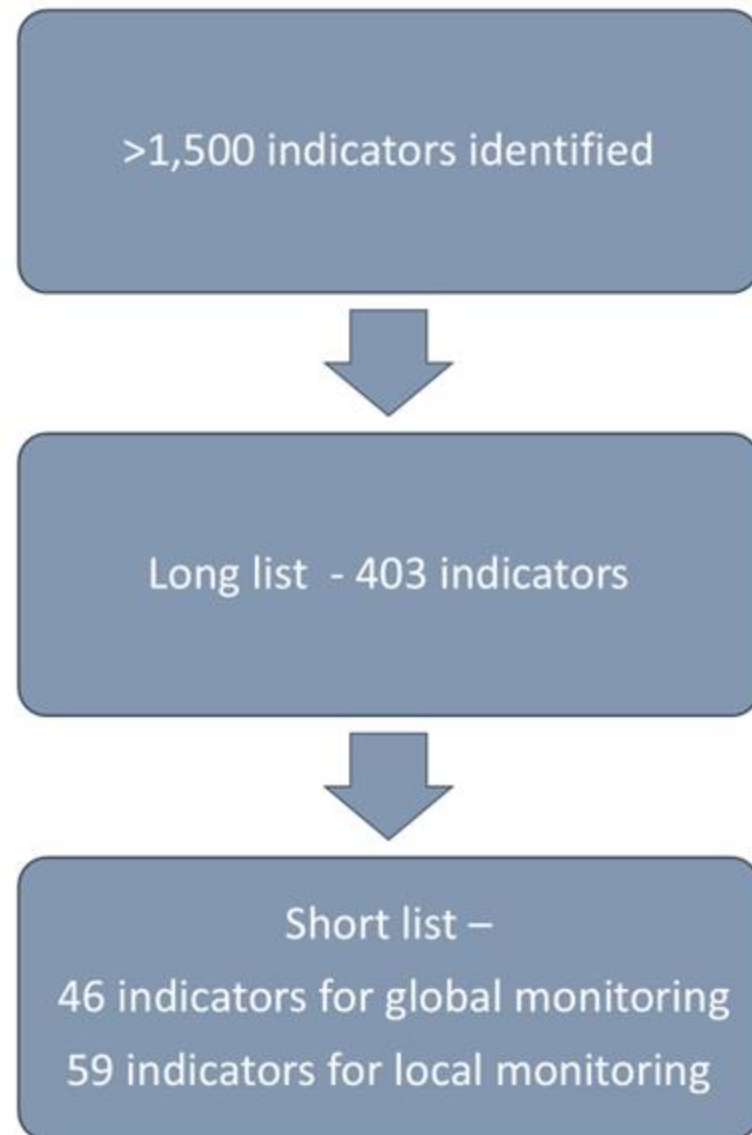
*Co-Lead WHO/UNICEF Joint Monitoring Programme, **World Health Organization***

Timeline and milestones



Progress so far: monitoring climate resilience and WASH

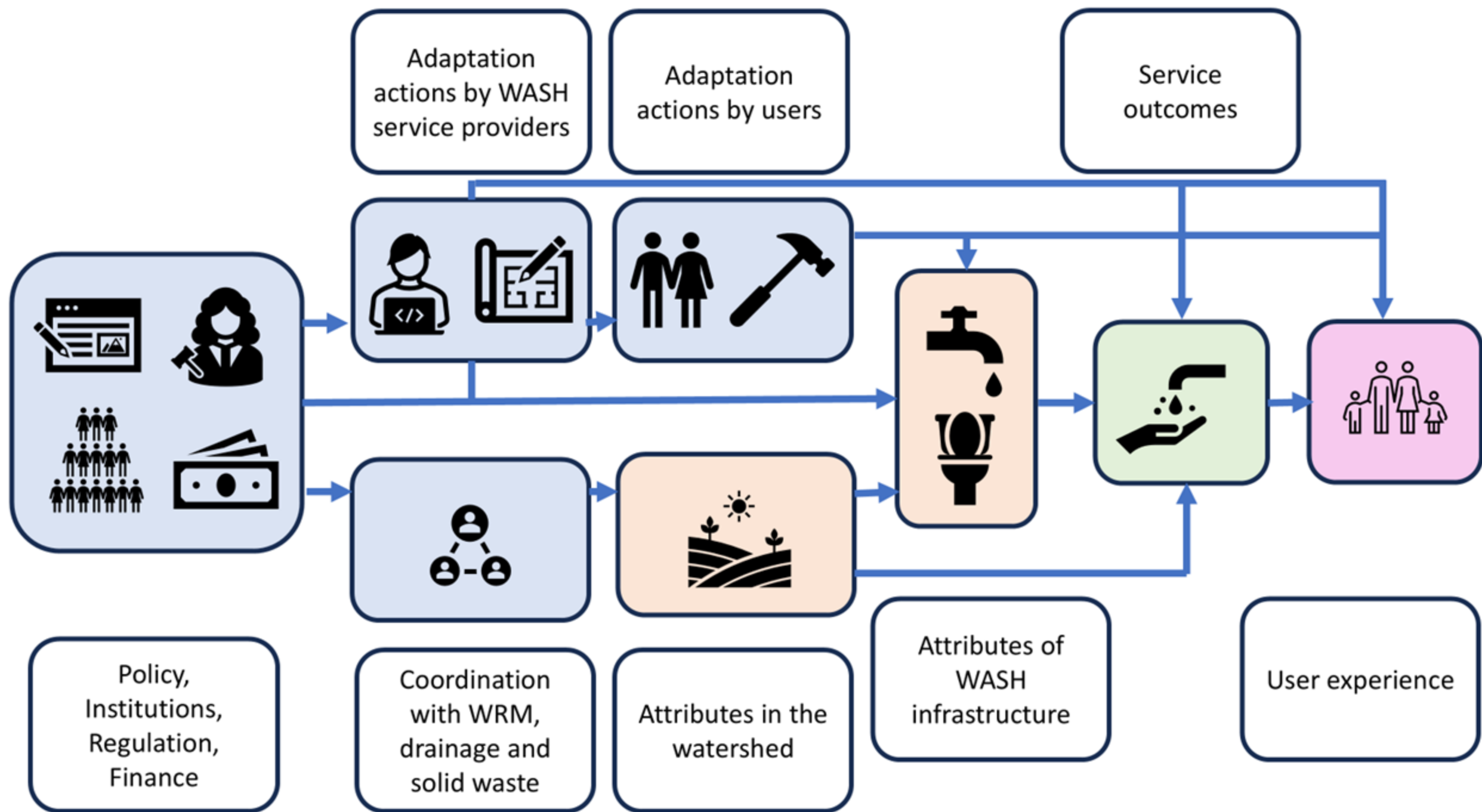
- Conducted 5 literature reviews to identify WASH (and WASH-adjacent) system attributes and adaptation actions that influence resilience
- Reviewed WASH Climate Resilience Frameworks
 - Developed a guiding conceptual framework
- Identified >1,500 potential indicators which were reduced to 403 indicators to consider for monitoring for CR WASH.
- Following public consultations and input from TWG developed shortlists (up to version 5.3)
 - 46 indicators for global monitoring of CR WASH
 - 59 indicators for local monitoring of CR WASH



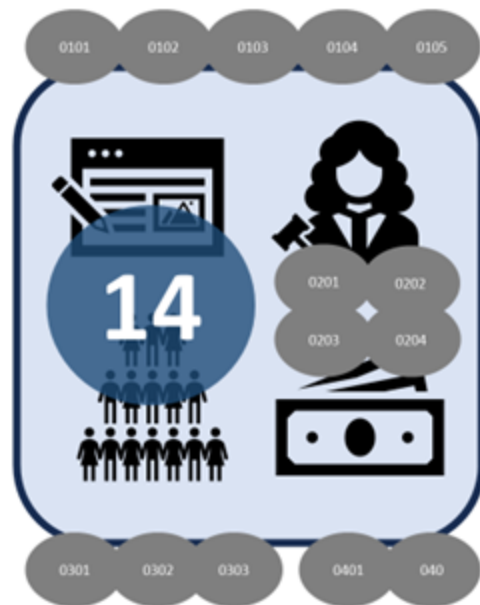
Global indicators (Set A) and local indicators (Set B)

Set A (46): Global indicators for JMP/GLAAS Programmes	Set B (59): Local indicators
Comparable across countries	Tailored to local contexts
Suitable for JMP/GLAAS reporting	Supports programme and operational decisions
Limited number of core indicators	Greater level of detail
Feasible to collect routinely at scale	May require specialised or resource-intensive data collection
Focus on global trends and progress	Focus on local risks, performance and adaptation actions
Prioritised for development in this project	Valuable indicators for future development and use at national/sub-national level

Example global indicator	Example local indicator
0601/0701 - Proportion of population / schools / health care facilities served by water or sanitation service providers that implement risk management plans which consider current and future climate	0705 - Proportion of sanitation service providers that have protocols and procedures in place for safe, appropriate and timely emptying of pits and tanks on receipt of early warning relating to a climate event



46 Set A indicators



Adaptation
actions by WASH
service providers



Adaptation
actions by users



Service
outcomes



Policy,
Institutions,
Regulation,
Finance



Coordination
with WRM,
drainage and
solid waste



Attributes in the
watershed

Attributes of
WASH
infrastructure

User experience

Global Goal on Adaptation

- Established in 2015 under the Paris Agreement to strengthen adaptive capacity and resilience worldwide
- UAE Framework for Global Climate Resilience
 - COP28 in 2023
 - Sets out targets, including on water and sanitation
- UAE-Belém Work Programme (2023-2025)
 - Involved expert teams to propose indicators for GGA targets
 - In 2025, COP30 adopted 59 Belém Adaptation Indicators
- Belém-Addis Vision on Adaptation (2025-2027)
 - Countries are encouraged to test the Belém Adaptation Indicators
 - Technical work to continue on metadata development
 - 2026 Bonn Climate Conference inconclusive



Belém Adaptation Indicators Paragraph 9(a)

Water resources / systems resilience

- a) Level of water stress, including as an outcome of adaptation actions where applicable, accounting for relevant climate hazard intensity and/or frequency;
- b) Level of water use efficiency, including as an outcome of adaptation actions where applicable;
- c) Proportion of critical water and sanitation infrastructure systems that are resilient to climate-related hazards under different warming scenarios, as appropriate for regions and contexts, including as an outcome of adaptation actions where applicable;
- d) Proportion of the total area of basins and cryosphere for which a climate adaptation plan has been developed and implemented on the basis of different warming scenarios, as appropriate for regions and contexts where applicable;

People-centred resilience

- e) Proportion of the population using safe and affordable potable water services that are climate-resilient, including as an outcome of adaptation actions where applicable;
- f) Proportion of the population using sanitation services that are safely managed and climate-resilient, including as an outcome of adaptation actions where applicable;
- g) Extent of measures taken to improve and extend water, sanitation and hygiene services to populations disproportionately affected by climate change and to vulnerable groups relative to needs;
- h) Proportion of bodies of water with good ambient water quality for drinking water supply, including as an outcome of adaptation actions where applicable;
- i) Number of people per 100,000 supported in planned relocation processes in response to water-related hazards, where adaptation measures were taken to ensure safety of populations.

Belém Adaptation Indicators Paragraph 9(a)

- a) Level of water stress, including as an outcome of adaptation actions where applicable, accounting for relevant climate hazard intensity and/or frequency;
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- d) Proportion of the total area of basins and cryosphere for which a climate adaptation plan has been developed and implemented on the basis of different warming scenarios, as appropriate for regions and contexts where applicable;
- ➡ e) **Proportion of the population using safe and affordable potable water services that are climate-resilient, including as an outcome of adaptation actions where applicable;**
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- f) Proportion of the population using sanitation services that are safely managed and climate-resilient, including as an outcome of adaptation actions where applicable;

Related indicators from JMP/GLAAS review

1703 Proportion of population / schools / health care facilities **within nationally determined climate hazard zones** using basic / safely managed drinking water services

1803 Proportion of population / schools / health care facilities **within nationally determined climate hazard zones** using basic / safely managed sanitation services

Similar to existing indicators monitored by JMP

0101 WASH policies and plans integrate climate adaptation measures for households, schools and health care facilities and (i) identify current and future climate risks to WASH, (ii) **identify populations vulnerable to climate change**, (iii) include costed climate adaptation measures and (iv) mandate 'build-back-better' principles for post climate-event recovery (a) are in place; (b) align with national adaptation plans; and (c) are regularly revised using updated climate projections

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Related indicators from JMP/GLAAS review

0104 WASH plans include measures to ensure climate resilient WASH investments are focused on populations vulnerable to [and disproportionately affected by] climate change

Similar to existing indicators monitored by GLAAS (A9ii)

0101 WASH policies and plans ... (ii) identify populations vulnerable to climate change

Current and Future Work

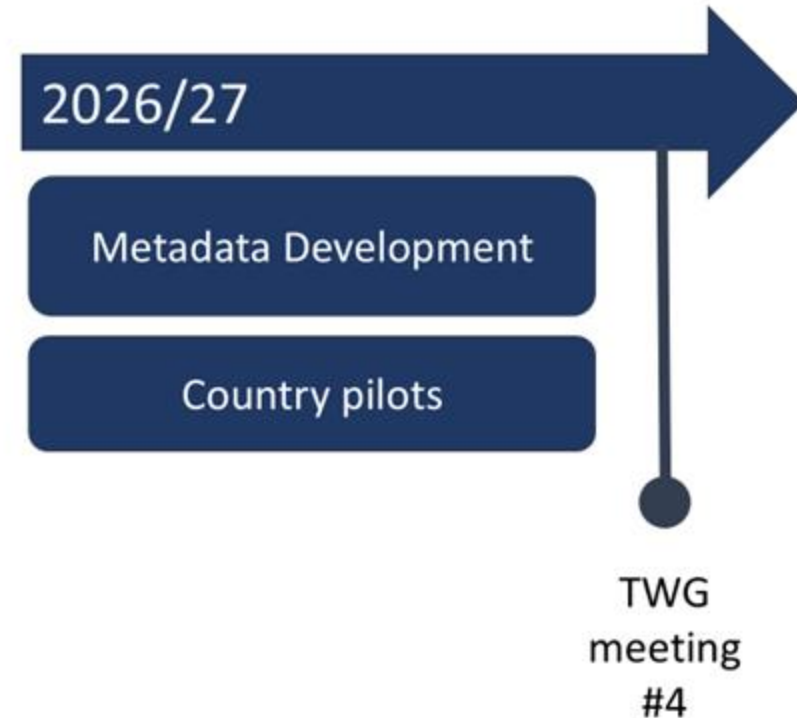
Moving from indicator identification to indicator operationalisation

1. Developing indicator metadata

- Definitions
- Data sources
- Collection methods
- Disaggregation requirement
- Reporting guidance

2. Pilot Testing

- Countries are encouraged to test the Belém Adaptation Indicators
- Assess data availability
- Test collection methods
- Engage national stakeholders
- Identify implementation challenges
- Refine indicators and metadata



A smiling woman wearing a blue headscarf and a matching blue shawl with a pink and yellow border. She is standing outdoors next to a blue water tap. The background is slightly blurred, showing some structures and trees.

Thank you!
Rick Johnston (WHO)



Resilience in Practice I — Cambodia: From Climate Data to Water Kiosk-Level Decisions

The CRA framework across 13 provinces — climate projections combined with operational vulnerability indicators into tiered risk profiles, with a live demo of the mapping tool



Eva Leneveu

Program manager, 1001fontaines



Tim Foster

Director, Institute of Sustainable Futures (UTS)

Teuk Saat 1001 - 20 years of supporting community-owned, entrepreneur-operated water kiosks



350 water kiosks



1000+ entrepreneurs & operators



Home delivery



Community committee



Convenience

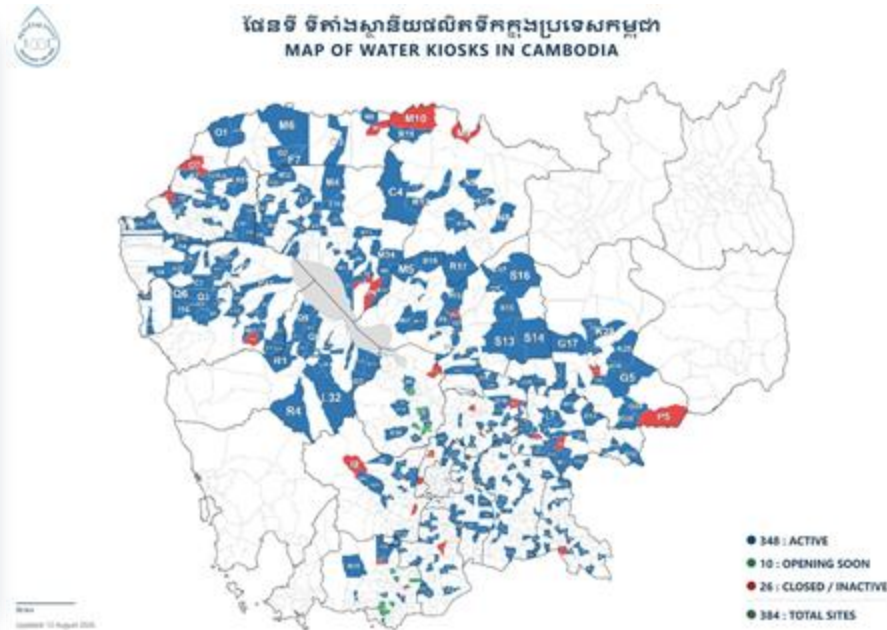


1.1 M consumers

Climate Risk Assessment: a groundbreaking study to strengthen resilience

Why now?

- Increase in extreme weather events disrupting operations (*flooding, scarcity, raw water quality*)
- Evidence highlighting Cambodia's vulnerability to climate change
- Preparation for major reinvestment at a critical turning point in a 20-year-old network



Our approach

- Partner with ISF UTS experts
- Start from operational data and field immersion
- Ensure outputs are actionable - integrated into the in-house information system to support decision-making

Record drought affecting the network

2019

O-we 2030 prospective study

2024

Climate Risk Assessment

2025-26

Resilient reinvestment plan

2027-29



Climate-Resilient WASH

Understanding climate-operational risks involved three step process

Rainfall at different lag-periods clearest predictor of operational risks

1

Site visits understand climate impacts



2

Link climate and operational data

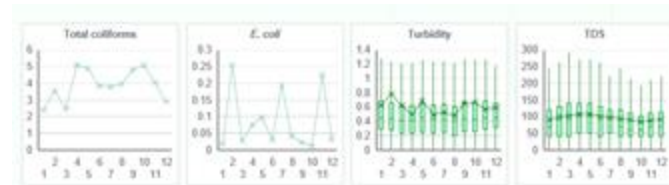
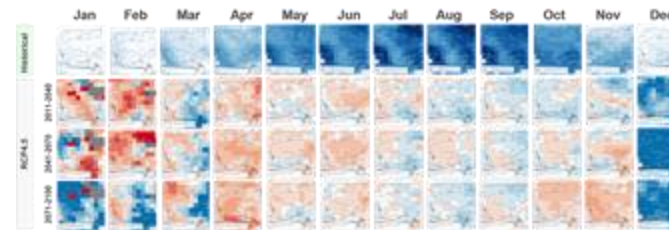


CMIP5-CORDEX E Asia ensemble:

- Discharge
- Soil moisture
- Aridity
- Rainfall
- Runoff

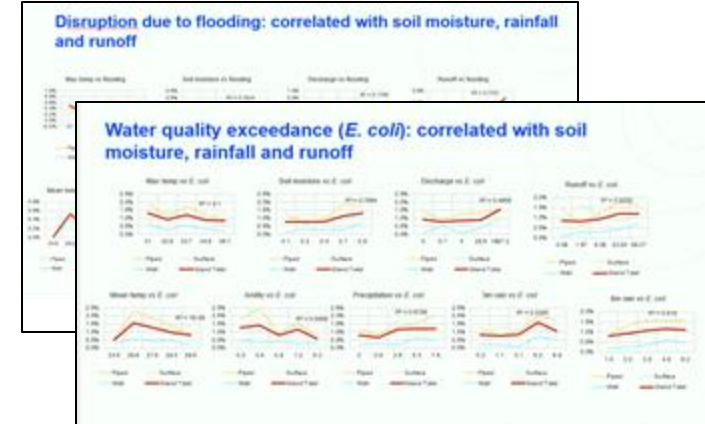
Operational data (>42,000 months)

- disruption: flooding, shortage
- microbial: *E.coli* TC
- chemical: manganese, nitrates etc



3

Quantify relationships & project forward

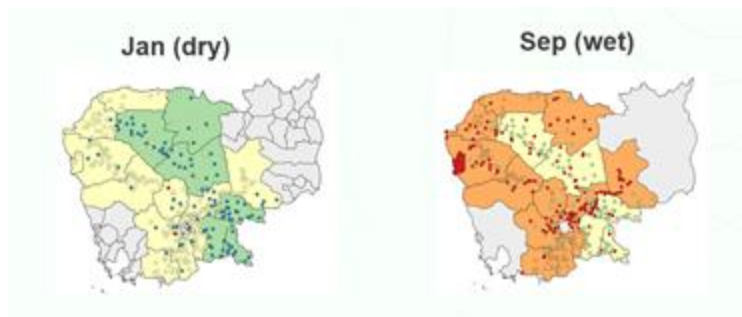
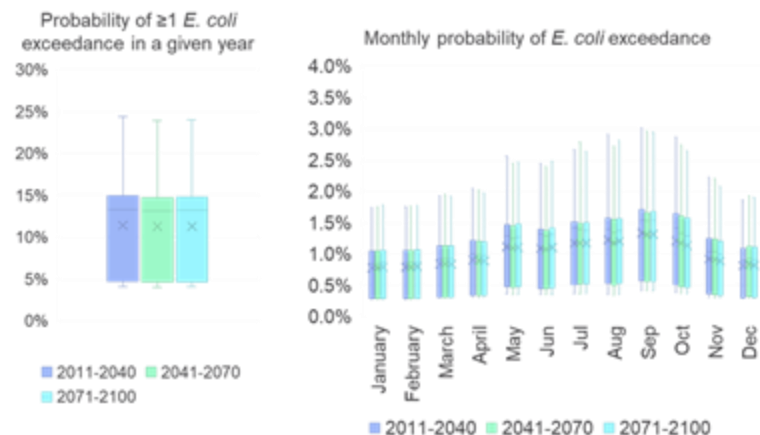


Summary table of correlations and significant associations

	Temp	Soil moisture	Discharge	Runoff	Aridity	Rainfall (monthly)	Rainfall (3-monthly)	Rainfall (6-monthly)
	r ² D	r ² D	r ² D	r ² D	r ² D	r ² D	r ² D	r ² D
E. coli detection		▲		▲	▼	▲	▲	▲
Total coliform detection		▲			▼	▲	▲	▲
Scarcity	▲	▲						▼
Flooding	▼	▲	▲	▲		▲	▲	▲
Turbidity exceedance				▲				▲

Operational risks modelled across seasons, time horizon and space

Risks will change over time but in a highly heterogeneous way



% increased in <i>E. coli</i> risk (to 2041-2070)	-1.2%	+0.2%	-0.1%	-0.4%	+1.3%	-1.8%	-1.7%	-0.2%	-4.1%	-1.8%	-3.2%	-1.0%	2.9%
% provinces with increased <i>E. coli</i> risk	0	9	10	4	4	3	2	6	0	3	0	3	18
% kiosks with increased risk	5	183	183	106	74	31	62	138	0	65	1	82	361



Linking data with operational performance can guide where and when to act and how to target investment in resilience measures

- **Plan seasonally:** Rainfall patterns over both short and medium-term can help to anticipate changing operational and water-quality risks
- **Think locally:** Network averages can conceal important differences between water systems and times of year
- **Tailor responses:** Match resilience measures to source type and local conditions
- **Target investment:** Prioritise monitoring and investment during higher-risk periods and at higher-risk locations.

Resilience in Practice II — Water & Sanitation SMEs: CRA for Business Continuity, Growth & Impact

Deployed across 10+ African countries — Risk = Hazard Likelihood × Impact, applied at enterprise level, with FLUSH as technical partner



Annemarie Mastenbroek

Manager Technical Assistance & Capacity Building, Aqua For All

Kimberly Worsham

Founder & Principal, FLUSH



Our dual approach

Sustainable. Inclusive. Climate-smart.

Market development

Supporting water and sanitation enterprises to scale and become sustainable and investment-ready.

Fund investments and capital structuring

Unlocking private capital for financing access to and delivery of water and sanitation services.

Cross cutting-themes

- Climate adaptation, mitigation and resilience
- Gender
- Impact focus



Assessment of adaptation and mitigation

Avoiding emissions. Reducing risks. Building resilience.



Adaptation impact

- Chronic climatic changes and acute hazards need to be **assessed by location** to understand the need to adapt operations to these risks.
- Resilience to climate change is looked at from two perspectives:
 - Resilience of Water & Sanitation services
 - Resilience created through Water & Sanitation services
- CRA to assess risks, identify vulnerabilities and design adaptation activities

Mitigation impact

- Interventions are assessed for possibilities to keep **emissions of greenhouse gasses** (GHGs) low
- List of questions to identify emissions and opportunities to reduce them

Process to assess adaptation impact:

Climate Risk Assessment
(Resilience of Water & Sanitation)

Design of adaptation measures

Categorisation of adaptation impact
(Resilience through Water and Sanitation)

Process to assess mitigation impact:

Assessment of operational emissions

Design of mitigation measures

Categorisation of mitigation impact

'Do-no-harm' verification

Assessment of adaptation and mitigation

Avoiding emissions. Reducing risks. Building resilience.



Adaptation impact

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(Resilience of Water & Sanitation)

Design of adaptation measures

Categorisation of adaptation impact
(Resilience through Water & Sanitation)

Process to assess mitigation impact:

Assessment of operational emissions

Design of mitigation measures

Categorisation of mitigation impact

'Do-no-harm' verification

From understanding to adapting: *Aqua for All's Climate Risk Assessment (CRA)*

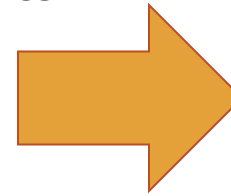
- Developed by Aqua for All, building on existing climate risk and adaptation frameworks
(incl. from UNEP FI & TFCD, UNICEF & GWP, Guy Howard et al.)
- Assesses site-specific climate risks and vulnerabilities, based on list of questions
- Suitable for small and large water and sanitation enterprises, but also relevant for financial service providers.
- Applies a systems perspective beyond technical infrastructure
- Supports climate adaptation planning and action prioritisation



Risk = Hazard Likelihood x Impact

Hazard Likelihood: The probability that a specific climate-related hazard will occur (such as flooding or drought) to which the WASH service may be exposed to within a defined time period

Impact: The severity of the negative effects on the WASH service, infrastructure, or users if the climate hazard occurs, and the capacity to recover from it.



Climate risks are assessed through the CRA by:

1. *Defining the local scope and service*
2. *Identifying climate hazards*
3. *Assessing vulnerability*
4. *Prioritising risks*

1. **Enterprise & Location Information:**
(Name, Sector, Country, Operational area description)
2. **Climate Hazard Likelihood Assessment:**
 - a) Floods
 - b) Water availability issues (e.g. drought, water scarcity)
 - c) Water quality issues (e.g. salinity)
 - d) Storms
 - e) Extreme heat
 - f) Other climate-related risks
3. **Impact Assessment:**
 - a) Technical/Operational
 - b) Environmental
 - c) Social/Market
 - d) Financial
 - e) Other
4. **Adaptive Capacity Assessment:**
 - a) Insurance availability
 - b) Internal emergency procedures
 - c) Early warning systems
 - d) Institutional support
 - e) Existing adaptation measures
5. **Adaptation Planning:**
(Priority list of adaptation activities & investments)



1. / 2. / 3. Climate Hazards

N.B. This first step is only assessing the likelihood of the hazard occurring in the area operations, not the impact of occurrence.

Floods

River/urban/coastal flood, extreme runoff

Water Availability

Drought, water scarcity, groundwater reduction

Water Quality

Saltwater intrusion, surface water quality risks, groundwater quality risks

Storms

Cyclones/ hurricanes/storms, hail

Extreme Heat

Other Climate Related Risks

Specify below





Phase 1 (2022-24): Climate in acceleration programmes

Carried out as part of:

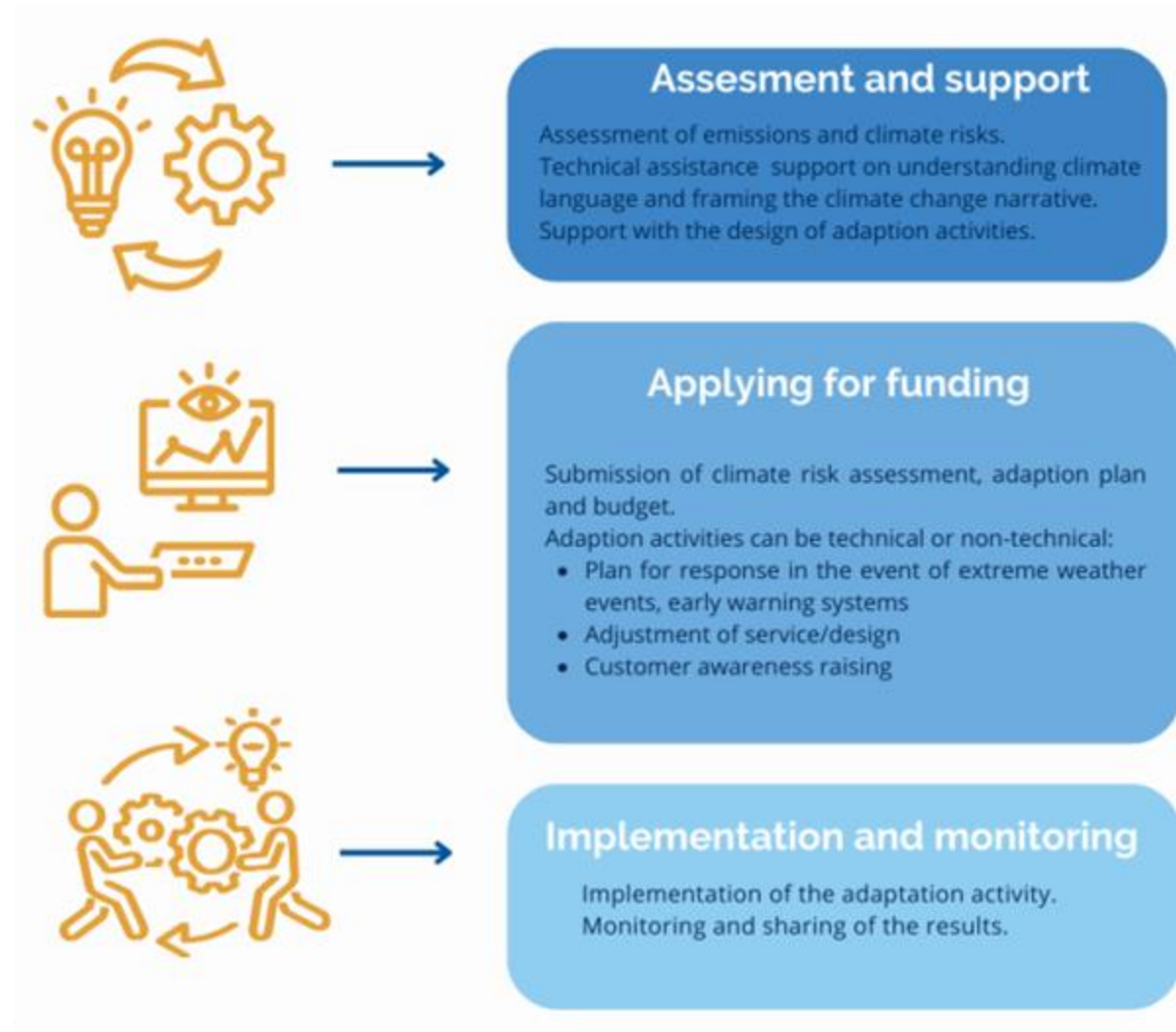
**PME performantes WASH
climate 2.0 accelerator** in
Burkina Faso

Rural Water Accelerator in
Kenya/Uganda

Intervention:

CRA support, TA & funding to
6 enterprises in Burkina Faso,
Kenya and Uganda

Total amount: ≈ € 45,000
(excl. in-kind support)



Phase 2 (2025-27): Climate in Results-Based Grants, TA & implementation grants

Carried out as part of:

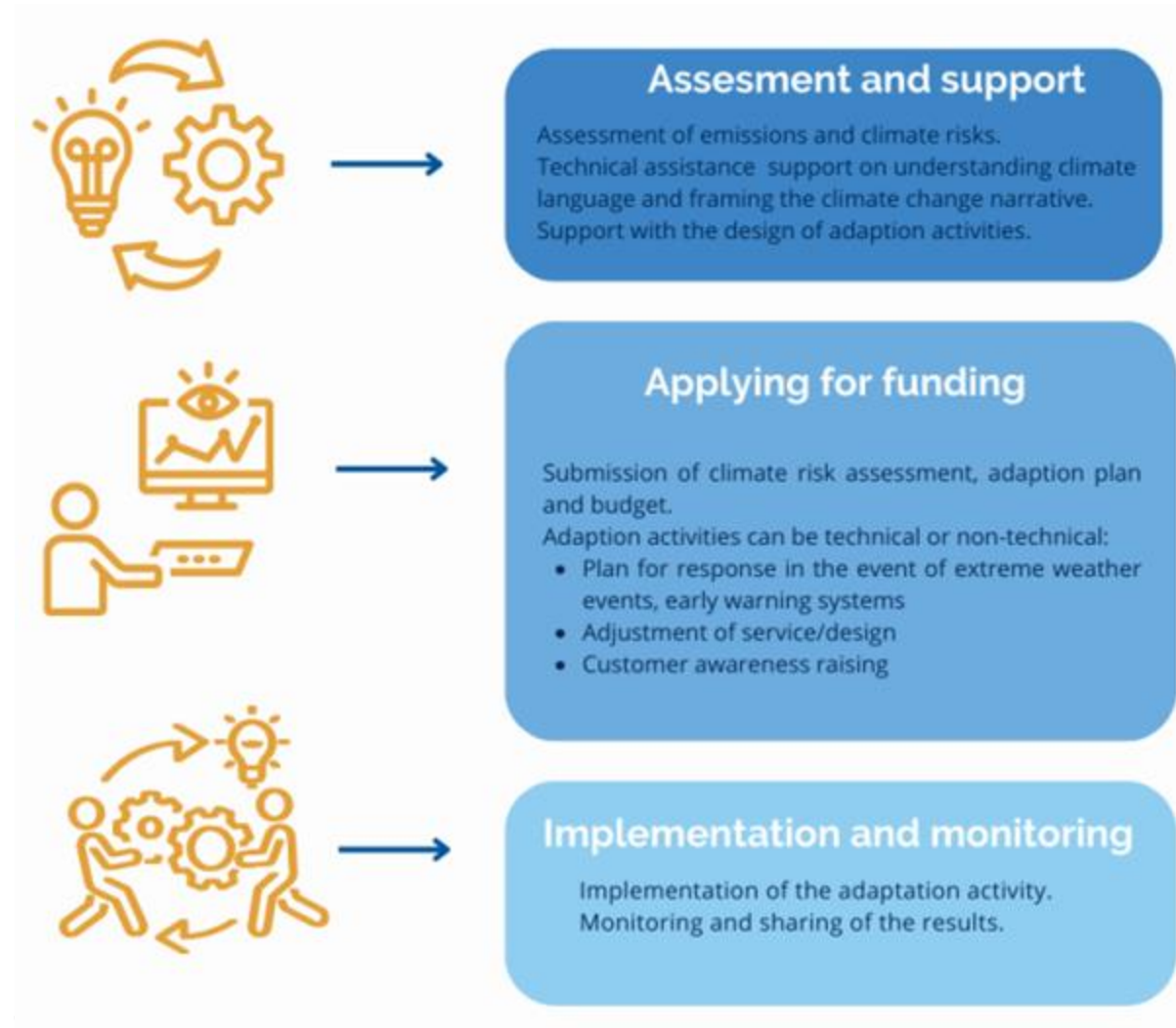
**Scaling Climate-Resilient WASH
Programme** in West-Africa and
Horn of Africa

Intervention:

CRA support to 12 enterprises in
Burkina Faso, Ethiopia, Ghana,
Mali, Nigeria, Senegal

TA & funding: TBD, to 4-6
enterprises (selection process
ongoing)

Total amount: ≈ € 120,000



Results & learnings Phase 1:

Promising Foundations with Limited Funding, Recourse Constraints Persist

Adaptation impact created	Result	No of projects that used this indicator
Number of people made more resilient through the activity, through:	92,980 ppl	6
Staff trained	49 ppl	4
Customers trained	5,331 ppl	5
Services made more resilient for (no) of customers	87,600 ppl	1
Other indicators used to measure resilience		
Additional water storage installed	226 m ³	2
Climate risk team established	1 team	1
Tree nursery established	1 nursery	1
Parishes with reduced flood risks	3 parishes	1

- 1 Climate adaptation TA filled important awareness & knowledge gap
- 2 All enterprises included capacity-building activities
- 3 Shortage of qualified climate trainers
- 4 Funding level may have favoured training-focused interventions
- 5 CRA and adaptation planning approach well received
- 6 Some enterprises considered funding Insufficient for long-term impact

Snapshot of reflections from enterprises

*"We have learnt many practical aspects of **how best to install rainwater tanks**. For example, that the beginning of winter is the ideal time to install the equipment. Or that it is important to integrate a shading system on top of the polytank to protect it from the sun, and that we need to set up a system for monitoring and regular maintenance of the systems."*

Enterprise in Burkina Faso that supplies clean drinking water to urban and rural homes by building, equipping, and running water supply networks & kiosks.

- Hazard(s) & vulnerability: Groundwater reduction & Decrease in Rainfall: Reliance & lack of awareness on declining groundwater.
- Adaptation strategy: Commercialisation of rainwater harvesting, retention systems to reduce dependency on groundwater, awareness creation on water conservation

*"We realized the **importance of having a dedicated risk team** to assess, recommend, and approve project plans before implementation, which has started saving us considerably. It's not a one-person task, but rather a team effort. The only **challenge we faced was finding a skilled and competent trainer** for climate-resilient water infrastructure."*

Enterprise in Uganda that designs, builds, enterprise that builds and runs solar-powered water systems and farm irrigation networks.

- Hazard(s) & vulnerability: River floods: Frequent relocation of customers and damaged boreholes
- Adaptation strategy: Build flood resilient infrastructure, train staff and increase community awareness on floods

*"Through **early issue detection, preventive maintenance, and responsible water use**, the community has improved its ability to adapt to fluctuating water availability and quality. A major success was the **high level of community engagement**, with 450 members from Burani and Moyeni attending the workshops, reflecting strong interest and awareness of water quality issues."*

Enterprise in Kenya that installs, runs, and fixes solar-powered water purification and desalination systems.

- Hazard(s) & vulnerability: Water quality risks & Extreme heat: Reliance on more saline groundwater, increased membrane damage due to salinity.
- Adaptation strategy: Increase frequency of water quality testing to increase life span of membranes, sensitization of community to climate risks

Learnings phase 2: *Grounding Climate Resilience in Daily Operations*

- 1** SMEs often assume
“climate solution = climate resilience”
- 2** AI-generated hazard text often lacks local context and clear pathways to action
- 3** SMEs identified risks not just about water
(ex: like extreme heat affecting labor)
- 4** The CRA process requires hand holding, but key to integrating climate into business models





Audience Q&A

Panel Discussion



Pierre André Têrisse

CEO, **1001fontaines**



Annemarie Mastenbroek

Manager Technical Assistance &
Capacity Building, **Aqua For All**



Tim Foster

*Director, Institute of Sustainable
Futures (UTS*



THANK you