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Indicators, Measures and Methods for Monitoring Climate Resilient WASH

Consolidated Long List v 3.2

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In collaboration with University Technology Sydney: Institute for Sustainable Futures, The University of Bristol, and Oxford University

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PART 1: PREAMBLE

1. Purpose

The purpose of this document is to provide context to the refined long list of indicators identified and developed by the consortium to submit to the technical working group for the process of shortlisting.

2. Background

The longlist was put forward for feedback through both technical working group sessions and a public consultation. Feedback was collected verbally and submitted through email and SurveyMonkey.

To address this feedback, the consortium held a series of virtual and in person meetings to:

1. further develop the indicator objectives. Objectives are now more specific. There is a specific list of objectives for each component of the conceptual framework and in each case the objective can be mapped to either water supply, sanitation, hygiene or the WASH system overall;
2. consolidate and reduce the number of indicators by (a) removing duplicates and (b) replacing clusters of related highly specific indicators with a single more general indicator;
3. convert highly specific indicators to improve relevance across a broader range of hazards and components of WASH systems (e.g., [proportion by length] of a key access road remains stable and undamaged during *flooding* has been changed to [proportion by length] of a key access road remains stable and undamaged *during and following a climate event*); and
4. add indicators to address gaps where no or few indicators had been found for a component of the conceptual framework.

Subsequently the consolidated Long List (version 3.0) was checked for internal consistency and some corrections and further modifications were agreed with the WHO and UNICEF team.

As a result, this Consolidated Long List (version 3.1) was prepared.

3. Project Scope, Theory of Change

The consolidated long list uses the terms 'framework component', 'system component', 'objective' and 'indicator' to group and report on features of Climate Resilient WASH that could be reported on.

The scope and conceptual framework of this project are laid out in the accompanying working document "Climate-resilient WASH global monitoring: Scope and definitions". The conceptual framework is summarised in **Figure 1.** **Figure 1** sets out the boundaries for the consideration of climate-resilient WASH in this project.

The framework can be read as a theory of change consisting of Inputs (shown in GREEN), Intermediate Outputs (shown in PINK), Outputs (shown in BLUE) and Outcomes (shown in YELLOW).

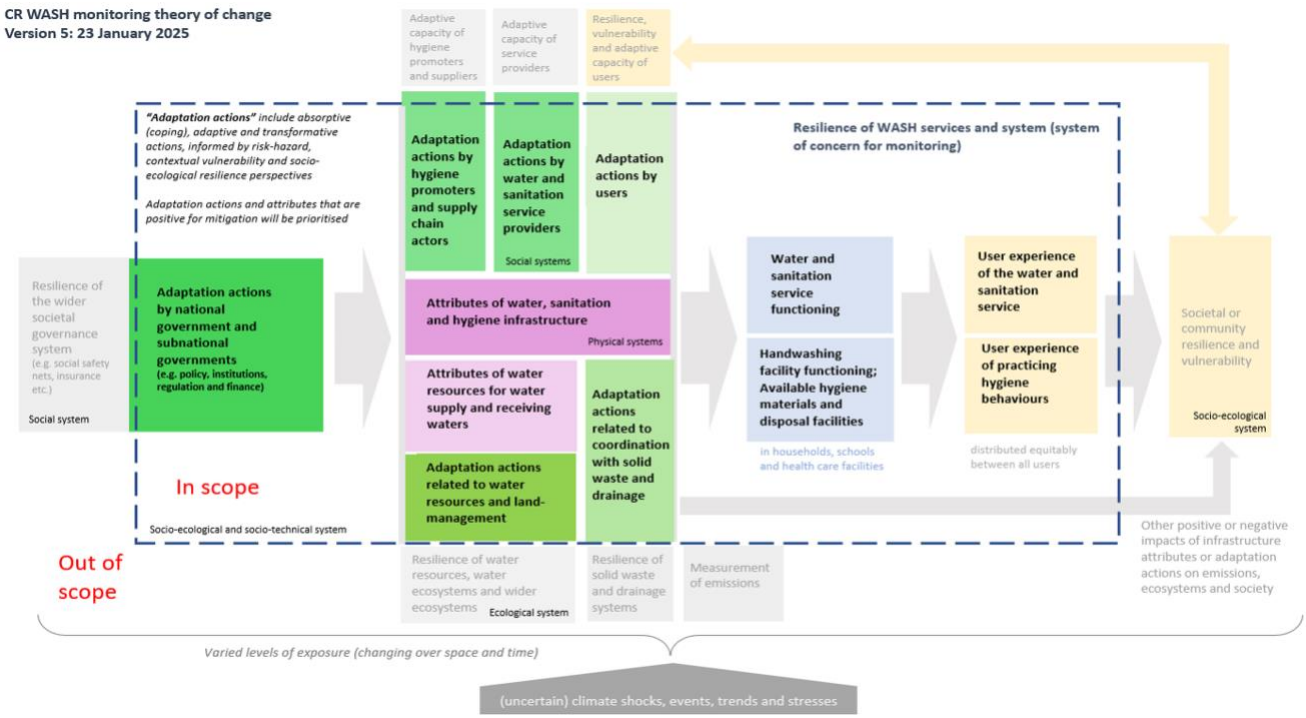

Figure 1: Scope of Climate Resilient WASH Monitoring

4. Definitions of Framework Component, System Component, Objectives, and Indicators in the Consolidated Long List

From **Figure 1** we derived twenty-two (22) 'framework components'. Most map directly on to one of the boxes in **Figure 1**. But some of the boxes have been further subdivided generally between 'system components' to enable indicators relating to water supply, sanitation, hygiene and the WASH system more generally to be distinguished. (see Table A below for a summary of all framework components).

Throughout this document and on the master excel sheet, the following terminology is used.

Framework component: one part of the theory of change that describes the scope of the CR WASH Monitoring project (see Table A below).

System component: one part of the WASH value chain relevant to this project. All the indicators shown in the consolidated long list can be mapped to one system component. Because some indicators are very specific and some more general, there are three 'levels' of system component as shown below on **Figure 2**. When indicators relate to very general aspects of WASH they will be mapped to the highest level system component ('climate resilient WASH system'). Some indicators relate to very specific parts of the WASH value chain (for example 'climate resilient conveyance by sewer'). Some fall in between and are mapped to 'climate resilient water supply system', 'climate resilient sanitation system' or 'climate resilient hygiene system'.

Climate Resilient WASH system	Climate resilient water supply system	Climate resilient water source
		Climate resilient treatment
		Climate resilient water storage and distribution
		Climate resilient household water management
	Climate resilient sanitation system	Climate resilient user interface, capture and containment (including flush)
		Climate resilient conveyance by road (including emptying)
		Climate resilient sewer conveyance
		Climate resilient design and operation of wastewater (WW) and feacal sludge (FS) treatment processes
	Climate resilient hygiene system	Climate resilient hand hygiene
		Climate resilient menstrual hygiene management

Figure 2: System components used in mapping indicators for climate resilient WASH monitoring.

Objective: An objective is the specific result relating to climate resilient WASH that is to be assessed. Objectives on the consolidated longlist reflect *what* is being measured. They have been developed to represent the full range of relevant processes, behaviours, and physical characteristics across the WASH value chain that lead to, or are measures of the climate resilience of the WASH system. Each framework component has between 2 and 16 objectives.

Indicator: An indicator is the measurable variable that reflects status of the objective. Indicators in the refined longlist reflect *how* the objective is being measured. The consolidated longlist includes a range of indicators drawn from evidence reviews, monitoring documents, along with some new indicators developed by the consortium to address identified gaps and incorporate feedback. Indicators in this list remain intentionally expansive to illustrate the variety of ways each objective could be measured (they are thus referred to as 'example indicators') and each is mapped to a single Objective. Example Indicators have not yet been refined in terms of precise wording or feasibility of data collection and they therefore vary in quality. Refining the specific wording of indicators will be a task that takes place once shortlisting has been completed. Some considerations on this topic are included below in Section 6.

Each indicator is mapped to a single objective, a single system component and a single framework component.

5. Guide to Tables of Objectives and Indicators

Table A summarises the framework components and indicates where you can find the full lists of objectives and indicators for each. The table also shows a total count of objectives and indicators for each framework component. Tables numbered 1.1 to 1.22 can be found in Part 2 of this document. Tables numbered 2.1 to 2.22 can be found in Part 3.

Table A: Summary count and table references for objectives and indicators for all framework components

Theory of change	Framework component (Plain text from Figure 1, *italic* indicates further subdivision)	Objectives		Indicators	
		count	Table ref	count	Table ref
INPUTS	1. Adaptation actions by national government and subnational governments - *policy*	9	1.1	19	2.1
	2. Adaptation actions by national government and subnational governments – *institutions*	5	1.2	23	2.2
	3. Adaptation actions by national government and subnational governments – *regulation*	13	1.3	23	2.3
	4. Adaptation actions by national government and subnational governments - *finance*	13	1.4	27	2.4
	5. Adaptation actions by hygiene promoters and supply chain actors	9	1.7	14	2.7
	6. Adaptation actions by water and sanitation service providers – *water supply*	14	1.5	24	2.5
	7. Adaptation actions by water and sanitation service provides - sanitation	16	1.6	27	2.6
	8. Adaptation actions by users – *water supply*	3	1.8	3	2.8
	9. Adaptation actions by users – *sanitation*	3	1.9	4	2.9
	10. Adaptation actions by users - *hygiene*	2	1.10	2	2.10
	11. Adaptation actions related to water resources and land management	6	1.12	13	2.12
	12. Adaptation actions related to coordination with solid waste and drainage	4	1.11	7	2.11
	13. Attributes of water resources for water supply and receiving waters	2	1.13	3	2.13

Theory of change	Framework component (Plain text from Figure 1, *italic* indicates further subdivision)	Objectives		Indicators	
		count	Table ref	count	Table ref
INTER-MEDIATE OUTPUTS	14. Attributes of water, sanitation and hygiene infrastructure – *water supply*	11	1.14	18	2.14
	15. Attributes of water, sanitation and hygiene infrastructure – s*anitation*	10	1.15	22	2.15
	16. Attributes of water, sanitation and hygiene infrastructure - *hygiene*	3	1.16	5	2.16
OUTPUTS	17. Water and sanitation service functioning – *water supply*	6	1.17	17	2.17
	18. Water and sanitation service functioning - *sanitation*	6	1.18	18	2.18
	19. Handwashing facility functioning, available hygiene materials and disposal facilities	6	1.19	14	2.19
OUTCOMES	20. User experience of the water and sanitation service – *water supply*	7	1.20	11	2.20
	21. User experience of the water and sanitation service – *sanitation*	7	1.21	11	2.21
	22. User experience of practicing hygiene behaviours	6	1.22	12	2.22

6. Considerations for example indicator text and future indicator development

6.1 Generic WASH indicators

Generic WASH indicators have been removed from the consolidated list except where they are particularly relevant to climate hazards, as the focus is on assessing climate resilience rather than general WASH performance. Indicators such as containment emptying (LL210) and leak detection for piped water (LL231) were retained where they reflect critical functions under climate-related stress.

6.2 Types of climate hazards

Where specific climate hazards were referenced, we aimed to generalise indicator language to apply across a range of hazard types, while considering both acute events and longer-term climate trends. Most indicators in the consolidated list are oriented toward high-impact, low-probability events since existing evidence and frameworks focused on monitoring resilience to these events. Fewer indicators within the evidence explicitly focused on gradual or cumulative hazards.

6.3 Indicator Types and Design Considerations

When evaluating both objectives and indicators, it is important to consider the variability of WASH systems, contexts, and institutional settings that global monitoring must be applicable to and measure. The design of specific indicators will be influenced by available data sources, measurement feasibility, and the structural and functional characteristics of the system being assessed. Indicators should enable disaggregation where relevant and allow for comparability across subgroups. The following are example indicators that demonstrate how different indicator types can be structured to reflect key indicator design considerations in global monitoring of climate-resilient WASH systems:

6.3.1 Disaggregation

Indicators can be structured to allow disaggregation by a range of dimensions, including hazard types, WASH subsectors (water, sanitation, or hygiene), and parameters relevant to equity. Disaggregating by these factors enables more nuanced interpretation of which populations, services, or regions are most affected before, during, and after climate events. Specifically for equity, applying equity-focused disaggregation across appropriate indicators supports the identification of disproportionately affected groups and can inform more targeted and inclusive resilience-building efforts. This example is developed from LL286 on the refined list.

Objective: Water quality is maintained
LL286 - Change in proportion of people dependent on rainwater, shallow groundwater or surface water for domestic uses before, during and following a climate event
LL286-EQ(x): Change in the proportion of [subgroup x] dependent on rainwater, shallow groundwater or surface water for domestic uses before, during and following a climate event LL286-EQ(LowSES): Individuals or households with low socioeconomic status LL286-EQ(HighSES): Individuals or households with high socioeconomic status (for comparative analysis) LL286-EQ(IDP): Internally displaced persons or residents of informal settlements LL286-EQ(Disability): Persons with disabilities

6.3.2 Ladder of ambition (levels of progress)

Scalar indicators can be designed as a ladder of ambition or level of progress to reflect the current status of the system towards reaching an objective. This example is derived from *WHO Climate change and health: Resilience and GHG emissions index* submitted to our call for contributions for indicator LL170 on the refined long list.

Objective: WASH policy and planning incorporates current and future climate risk	
o No reference to climate risks in WASH sector policies or strategies	Level 0

o Climate risks are acknowledged, but no specific adaptation actions or measures are included	Level 1
o General adaptation measures are mentioned but not costed and/or only loosely tied to identified risks	Level 2
o Specific climate adaptation measures are outlined and linked to identified risks in the WASH sector	Level 3
o Adaptation measures are costed and integrated into sector strategies, but with limited mechanisms for implementation	Level 4
o Costed adaptation measures are fully integrated, with assigned responsibilities, timelines, and financing mechanisms in place for implementation	Level 5

PART TWO: TABLES OF OBJECTIVES

7. Objectives for INPUTS

Table 1.1: Adaptation Actions by National and Subnational Government (Policy)

System component	Objective
Climate Resilient Water Supply System	Financial incentives in place to invest in climate change adaptation in the WASH sector
Climate Resilient Hygiene System	Supply chains are resilient to climate hazards
Climate Resilient WASH System	CR WASH strategy proactively addresses dis-equity
	Early warning systems in place that support actions to reduce impact of climate events
	National level policy aligned with international climate goals
	Supply chains are resilient to climate hazards
	Co-benefits of CR WASH are realised
	WASH policy and planning incorporates current and future climate risk
	Institutional culture that is adaptive, responsive to change, and oriented toward transformative climate adaptation.

Table 1.2: Adaptation Actions by National and Subnational Government (Institutions)

System component	Objective
Climate Resilient WASH System	Climate data available for CR WASH planning
	Coherence and cooperation structures in place between agencies to deliver CRWASH
	Early warning systems in place that support actions to reduce impact of climate events
	WASH institutions are adaptive and transformative to meet climate-related challenges
	Workforce is adequate for CR WASH Systems

Table 1.3: Adaptation Actions by National and Subnational Government (Regulations)

System component	Objective
Climate Resilient Water Supply System	National monitoring systems collect information on the climate resilience of WASH
	WASH planning incorporates current and future climate risk
	Operational standards and guidance exist for CR WASH
Climate Resilient Sanitation System	WASH planning incorporates current and future climate risk
	Operational standards and guidance exist for CR WASH
Climate Resilient Hygiene System	WASH planning incorporates current and future climate risk
Climate Resilient WASH System	National monitoring systems collect information on the climate resilience of WASH
	Progress in improving WASH supply access is tracked for populations disproportionally affected by climate change
	WASH planning incorporates current and future climate risk
	Operational standards and guidance exist for CR WASH
	Design and construction standards and guidance exist for CR WASH
	Post-climate event response times and service disruptions are tracked and reported.
	Recovery processes are rapid and support long-term, transformative improvements

Table 1.4: Adaptation Actions by National and Subnational Government (Finance)

System component	Objective
Climate Resilient Water Supply System	Sufficient budget allocation/expenditure for WASH climate adaptation
Climate Resilient Hygiene System	Sufficient budget allocation/expenditure to support equitable adaptation during and following a climate event
Climate Resilient WASH System	Accessible finance available to support rapid recovery following a climate event
	External funding is aligned with national CR WASH strategy
	Financial incentives in place to invest in climate change adaptation in the WASH sector
	Financial plans are regularly reviewed and adapted in response to changing climate risk
	Sufficient budget allocation/expenditure for capacity building for CR WASH
	Sufficient budget allocation/expenditure for WASH climate adaptation
	Sufficient budget allocation/expenditure to support equitable adaptation during and following a climate event
	Co-benefits of CR WASH are realised
	Financial costs of climate adaptation are tracked
	Financial costs of damage to WASH infrastructure are tracked
	Sufficient budget allocation/ expenditure to support WASH supply chain strengthening
	Sufficient budget allocation/ expenditure to support WASH-relevant early warning systems

Table 1.5: Adaptation Actions by Hygiene Promoters and Supply Chain Actors

System component	Objective
Climate Resilient Menstrual Management	Early warning systems in place that support actions to reduce impact of climate events
	Support to households provided to undertake actions for climate resilience/ recovery
	WASH planning incorporates current and future climate risk
	Workforce is adequate for CR WASH Systems
Climate Resilient Hygiene System	Early warning systems in place that support actions to reduce impact of climate events
	Supply chains are resilient to climate hazards
	Support to households provided to undertake actions for climate resilience/ recovery
	Use of appropriate technology for hygiene kit distribution
	Participatory planning in place to ensure appropriate emergency hygiene kit contents

Table 1.6: Adaptation Actions by Water Supply Service Providers

System component	Objective
Climate Resilient Water Source	Operation and management is appropriate to ensure and advance climate resilience
	Water resources management considers current and future climate risk
	Redundancy is provided to reduce impacts of climate change
Climate Resilient Water Treatment	Emergency response protocols/plans/back-ups in place
	Operation and management is appropriate to ensure and advance climate resilience
Climate Resilient Storage and Distribution	Operation and management is appropriate to ensure and advance climate resilience
Climate Resilient Water Supply	Early warning systems in place that support actions to reduce impact of climate events
	Emergency response protocols/plans/back-ups in place
	Operation and management is appropriate to ensure and advance climate resilience
	Proactive plans and actions in place to prepare for the effects of climate events
	Support to households provided to undertake actions for climate resilience/ recovery
	Time for services to be restored is minimised
	Sufficient quality and quantity of workforce exists for CR WASH
	CR WASH strategy proactively addresses inequity

Table 1.7: Adaptation Actions by Sanitation Service Providers

System component	Objective
Climate Resilient Sanitation User Interface, Capture, and Containment (including flush)	Operation and management is appropriate to ensure and advance climate resilience
Climate Resilient Conveyance by Road (including emptying)	Emergency response protocols/plans/back-ups in place
	Operation and management is appropriate to ensure and advance climate resilience
	Proactive plans and actions in place to prepare for the effects of climate events
Climate Resilient Sewer Conveyance	Emergency response protocols/plans/back-ups in place
	Operation and management is appropriate to ensure and advance climate resilience
Climate Resilient Design and Operation of WW and FS Treatment Processes	Emergency response protocols/plans/back-ups in place
	Operation and management is appropriate to ensure and advance climate resilience
Climate Resilient Sanitation System	Emergency response protocols/plans/back-ups in place
	Operation and management is appropriate to ensure and advance climate resilience
	Proactive plans and actions in place to prepare for the effects of climate events
	Support to households provided to undertake actions for climate resilience/ recovery
	Time for services to be restored is minimised
	Service providers secure adequate finance for climate resilience
	Sufficient quality and quantity of workforce exists for CR WASH
	CR WASH strategy proactively addresses inequity

Table 1.8: Adaptation Actions by Users (Water Supply)

System component	Objective
Climate Resilient Household Water Management	Users build back better following a climate event
	Users prepare themselves for climate events by securing household water storage
	Users respond to climate events by taking actions to secure water quantity and quality

Table 1.9: Adaptation Actions by Users (Sanitation)

System component	Objective
Climate Resilient Sanitation User Interface, Capture, and Containment (including flush)	Users build back better following a climate event
	Users prepare for climate events by providing themselves with climate adapted toilets
	Users provide themselves with redundancy to offset effects of service interruption/system failure

Table 1.10: Adaptation Actions by Users (Hygiene)

System component	Objective
Climate Resilient Hygiene System	Users build back better following a climate event
	Users prepare for climate events by stockpiling essential hygiene items

Table 1.11: Adaptation Actions Related to Water Resources and Land Use Management

System component	Objective
Climate Resilient Water Source	Water resource management supports climate resilience
	Climate related risk is managed in the catchment
	Adaptive water resources planning in place
Climate Resilient Water Supply System	WASH sector has embedded approach to adaptation to climate change
	Climate related risk is managed in the catchment
Climate Resilient Sanitation System	Climate related risk is managed in the catchment

Table 1.12: Adaptation Actions Related to Coordination with Solid Waste and Drainage

System component	Objective
Climate Resilient Sanitation System	Coherence and cooperation between agencies to deliver climate resilient WASH
	Operation and management is appropriate to ensure and advance climate resilience
	Users receiving messages that inform user adaptation actions
	Coordinated investment in grey/green urban infrastructure able to cope with extreme events (e.g. wastewater treatment and NbS)

8. Objectives for INTERMEDIATE OUTPUTS

Table 1.13: Attributes of Water Resources for Water Supply and Receiving Waters

System component	Objective
Climate Resilient WASH System	Water quality is maintained
	Water supply quantity is maintained

Table 1.14: Attributes of Water Supply Infrastructure

System component	Objective
Climate Resilient Water Source	Assets and systems have reduced exposure to climate shocks and stresses
	Assets and systems have reduced sensitivity to climate shocks and stresses
	System design includes redundancy to offset effects of service interruption/system failure
Climate Resilient Water Treatment	Assets and systems have reduced sensitivity to climate shocks and stresses
	Construction and design standards for climate resilient water supply are implemented
Climate Resilient Storage and Distribution	Assets and systems have reduced sensitivity to climate shocks and stresses
	Time for services to be restored is minimised
Climate Resilient Water Supply System	Assets and systems have reduced sensitivity to climate shocks and stresses
	Construction and design standards for climate resilient WASH are implemented
	Emergency response protocols/plans/back-ups in place
	Co-benefits of CR WASH are realised

Table 1.15: Attributes of Sanitation Infrastructure

System component	Objective
Climate Resilient Sanitation User Interface, Capture, and Containment (including flush)	Assets and systems have reduced exposure to climate shocks and stresses
	Assets and systems have reduced sensitivity to climate shocks and stresses
	System design includes redundancy to offset effects of service interruption/system failure
Climate Resilient Sewer Conveyance	Assets and systems have reduced sensitivity to climate shocks and stresses
Climate Resilient Design and Operation of WW and FS Treatment Processes	Assets and systems have reduced exposure to climate shocks and stresses
	Assets and systems have reduced sensitivity to climate shocks and stresses
	Operation and management is appropriate to ensure and advance climate resilience
Climate Resilient Sanitation System	Assets and systems have reduced sensitivity to climate shocks and stresses
	Diversity in sanitation service providers
	Co-benefits of CR WASH are realised

Table 1.16: Attributes of Hygiene Infrastructure

System component	Objective
Climate Resilient Hygiene System	Assets and systems have reduced exposure to climate shocks and stresses
	Assets and systems have reduced sensitivity to climate shocks and stresses
	System design includes redundancy to offset effects of service interruption/system failure

9. Objectives for OUTPUTS

Table 1.17: Water Supply Service Functioning

System component	Objective
Climate Resilient Water Source	Sufficient water quantity is supplied
Climate Resilient Water Treatment	Water quality is maintained
Climate Resilient Storage and Distribution	Sufficient water quantity is supplied
Climate Resilient Water Supply System	Time for services to be restored is minimised
	Water quality is maintained
	Access to basic water supply is maintained

Table 1.18: Sanitation Service Functioning

System component	Objective
Climate Resilient Sanitation User Interface, Capture, and Containment (including flush)	Access to basic sanitation is maintained
Climate Resilient Conveyance by Road (including emptying)	Road based FSM continues to provide a minimum service
Climate Resilient Sewer Conveyance	Sewer system continues to provide a minimum service
Climate Resilient Design and Operation of WW and FS Treatment Processes	Sewer system continues to provide a minimum service
Climate Resilient Sanitation System	Access to basic sanitation is maintained
	Time for services to be restored is minimised

Table 1.19: Handwashing Facility Functioning and Supply of Hygiene Materials and Disposal Facilities

System component	Objective
Climate Resilient Hand Hygiene	Handwashing (basic services) with soap and water are available at home
	Handwashing facilities are available
Climate Resilient Menstrual Hygiene Management	Safe, secure, and preferred MHM facilities available during and following a climate event
	People have access to preferred materials to manage their menstrual hygiene
Climate Resilient Hygiene System	Disposal facilities for hygiene products are available
	People have access to preferred materials to manage their hygiene

10. Objectives for OUTCOMES

Table 1.20: User Experience of Water Supply Service

System component	Objective
Climate Resilient Water Supply System	Access to water supply is maintained
	Financial impacts on users are minimised
	Users are protected from psychosocial distress related to water service disruptions
	User complaints/ requests for assistance are dealt with in a timely manner
	Users have the financial capacity to respond to a climate event
	Water quality is maintained
	Users are protected from GBV related to water supply service interruptions

Table 1.21: User Experience of Sanitation Service

System component	Objective
Climate Resilient Sanitation User Interface, Capture, and Containment (including flush)	Access to basic sanitation is maintained
Climate Resilient Sanitation System	Access to basic sanitation is maintained
	Financial impacts on users are minimised
	User complaints/ requests for assistance are dealt with in a timely manner
	Users are protected from GBV related to sanitation service interruptions
	Users are protected from psychosocial distress related to sanitation service interruptions
	Users have the financial capacity to respond to a climate event

Table 1.22: User Experience of Practicing Hygiene

System component	Objective
Climate Resilient Hand Hygiene	Users are protected from uncertainty related to practicing hygiene
Climate Resilient Menstrual Hygiene Management	Users are protected from psychosocial distress related to practicing hygiene
	People have access to the water they need to practice menstruation
Climate Resilient Hygiene System	Users are protected from psychosocial distress related to sanitation service interruptions
	Users are protected from uncertainty related to practicing hygiene
	Users are protected from GBV related to practicing hygiene

PART THREE: TABLES OF INDICATORS

11. Indicators for INPUTS

Table 2.1: Adaptation Actions by National and Subnational Government (Policy)

System component	Objective	Example indicators
Climate Resilient Water Supply System	**Financial incentives in place to invest in climate change adaptation in the WASH sector**	LL221 - Incentives and support to service providers to encourage the promotion of water efficiency by consumers (e.g. funding to roll out volumetric metering, or advise and technical assistance facility to promote water saving devices in the home)
Climate Resilient Hygiene System	**Supply chains are resilient to climate hazards**	LL340 - Policy in place to support availability/stockpiling of hygiene materials for use during and following climate events
		NL024 - Policy in place to support availability of materials, products and services for improving the resilience of WASH infrastructure
Climate Resilient WASH System	**CR WASH strategy proactively addresses dis-equity**	LL219 - [Proportion of] vulnerable groups engaged in local planning through targeted actions, using differentiated communication channels and tailored messages to address increased risks and limited response capacity
		NL017 - Sector strategies include measures to improve WASH services for populations vulnerable to climate change
		NL022 - National WASH strategy includes consideration of services for vulnerable populations
		NL134 - A policy is in place that explicitly states that CR WASH investments should be made so that CR WASH services are extended equitably

System component	Objective	Example indicators
	Early warning systems in place that support actions to reduce impact of climate events	LL046 - Policies and procedures relating to early warning systems for climate hazards account for impacts on WASH services
	National level policy aligned with international climate goals	LL408 - The country is a signatory to the United Nations Framework Convention on Climate Change and the Paris Agreement and has set clear and realistic objectives of adaptation
		NL133 - Emissions from WASH are included in NDCs and systematically reported in international systems
	Supply chains are resilient to climate hazards	NL024 - Policy in place to support availability of materials, products and services for improving the resilience of WASH infrastructure
	Co-benefits of CR WASH are realised	NL139 - Policy in place to create incentives for selection of CR WASH services that have low carbon/low emissions (at all levels of government)
	WASH policy and planning incorporates current and future climate risk	LL170 - WASH sector policy and strategies identify climate risks and include costed climate adaptation measures
		LL181 - National Adaptation Planning frameworks exist
		LL198 - National climate change adaptation priorities in the WASH sector are reflected in the respective regional development plans
		LL376 - [Proportion of geographic area] for which maps of areas at risk have been produced – e.g. those exposed to a combination of high climate risk, difficult hydrology, and potentially less resilient technologies

System component	Objective	Example indicators
		NL023 - Inclusion of climate resilience in WASH sector review and planning
		NL021 - WASH climate adaptation plans aligned with national adaptation plans/National adaptation plans have targeted WASH objectives
	Institutional culture that is adaptive, responsive to change, and oriented toward transformative climate adaptation.	NL129 - [Percentage of WASH governance instruments (policies, standards, or guidelines)] that mandate resilience improvements as part of post-climate event recovery and

Table 2.2: Adaptation Actions by National and Subnational Government (Institutions)

System component	Objective	Example indicators
Climate Resilient WASH System	**Climate data available for CR WASH planning**	NL009 - Climate data, seasonal forecasts and downscaled projections available to the WASH sector, reviewed regularly
	Coherence and cooperation structures in place between agencies to deliver CRWASH	LL265 - Mechanisms for WASH coordination and data exchange and feedback between central, subnational, and local levels exist
		LL406 - The country Focal Points of the United Nations Framework Convention on Climate Change, National Communication processes to the Convention, National Adaptation processes and Nationally Determined Contributions to the Paris Agreement coordinate with governmental water and sanitation departments for the establishment of sectoral adaptation priorities
		NL128 - Presence of a national climate adaptation reporting framework that systematically includes WASH sector indicators and actions.
		LL021 - [Proportion of] relevant agencies with active cross-agency climate working groups in place for Water, Sanitation, and Hygiene (WASH) coordination (across all levels of government)
		LL022 - [Presence of a] lead agency responsible for climate-resilient WASH policies (across all levels of government)
		LL413 - Roles and responsibilities for climate resilient WASH are clearly defined between sectors (across all levels of government)
		LL414 - Institutions working with WASH have adequate capacity to address the integration of climate change risk reduction into WASH delivery and ongoing management (across all levels of government)

System component	Objective	Example indicators
		NL015 - Proportion of relevant stakeholders (climate change committees, regulatory bodies, and ministries/departments) that have formal agreements or mechanisms in place to coordinate on climate adaptation and environmental management (across all levels of government)
		NL016 - Climate ministry has a mandated role in WASH sector review and planning (across all levels of government)
		LL276 - WASH sector is consulted, and actively participates in, national adaptation processes (across all levels of government)
	Early warning systems in place that support actions to reduce impact of climate events	LL069 - [Proportion of households] receiving clear and timely messaging from early warning systems before, during, and after a climate event or hazard
		LL070 - [Proportion of service providers] receiving clear and timely messaging from early warning systems before, during, and after a climate event or hazard
		LL071 - National early warning system for climate hazards is in place and includes WASH-relevant information
	WASH institutions are adaptive and transformative to meet climate-related challenges	NL135 - Annual and multi-annual WASH investment and management plans are regularly reviewed and updated (at least X times in Y years) leading to significant change in response to current and future climate data
		NL136 - Incentives exist in WASH institutions (e.g. salary increments, promotions) to reward adaption and innovation which addresses current and future climate hazards
	Workforce is adequate for CR WASH Systems	LL025 - [Proportion of the population served by] WASH services with service providers trained in climate risk assessment and management.

System component	Objective	Example indicators
		LL278 - [Percentage of population in areas where local WASH committees exist] with at least 3 WASH committee members participating in education and training activities on early warning systems with respect to WASH needs
		NL012 - Proportion of construction workers trained in resilient structure construction
		NL013 - Sufficient human resources [are in place] to design, implement, and monitor adaptation plans for the WASH sector
		NL014 - Number of regulators or local government staff supporting WASH systems who have received training on climate risk assessment and management
		LL410 - There is a comprehensive capacity development plan for climate resilience and risk assessment based on a capacity needs assessment
		LL262 - Percentage of staff in WASH service provider organisations receiving training in early warning and response systems and in emergency planning and procedures

Table 2.3: Adaptation Actions by National and Subnational Government (Regulation)

System component	Objective	Example indicators
Climate Resilient Water Supply System	**National monitoring systems collect information on the climate resilience of WASH**	NL126 - Water quality monitoring programme capable of tracking temporal change, event and long term change, that integrates community reporting.
	WASH planning incorporates current and future climate risk	LL171 - Sector policy mandates the use of climate-resilient Water Safety Planning
	Operational standards and guidance exist for CR WASH	LL052 - Regulatory measures [in place] to place restrictions on non-critical household water use (e.g. hosepipe bans)
		LL168 - Regulation mandates that sufficient quantities of domestic water supply be provided as a priority before allocations to other water uses are made
Climate Resilient Sanitation System	**WASH planning incorporates current and future climate risk**	NL007 - The extent to which climate risks are systematically incorporated into sanitation planning processes across cities and local authorities—covering the entire sanitation chain.
	Operational standards and guidance exist for CR WASH	LL239 - Effluent discharge limits can be relaxed to maintain operations during periods of extreme drought
		NL137 - Regulations in place to establish appropriate operational parameters for use of combined sewer overflows and emergency by-pass sewers are regularly updated in response to current and future climate data2

System component	Objective	Example indicators
Climate Resilient Hygiene System	**WASH planning incorporates current and future climate risk**	LL361 - Monitoring of access to MHM material disposal facilities is in place and considers climate-related disruptions
Climate Resilient WASH System	**National monitoring systems collect information on the climate resilience of WASH**	LL040 - Regulator collects data on climate impacts and adaptation measures from service providers
		LL274 - National climate impact evaluation includes WASH, carried out in the past 5 years
		LL279 - [Percentage of population in] areas with monitoring in place to support an effective early warning system
		LL411 - There are impact assessments of previous interventions in WASH that include an analysis of how climate threats have affected the achievement of the desired impact and objectives
		NL010 - Monitoring of hygiene product sales or purchases of other cleansing materials considers climate-related disruptions
		NL008 - The existence of systems to monitor and evaluate the impact of extreme weather events on WASH infrastructure and services
		LL042 - [Presence of] monitoring initiatives tracking [diarrheal] disease outbreaks linked to extreme weather events.
	Progress in improving WASH supply access is tracked for populations disproportionally affected by climate change	LL037 - Progress in improving WASH supply access is tracked for populations disproportionally affected by climate change

System component	Objective	Example indicators
	WASH planning incorporates current and future climate risk	LL412 - WASH plans are grounded in a comprehensive risk analysis, which includes climate change considerations
	Operational standards and guidance exist for CR WASH	LL156 - WASH Sector policy sets thresholds (e.g. weather, pollution, inter alia) that trigger hazard management plans
		LL266 - Appropriate regulation on water source/resource protection exists and accounts for climate change
	Design and construction standards and guidance exist for CR WASH	LL095 - [Existence of a national or local] QA (quality assurance process) which accounts for climate change to be performed by service providers
		NL011 - Design standards and related regulations are available to support the construction of infrastructure and delivery of climate resilient WASH services (considers risk from climate variability and change)
	Post-climate event response times and service disruptions are tracked and reported.	NL130 - [Existence of] a system for monitoring and reporting WASH service downtime and response actions following climate-related events.
	Recovery processes are rapid and support long-term, transformative improvements	NL131 - [Proportion of] post-climate event recovery actions that are implemented within defined timelines and include measures to enhance long-term WASH system resilience.

Table 2.4: Adaptation Actions by National and Subnational Government (Finance)

System component	Objective	Example indicators
Climate Resilient Water Supply System	**Sufficient budget allocation/expenditure for WASH climate adaptation**	LL205 - Financial incentives for water efficiency by service providers
		LL364 - Finance prioritised to support climate resilience, as needed for local hazards
Climate Resilient Hygiene System	**Sufficient budget allocation/expenditure to support equitable adaptation during and following a climate event**	NL006 - Financial mechanisms in place (e.g. cash transfers) to support vulnerable populations to access hygiene products during and following climate events
Climate Resilient WASH System	**Accessible finance available to support rapid recovery following a climate event**	NL001 - Value and availability of emergency cash transfers for WASH response and recovery after climate events
		NL002 - Total value of investment to build WASH climate resilience sufficient to meet the needs of the most climate and socially vulnerable populations
		NL003 - The proportion of WASH service providers with dedicated and accessible budgets or insurance funds allocated for rapid response, repair, and rehabilitation of services following climate-related extreme events, including post-disaster emergency construction
	External funding is aligned with national CR WASH strategy	LL201 - Total funding secured from multilateral funds for climate change (e.g. Green Climate Fund, Adaptation Fund, Global Environment Facility) for CR WASH
	Financial incentives in place to invest in climate change adaptation in the WASH sector	NL047 - Transfers from central to local government or from government to utilities is conditional on the existence of investment and management plans to improve CR WASH

System component	Objective	Example indicators
	Financial plans are regularly reviewed and adapted in response to changing climate risk	NL004 - The WASH sector revises its investment plans, including water resource management plans, every X years using climate projections that are updated within the last Y years, and has conducted a comprehensive assessment of the cost of climate change adaptation under different scenarios.
	Sufficient budget allocation/expenditure for capacity building for CR WASH	LL204 - Funds are allocated to support technical capacity of regulatory bodies on climate resilience of WASH
	Sufficient budget allocation/expenditure for WASH climate adaptation	LL478 - Percentage of WASH capital budget which is earmarked for projects where climate change is a significant objective (OECD CRS Rio Marker RM 1)
		LL479 - Percentage of WASH capital budget which is earmarked for projects where climate change is a principal objective (OECD CRS Rio Marker RM 2)
		LL480 - Percentage of WASH total budget which is earmarked for projects where climate change is a significant objective (OECD CRS Rio Marker RM 1)
		LL481 - Percentage of WASH total budget which is earmarked for projects where climate change is a principal objective (OECD CRS Rio Marker RM 2)
		NL005 - Finance and appropriate mechanisms are in place to support national priorities for climate risk management and adaptation in the WASH sector
		LL281 - [Percentage of service providers] reporting sufficient funding to cover any additional costs associated with achieving climate resilient WASH

System component	Objective	Example indicators
	Sufficient budget allocation/expenditure to support equitable adaptation during and following a climate event	LL051 - [Existence of] an institutional financing analysis that includes options such as cash transfers, with specific mechanisms for supporting low-income households and reinvesting in climate adaptation and recovery from extreme weather events.
		NL138 - Total expenditure OR total expenditure per capita OR total expenditure per capita living in at-risk locations on climate resilient WASH
	Co-benefits of CR WASH are realis	NL140 - Financial incentives in place for selection of CR WASH services that have low carbon/low emissions (at all levels of government)
	Financial costs of climate adaptation are tracked	LL470 - Total expenditure OR total expenditure per capita OR total expenditure per capita living in at-risk locations on climate resilient WASH
		LL471 - Total climate-resilient WASH expenditure as a % of total WASH expenditure
		LL472 - Total climate-resilient WASH expenditure as a % of GDP
		LL473 - Total climate-resilient WASH expenditure as a % of total national climate-resilience expenditure
		LL474 - Climate-resilient WASH expenditure is reported along with national climate-resilience expenditure
	Financial costs of damage to WASH infrastructure are tracked	NL132 - [Total annual estimated cost of] damage to WASH infrastructure due to climate-related events, as reported by relevant authorities.

System component	Objective	Example indicators
	Sufficient budget allocation/ expenditure to support WASH supply chain strengthening	NL045 - Total expenditure OR total expenditure per capita on supply chain strengthening for climate resilient WASH
	Sufficient budget allocation/ expenditure to support WASH-relevant early warning systems	NL046 - Total expenditure OR total expenditure per capita on early warning systems for climate resilient WASH

Table 2.5: Adaptation Actions by Hygiene Promoters and Supply Chain Actors

System component	Objective	Example indicators
Climate Resilient Menstrual Hygiene Management	**Early warning systems in place that support actions to reduce impact of climate events**	LL329 - [Proportion of menstruators] whose local menstrual practices and beliefs are documented in pre-emergency databases
	Support to households provided to undertake actions for climate resilience/ recovery	LL461 - [Proportion of] menstruators that have received messaging on MHM product disposal during and after event
	WASH planning incorporates current and future climate risk	NL042 - Service providers carry out pre-disaster planning and education for the management of menstrual waste disposal during and following climate events
	Workforce is adequate for CR WASH Systems	LL316 - [Proportion of menstruators] with access to discrete distribution of emergency menstrual products by preferred persons
Climate Resilient Hygiene System	**Early warning systems in place that support actions to reduce impact of climate events**	LL339 - [Proportion of] hygiene supply chain actors receive Early Warning Alerts (Weather)
		LL350 - [Proportion of] hygiene promoters receive Early Warning Alerts (Weather)
	Supply chains are resilient to climate hazards	LL338 - [Proportion by length of] key roads for which plans in place to reroute or adapt transport methods if key roads are damaged or inaccessible
		LL355 - Climate resilient WASH management plans address stockpiling of hygiene materials
		LL337 - [Proportion by length of] key access roads remain stable and undamaged during and following a climate event

System component	Objective	Example indicators
	Support to households provided to undertake actions for climate resilience/ recovery	LL290 - [Proportion of the affected population] provided with hygiene kits (including preferred MHM products, and incontinence products) before, during, and following a climate event
		NL043 - [Proportion of population at risk of climate related shock] receiving education/messaging on hygiene behaviour, practice, and materials (in local language) relevant to climate events
	Use of appropriate technology for hygiene kit distribution	NL041 - [Proportion of rescue teams] utilising appropriate technologies to distribute hygiene materials in during and following a climate event
	Participatory planning in place to ensure appropriate emergency hygiene kit contents	LL294 - [Proportion of women] consulted on their preferences for emergency hygiene kit contents.
	Emergency response protocols/plans/back-ups in place	NL020 - [Proportion of households for whom] well-defined, event-specific, timely action plans are ready for execution on receiving early warnings

Table 2.6: Adaptation Actions by Water Supply Service Providers

System component	Objective	Example indicators
Climate Resilient Water Source	**Operation and management is appropriate to ensure and advance climate resilience**	NL108 - [Proportion of households served by] reservoirs that use dynamic management practices (e.g., seasonal demand forecasting, climate-adjusted release schedules).
		LL222 - [Proportion of population served] by water supplies where the source has an active sediment, nutrient and contaminant management plan
		LL226 - [Proportion of population served by] water supplies served by groundwater with active groundwater management
		LL230 - [Proportion of population served by] water supplies which depend on reservoirs with flexible reservoir operation rules
	Water resources management considers current and future climate risk	LL393 - [Proportion of] water resource assessments for water supply that consider current and future climate scenarios
	Redundancy is provided to reduce impacts of climate change	LL229 - [Proportion of the population served by] utilities with multiple or diverse sources.
Climate Resilient	**Emergency response protocols/plans/back-ups in place**	NL117 - [Proportion of households served by] water treatment facilities where service provider has a quick-restart plan in place for use following climate event
		NL118 - [Proportion of water treatment facilities with] emergency storage of treatment chemicals

System component	Objective	Example indicators
Water Treatment	**Operation and management is appropriate to ensure and advance climate resilience**	NL125 - [Proportion of households served by] water treatment systems that use dynamic management practices (e.g. seasonal demand forecasting)
Climate Resilient Storage and Distribution	**Operation and management is appropriate to ensure and advance climate resilience**	LL231 - [Proportion of population served by] water supplies with leak detection and reduction programs
		NL097 - [Proportion of households served by] water storage and distribution systems that use dynamic management practices (e.g. seasonal demand forecasting, climate-adjusted storage and distribution schedules)
Climate Resilient Water Supply System	**Early warning systems in place that support actions to reduce impact of climate events**	LL217 - [Proportion of population served by] water supplies supported by consumer education and communication programs addressing local climate hazards (i.e. boil water advisory)
	Emergency response protocols/plans/back-ups in place	LL048 - [Proportion of water supply service providers OR population with] well-defined, event-specific, timely action plans ready for execution on receiving early warnings
	Operation and management is appropriate to ensure and advance climate resilience	LL167 - [Proportion of population served by] water supplies that implement climate-resilience plans (for example climate-resilient water safety plans) which consider climate variability and climate projections
		NL095 - [Percentage by length of] water supply network (storage and distribution) new or refurbished within the last X (25-30?) Years
		LL035 - [Proportion of population served by] water supplies that use data on climate impacts for decision-making

System component	Objective	Example indicators
	Proactive plans and actions in place to prepare for the effects of climate events	LL038 - [Proportion of population served by] water supplies whose service providers monitor and report climate impacts and nationally determined resilience indicators
		LL045 - [Proportion of population using] water supplies where water quality is monitored in line with current hazards and future risks as set out in national guidelines
		NL111 - Construction materials, equipment and resources are available to ensure robust re-construction and repair of water supply infrastructure
	Support to households provided to undertake actions for climate resilience/ recovery	NL114 - [Proportion of households responsible for their own water supply] that receive support improving resilience
		NL104 - [Proportion of educational programs] incorporating appropriate user actions for operations and maintenance of household/non-utility water supply infrastructure in response to climate events
	Time for services to be restored is minimised	NL106 - [Proportion of service providers] who have internal targets for service reinstatement following a climate event (incl. time and quality)
	Sufficient quality and quantity of workforce exists for CR WASH	LL018 - [Proportion of population served by] water supplies whose service providers have received training that includes climate risk assessment and management
	CR WASH strategy proactively addresses inequity	NL103 - [Proportion of service providers] who have plans for equitable distribution of CR services

Table 2.7: Adaptation Actions by Sanitation Service Providers

System component	Objective	Example indicators
Climate Resilient Sanitation User Interface, Capture, and Containment (including flush)	**Operation and management is appropriate to ensure and advance climate resilience**	LL210 - [Proportion of population with] household pits or tanks which are emptied regularly and predictably
	Support to households provided to undertake actions for climate resilience/ recovery	LL269 - [Proportion of population] who can recall key messages on how to construct and maintain resilient latrines/toilets from communication campaigns
		NL066 - [Proportion of population] who can recall key messages on the health hazards associated with FS/WW pollution and clean up requirements during and following a climate event
Climate Resilient Conveyance by Road (including emptying)	**Emergency response protocols/plans/back-ups in place**	LL058 - [Proportion of sanitation service providers with] well-defined, event-specific action plans ready for execution on receiving early warnings
	Operation and management is appropriate to ensure and advance climate resilience	LL054 - [Proportion of the required volume of] water for FSM operations is available [at all times/ during drought]
		LL053 - [Proportion of] FSM workers have access to appropriate PPE for climate hazards (including PPE for extreme heat, wet weather)
	Proactive plans and actions in place to prepare for the effects of climate events	LL059 - A programme of pre-emptive emptying, (e.g. before wet season) is in place
		NL035 - [Proportion of FSM operations] that have backup strategies to be deployed during and following climate events : (a) terrain-adapted vehicles, (b) contingency plans for access road disruption (c) back up fuel
		NL065 - [Proportion of] truck storage facilities are sited based on current and future climate risk

System component	Objective	Example indicators
Climate Resilient Sewer Conveyance	**Emergency response protocols/plans/back-ups in place**	NL068 - [Proportion of utilities] with response plan for sewer flooding/backflow
	Operation and management is appropriate to ensure and advance climate resilience	LL122 - [Percentage by length of] sewer network new or refurbished within the last X (25-30?) Years
		NL067 - [Percentage by length of] sewer network with wastewater surveillance monitoring (to detect disruption)
Climate Resilient Design and Operation of WW and FS Treatment Processes	**Emergency response protocols/plans/back-ups in place**	LL128 - [Proportion of households served by a treatment facility with] well-defined, event-specific action plans are ready for execution on receiving early warnings
		LL141 - [Proportion of] faecal sludge and wastewater treatment capacity with emergency storage of treatment chemicals
		LL419 - [Proportion of households served by] faecal sludge or wastewater treatment facilities where service provider has a quick-restart plan in place for following climate event
	Operation and management is appropriate to ensure and advance climate resilience	LL284 - [Proportion of] faecal sludge and wastewater treatment works with regular monitoring of influent/effluent where data are analysed to detect short and long-term trends
Climate Resilient Sanitation System	**Emergency response protocols/plans/back-ups in place**	NL018 - [Proportion of households for whom] well-defined, event-specific, timely action plans are ready for execution on receiving early warnings
	Operation and management is appropriate to ensure and advance climate resilience	LL151 - [Proportion of] the population served by sanitation systems that are maintained through proactive repair, replacement, and retrofitting to ensure physical integrity against current and future climate hazards.

System component	Objective	Example indicators
		LL192 - [Proportion of population served by] sanitation services with risk management plans (that may include sanitation safety plans, Flood/Drought management plan) consider climate variability and climate projections and include emergency response procedures for extreme events
	Proactive plans and actions in place to prepare for the effects of climate events	LL206 - Construction materials, equipment and resources are available to ensure robust re-construction and repair of sanitation infrastructure
	Support to households provided to undertake actions for climate resilience/ recovery	LL310 - [Proportion of educational programs (where appropriate)] incorporating appropriate user actions for latrine maintenance and household sewer connection and construction in response to climate events
		NL080 - [Proportion of educational programs (where appropriate)] detailing methods of alternative water supply (icl. Grey water recycling)
	Time for services to be restored is minimised	NL072 - [Proportion of service providers] who have internal targets for service reinstatement following a climate event (incl. time and quality)
	Service providers secure adequate finance for climate resilience	LL183 - [Service providers] have climate resilience investment plans
	Sufficient quality and quantity of workforce exists for CR WASH	LL131 - [Proportion of] service providers trained in adapting operations for high and low flow conditions.
		LL434 - [Proportion of utility-served population] with access to construction workers trained in climate-resilient construction standards and guidelines.

System component	Objective	Example indicators
	CR WASH strategy proactively addresses inequity	NL071 - [Proportion of service providers] who have plans for equitable distribution of CR services

Table 2.8: Adaptation Actions by Users (Water Supply)

System component	Objective	Example indicators
Climate Resilient Household Water Management	**Users build back better following a climate event**	NL141 - [Proportion of households with private household supplies] that have taken action to upgrade the supply (e.g. deepening boreholes etc) following a climate event
	Users prepare themselves for climate events by securing household water storage	LL252 - Proportion of households with a water storage container on site that is secured against hazards
	Users respond to climate events by taking actions to secure water quantity and quality	NL123 - [Proportion of users] that act upon advice regarding water supply (boiling, reducing/restricting usage)
		NL124 - [Proportion of users with non-utility supplies] that act upon advice to protect/adapt water supply

Table 2.9: Adaptation Actions by Users (Sanitation)

System component	Objective	Example indicators
Climate Resilient Sanitation User Interface, Capture, and Containment (including flush)	**Users build back better following a climate event**	LL254 - Proportion of households that have taken action to upgrade latrines following a climate event
	Users prepare for climate events by providing themselves with climate adapted toilets	NL038 - [Proportion of households] that have built/upgraded to climate resilient toilets/latrines prior to a climate event
	Users provide themselves with redundancy to offset effects of service interruption/system failure	NL039 - [Proportion of the population with access to] multiple toilet technologies for use during and following climate events

Table 2.10: Adaptation Actions by Users (Hygiene)

System component	Objective	Example indicators
Climate Resilient Hygiene System	**Users build back better following a climate event**	NL142 - [Proportion of households] that have upgraded their domestic infrastructure to secure space and water to support essential hygiene activities following a climate event
	Users prepare for climate events by stockpiling essential hygiene items	NL143 - [Proportion of households] that store sufficient soap, MHM and incontinence products to supply all needs for [up to X weeks] for use during and following a climate event

Table 2.11: Adaptation Actions Related to Water Resources and Land Use Management

System component	Objective	Example indicators
Climate Resilient Water Source	**Water resource management supports climate resilience**	LL457 - [Proportion of required] managed aquifer recharge schemes in place for treated wastewater to boost groundwater reserves
		NL149 - [Proportion of managed aquifer recharge schemes] which conform to national standards and guidance
	Climate related risk is managed in the catchment	LL389 - [Proportion of total water sources] (surface and groundwater) or catchments for which there is a permitting process in place for discharges
		LL458 - [Proportion of required] vegetation management to manage wildfire risks is in place in catchments
		NL127 - [Proportion of] water resources conflict resolution systems (e.g. WR management committee, basin management committee) which considers current and future climate
	Adaptive water resources planning in place	LL373 - [Proportion of catchments for which] an abstraction inventory has been compiled
		LL374 - [Proportion of catchments for which] assessments have been completed on aquifer characteristics
		LL375 - [Proportion of catchments] where water allocation planning is in place
Climate Resilient	**Early warning systems in place that support actions to reduce impact of climate events**	LL456 - [Proportion of reservoirs by volume for which] early warning systems in place for spillway discharges

System component	Objective	Example indicators
Water Supply System	**WASH sector has embedded approach to adaptation to climate change**	LL363 - [Proportion of catchments for which] water allocation plans take into account water supply, sanitation and hygiene needs
	Climate related risk is managed in the catchment	LL455 - [Proportion of reservoirs by volume for which] spillway discharges managed to prevent flood surge that threaten water treatment works and offtakes
Climate Resilient Sanitation System	**Climate related risk is managed in the catchment**	LL452 - Environmental water regulations specify minimum low-flow discharge in receiving waters to maintain dilution and meet water quality objectives [taking into account future flows]
		LL453 - Environmental regulations set appropriate limits on discharge quality from WWTPs that achieve appropriate water quality standards taking account current and future climate scenarios

Table 2.12: Adaptation Actions Related to Coordination with Solid Waste and Drainage

System component	Objective	Example indicators
Climate Resilient Sanitation System	**Coherence and cooperation between agencies to deliver climate resilient WASH**	LL437 - Sanitation system design is aligned with and takes into account design and operational conditions of drainage and solid waste management systems
		LL438 - Appropriate coordination mechanisms to promote active and responsive co-design of sanitation with drainage and SWM are mandated and funded
		NL120 - [Proportion of population served by] strategic solid waste management for hygiene product disposal during and after climate events.
	Operation and management is appropriate to ensure and advance climate resilience	LL441 - Interventions to reduce risks of failures in the drainage system inducing climate-change related failures in sanitation systems are included in standard operating procedures
		LL440 - Interventions to reduce risks of failures in the solid waste management system inducing climate-change related failures (blockages etc.) in sanitation systems are included in standard operating procedures
	Users receiving messages that inform user adaptation actions	LL439 - Solid waste management actions which reduce risks of climate-change related failures (blockages etc.) are included in sanitation behaviour change campaigns
	Coordinated investment in grey/green urban infrastructure able to cope with extreme events (e.g. wastewater treatment and NbS)	NL034 - Sanitation systems are designed in conjunction with blue-green infrastructure for SUDS, to reduce the impacts of future climate

12. Indicators for INTERMEDIATE OUTPUTS

Table 2.13: Attributes of Water Resources for Water Supply and Receiving Waters

System component	Objective	Example indicators
Climate Resilient WASH System	**Water Quality is Maintained**	LL286 - Change in proportion of people dependent on rainwater, shallow groundwater or surface water for domestic uses before, during and following a climate event
		LL442 - [Number of people affected by OR number of] incidents of non-compliance of downstream water quality before, during and following a climate event
	Water supply quantity is maintained	LL394 - [Proportion of water sources] which remain functional and effectively meet demand before, during and following a climate event

Table 2.14: Attributes of Water Supply Infrastructure

System component	Objective	Example indicators
Climate Resilient Water Source	**Assets and systems have reduced exposure to climate shocks and stresses**	NL112 - [Proportion of the population served by] a water source/ collection point where infrastructure siting considers both current and future climate risks
	Assets and systems have reduced sensitivity to climate shocks and stresses	NL096 - Proportion of reservoirs with variable intake
		NL110 - [Proportion of population served by water source/ collection point] where infrastructure conforms to national regulations and standards for climate resilience
		NL098 - [Proportion of water sources/ collection points] with appropriate flood protection
		NL113 - [Proportion of population served by water source/ collection point] where infrastructure is designed with consideration of current and future climate risks
	System design includes redundancy to offset effects of service interruption/system failure	NL122 - [Proportion of population with access to] multiple water sources during and following climate events
Climate Resilient Water Treatment	**Assets and systems have reduced sensitivity to climate shocks and stresses**	NL102 - [Proportion of the population served by] water treatment system has automatic shut-down to respond to degraded water quality/ high turbidity in the source
		NL107 - [Proportion of population served by treatment facilities] where infrastructure is designed with consideration of current and future climate risks
		NL109 - [Proportion of population served by treatment facilities] where infrastructure that conform to national regulations and standards for climate resilience

System component	Objective	Example indicators
		NL099 - [Proportion of water treatment plants] with appropriate flood protection
	Construction and design standards for climate resilient water supply are implemented	NL101 - [Proportion of the population served by] a water treatment facility where process selection considers both current and future climate risks
Climate Resilient Water Storage and Distribution	**Assets and systems have reduced sensitivity to climate shocks and stresses**	NL115 - [Proportion of population served by distribution network] where critical infrastructure is protected from the effects of climate events (e.g. flooding)
		NL116 - [Proportion by length of distribution network that] conforms to national regulations and standards for climate resilience
	Time for services to be restored is minimised	NL100 - [Proportion by length of the water network for which] equipment is readily available for rapid repairs (i.e. trenching)
Climate Resilient Water Supply System	**Assets and systems have reduced sensitivity to climate shocks and stresses**	NL105 - [Proportion of population served by] water supply system with backup power supply
	Construction and design standards for climate resilient WASH are implemented	LL098 - [Proportion of population served by] water supplies conform to national regulations and standards on resilient water supply design and utilise approved construction materials
	Emergency response protocols/plans/back-ups in place	NL119 - [Proportion of population served by] water supply system with telecoms for continuous monitoring
	Co-benefits of CR WASH are realised	NL121 - [Proportion of users served by] CR systems that are considered low carbon/low emissions

Table 2.15: Attributes of Sanitation Infrastructure

System component	Objective	Example indicators
Climate Resilient Sanitation User Interface, Capture, and Containment (including flush)	**Assets and systems have reduced exposure to climate shocks and stresses**	NL030 - [Proportion of population served by toilets/latrines where] infrastructure siting considers both current and future climate risk
	Assets and systems have reduced sensitivity to climate shocks and stresses	LL256 - [Proportion of pit latrines in flood risk areas] designed to promote and allow regular pumping or emptying
		NL025 - [Proportion of containments] designed for current and future climate risk
		NL026 - [Proportion of latrine superstructures] designed for current and future climate risks
		NL031 - [Proportion of latrines and containments] that conform to national regulations and standards for climate resilience
	System design includes redundancy to offset effects of service interruption/system failure	LL215 - [Proportion of population] with access to multiple sanitation services during and following climate events
Climate Resilient Sewer Conveyance	**Assets and systems have reduced sensitivity to climate shocks and stresses**	LL031 - [Proportion of population with sewer connection served by a] sewer system fitted with filtration system to limit impact of CSO spill
		LL115 - [Proportion of population with a sewer connection served by a] sewer system with storage and interceptors to reduce flow and prevent overloading.
		LL117 - [Proportion of population with a sewer connection served by a] separate sewer systems (rather than combined sewers)

System component	Objective	Example indicators
		LL285 - [Proportion of population with sewer connection served by a] sewer system all outfalls are reinforced against impacts of floating debris, erosion and siltation
		NL033 - [Proportion, by length of sewers] that conform to national regulations and standards for design and material selection for climate resilience
		NL027 - [Proportion of population with sewer connection served by a] sewer where its horizontal alignment, invert levels, joint density, and maintenance access points consider current and future climate risk
Climate Resilient Design and Operation of WW and FS Treatment Processes	**Assets and systems have reduced exposure to climate shocks and stresses**	NL029 - [Proportion of population served by WW/FS treatment facilities where] infrastructure siting considers both current and future climate risk
	Assets and systems have reduced sensitivity to climate shocks and stresses	NL028 - [Proportion of population served by treatment facilities] where infrastructure is designed with consideration of current and future climate risks.
		NL032 - [Proportion of WW/FS treatment facilities] that conform to national regulations and standards for climate resilience
		LL139 - [Proportion of] water treatment capacity with backup power supply
	Operation and management is appropriate to ensure and advance climate resilience	NL069 - [Proportion of households served by] faecal sludge or wastewater treatment facilities that have temporary storage for FS/WW
		NL070 - [Proportion of households served by] faecal sludge or wastewater treatment facilities where multiple members of staff exist with knowledge of how to operate the facilities

System component	Objective	Example indicators
Climate Resilient Sanitation System	**Assets and systems have reduced sensitivity to climate shocks and stresses**	NL073 - [Proportion of the population served by infrastructure] that is either engineered for robustness or purposefully designed to fail safely with minimal disruption and ease of replacement.
	Diversity in sanitation service providers	NL074 - [Number of households] with functional access to redundant FSM service options during and after climate-induced events.
	Co-benefits of CR WASH are realised	NL075 - [Proportion of users served by] CR systems that are considered low carbon/low emissions
		NL076 - [Proportion of users served by] CR systems that facilitates re-use of FS/WW products (e.g. energy and agriculture)

Table 2.16: Attributes of Hygiene Infrastructure

System component	Objective	Example indicators
Climate Resilient Hygiene System	**Assets and systems have reduced exposure to climate shocks and stresses**	NL144 - [Proportion of population served by handwashing and MHM facilities where] infrastructure siting considers both current and future climate risk
		NL150 - [Proportion by length of critical] transport infrastructure essential to the delivery of hygiene goods and services which are located away from areas affected by flooding due to current or future climate events
	Assets and systems have reduced sensitivity to climate shocks and stresses	NL145 - [Proportion of handwashing and MHM facilities] designed and constructed in line with national guidelines on climate resilient infrastructure
		NL151 - [Proportion by length of critical] transport infrastructure essential to the delivery of hygiene goods and services which are designed to be resilient to current and future climate events
	System design includes redundancy to offset the effects of service disruption/ system failure	NL146 - [Proportion of population] with access to multiple places to practice hygiene and safe and secure MHM which have adequate water supply during and following climate events

13. Indicators for OUTPUTS

Table 2.17: Water Supply Service Functioning

System component	Objective	Example indicators
Climate Resilient Water Source	**Sufficient water quantity is supplied**	LL385 - [Proportion of population using spring-based water supplies where] spring flow is maintained during and following a climate event
		NL089 - [Proportion of population using surface water supplies] where level or flow falls below design minimum level during and following a climate event
		LL386 - [Proportion of population using groundwater-based water supplies] where production falls below design minimum yield for x days per year
		LL391 - [Proportion of water points] that have dried up for at least X months out of the previous Y months
Climate Resilient Water Treatment	**Water quality is maintained**	NL082 - Operational treatment performance remains [within X% of standard levels]
		NL083 - [Number of water treatment facilities] out of service due to infrastructure failure before, during and following a climate event
Climate Resilient Storage and Distribution	**Sufficient water quantity is supplied**	LL443 - [Number of] pipe breaks per km length of network per year before, during and following a climate event
Climate Resilient	**Access to basic water supply is maintained**	NL088 - [Proportion of population] for which the water supply volume meets the required national daily standards during and following a climate event

System component	Objective	Example indicators
Household Water Management		NL087 - [Proportion of population] whose domestic water supply infrastructure is damaged during and following a climate event
Climate Resilient Water Supply System	**Time for services to be restored is minimised**	LL249 - Water supply services are restored to [defined level of service] within [X time step] to [Y% of the population] after a climate-change induced hazard event
		NL086 - Time to restore water supply service [to 100% of the population in the service areas] to minimum, baseline or transformative levels following a climate event
	Water quality is maintained	LL396 - [Proportion of the population served by water supplies exhibiting] raised groundwater electrical conductivity levels
		LL397 - [Proportion of the population served by water supplies with] increasing reports of salty tasting water
		LL395 - [Proportion of the population served by water supplies exhibiting] increased levels of E. Coli and/or other pathogen concentrations before, during and following a climate event
	Access to basic water supply is maintained	LL225 - [Proportion of population with] access to more than one safely managed water supply
		NL084 - [Proportion of population] with access to basic water supply services before, during and following a climate event
		NL085 - Number of disruptions to a basic service attributable to a climate event (UNDESA SENDAI indicator)

Table 2.18: Sanitation Service Functioning

System component	Objective	Example indicators
Climate Resilient Sanitation User Interface, Capture, and Containment (including flush)	**Access to basic sanitation is maintained**	LL004 - [Proportion of users with] access to at least one toilet for use during and following a climate event
		LL010 - [Population of households where] latrines collapsed in the last year due to heavy rains or other extreme weather events
		LL216 - [Proportion of users with] access to at least one functioning water sources to use for flushing if needed
		NL062 - [Proportion of population] with access to a functioning portable/ temporary toilet (where permanent toilet not available)
		NL081 - [Proportion of toilets] that remains functional before, during, and following a climate event
Climate Resilient Conveyance by Road (including emptying)	**Road based FSM continues to provide a minimum service**	NL058 - [Frequency of] unsafe dumping of FS into the environment before, during and following a climate event
		NL057 - [Frequency of] emptying services being unavailable/ interrupted when emptying is required before, during, and following climate events
Climate Resilient	**Sewer system continues to provide a minimum service**	LL123 - [Number of] pipe breaks per km length of sewer network per year before, during and following a climate event
		LL124 - [Frequency of] sewer overflows before, during and following a climate event

System component	Objective	Example indicators
Sewer Conveyance		NL056 - [Frequency of] sewer backflows into houses before, during, and following climate events
Climate Resilient Design and Operation of WW and FS Treatment Processes	**FS and WW treatment continues to provide a minimum service**	LL127 - Operational treatment performance remains [within X% of standard levels], when backup processes are utilised to manage untreated inflows bypassing the system
		NL059 - [Frequency of] unsafe dumping of post-treatment FS/WW sludges
		NL060 - [Number of FS/WW treatment facilities] out of service due to infrastructure failure before, during and following a climate event
Climate Resilient Sanitation System	**Access to basic sanitation is maintained**	LL008 - [Proportion of population] practising open defecation during and following a climate event
		LL009 - [Proportion of population] with access to basic sanitation services before, during and following a climate event
		NL061 - Number of disruptions to a basic service attributable to a climate event (UNDESA SENDAI indicator)
	Time for services to be restored is minimised	LL012 - Time to restore sanitation service [to 100% of the population in the service areas] to minimum, baseline or transformative levels following a climate event
		LL260 - Sanitation services are restored to [defined level of service] within [X time step] to [Y% of the population] after a climate event

Table 2.19: Handwashing Facility Functioning and Supply of Hygiene Materials and Disposal Facilities

System component	Objective	Example indicators
Climate Resilient Hand Hygiene	**Handwashing (basic services) with soap and water are available at home**	LL418 - [Proportion of population] with access to soap and water at a handwashing facility at home during and following a climate hazard
		LL334 - [Proportion of population] with access to portable sinks equipped with soap, water, and paper towels where basic hygiene not available
	Handwashing facilities are available	LL299 - [Proportion of displaced population] with access to safe, secure and preferred handwashing facilities outside the home before, during and following a climate event
		NL063 - [Proportion of population] with access to a handwashing facility at home before, during and following a climate event
		NL040 - [Proportion of population (both medical and non-medical personnel)] with access to handwashing facilities, with soap and water or alcohol-based hand sanitisers before, during and following climate events
Climate Resilient Menstrual Hygiene Management	**Safe, secure, and preferred MHM facilities available during and following a climate event**	LL296 - [Proportion of menstruators] who dispose of menstrual cloth after a single use due to lack of washing and drying facilities
		LL315 - [Proportion of menstruators] with access to temporary structures for MHM when primary structure is unusable due to climate hazard
		LL328 - [Proportion of menstruators living in displacement camps] with access to safe, secure, and preferred facilities for discussing menstruation in educational programs

System component	Objective	Example indicators
		LL444 - [Proportion of] sanitation facilities in evacuation/displacement camp that are single-sex and usable (available, functional, and private) lockable from the inside, have covered disposal bins and have discreet disposal mechanisms at the time of the survey
		LL460 - [Proportion of] menstruators that have access to safe, secure, and private facilities to wash and dry MHM products/cloths
	People have access to preferred materials to manage their menstrual hygiene	LL292 - [Proportion of menstruators] with access to safe, secure, and preferred MHM products before, during and following a climate event
		LL313 - [Proportion of menstruators] using homemade menstrual products before, during, and following a climate event
Climate Resilient Hygiene System	**Disposal facilities for hygiene products are available**	NL064 - [Proportion of the population] with access to safely managed solid waste disposal system for hygiene and incontinence products before, during and following a climate event
	People have access to preferred materials to manage their hygiene	LL302 - [Proportion of the population] with access to hygiene kits containing preferred materials before, during and following a climate event

14. Indicators for OUTCOMES

Table 2.20: User Experience of Water Supply Service

System component	Objective	Example indicators
Climate Resilient Water Supply System	**Access to water supply is maintained**	LL467 - [Proportion of household OR population reporting a] change in the frequency of times that they have had to change schedules or plans because of problems with their water situation in the preceding 4 weeks/ during the dry season/ during or after a drought/ during floods
		LL468 - [Proportion of household OR population reporting a] change in the frequency of times that they [or anyone in the household] has not had as much water to drink as they would like in the preceding 4 weeks/ during the dry season/ during or after a drought/ during floods
	Financial impacts on users are minimised	NL090 - Value of financial losses due to damaged household infrastructure, loss of time, and health care costs due to water supply failures in a climate event
		NL094 - [Value of] additional time spent collecting, treating and managing water supply (disaggregated by gender) during and following a climate event
	Users are protected from psychosocial distress related to water service disruptions	LL466 - [Proportion of household OR population reporting a] change in the frequency of times that they worried about not having enough water for all household needs in the preceding 4 weeks/ during the dry season/ during or after a drought/ during floods
		LL464 - [Proportion of population reporting a] change in water insecurity experiences relating to climate events using IWISE/HWISE scale
		NL091 - [Time lapsed] in redressal of customer complaints before, during and following a climate event

System component	Objective	Example indicators
	User complaints/ requests for assistance are dealt with in a timely manner	NL092 - Total complaints received, analysed and acted upon by service provider per 1000 customers before, during and following a climate event
	Users have the financial capacity to respond to a climate event	NL093 - [Proportion of] households that report good access to affordable materials, products and services for improving the resilience of water supply infrastructure
	Water quality is maintained	LL367 - [Proportion of the population reporting a perceived change] in quality of water before during and following a climate event
	Users are protected from GBV related to water supply service interruptions	LL447 - [Number of] reported cases of GBV related to accessing water supply facilities during and following a climate event

Table 2.21: User Experience of Sanitation Service

System component	Objective	Example indicators
Climate Resilient Sanitation User Interface, Capture, and Containment (including flush)	**Access to basic sanitation is maintained**	NL037 - [Proportion of] latrines/toilets that remain accessible for emptying during and following flooding caused by a climate event
Climate Resilient Sanitation System	**Access to basic sanitation is maintained**	NL049 - [Proportion of household OR population reporting a] change in the frequency of times that they [or anyone in the household] has not had access to the sanitation services that they would like in the preceding 4 weeks during and following a climate event
		NL051 - [Proportion of household OR population reporting a] change in the frequency of times that they have had to change schedules or plans because of a lack of access to sanitation services in the preceding 4 weeks during and following a climate event
		NL147 - [Proportion of users who] report easy access to alternative sanitation services when needed during and following a climate event
	Financial impacts on users are minimised	NL148 - Value of financial losses due to damaged household infrastructure, loss of time, and health care costs due to sanitation failures in a climate event
		LL426 - [Time lapsed] in redressed of customer complaints before, during and following a climate event

System component	Objective	Example indicators
	User complaints/ requests for assistance are dealt with in a timely manner	LL427 - Total complaints received, analysed and acted upon by utility in waste water per 1000 customers before, during and following a climate event
	Users are protected from GBV related to sanitation service interruptions	NL044 - [Number of] reported cases of GBV related to using the toilet during and following a climate event
	Users are protected from psychosocial distress related to sanitation service interruptions	NL048 - [Proportion of population reporting a] change in sanitation service insecurity experiences relating to climate events [as per IWISE scale]
		NL050 - [Proportion of household OR population reporting a] change in the frequency of times that they worried about not having access to sanitation services in the preceding 4 weeks during and following a climate event
	Users have the financial capacity to respond to a climate event	LL267 - [Proportion of] households that report good access to affordable materials, products and services for improving the resilience of sanitation infrastructure

Table 2.22: User Experience of Practicing Hygiene

System component	Objective	Example indicators
Climate Resilient Hand Hygiene	**Users are protected from uncertainty related to practicing hygiene**	LL469 - [Proportion of household OR population reporting a] change in the frequency of times that they [or anyone in the household] has had to go without washing hands after dirty activities in the preceding 4 weeks/ during the dry season/ during or after a drought/ during floods
Climate Resilient Menstrual Hygiene Management	**Users are protected from psychosocial distress related to practicing hygiene**	LL445 - [Proportion of menstruators] who reported difficulty accessing affordable menstrual materials due to market disruptions during and following a climate event
		LL446 - [Proportion of menstruators] who felt safe accessing WASH facilities for menstrual hygiene management during and following a climate event
		LL448 - [Proportion of menstruators] who reported good access to relief to alleviate worsened menstrual symptoms (e.g., cramping, dehydration) before, during and following a climate event
	People have access to the water they need to practice menstruation	LL319 - [Proportion of menstruators] relying on alternative water sources, such as springs, surface water, or groundwater, for hygiene purposes during menstruation before, during and following a climate event
		LL325 - [Proportion of menstruators] reducing water usage during menstruation by using tissues or cloth instead of washing with water before, during and following a climate event
Climate Resilient Hygiene System	**Users are protected from psychosocial distress related to sanitation service interruptions**	NL054 - [Proportion of household OR population reporting a] change in the frequency of times that they worried about not having access to hygiene products and facilities in the preceding 4 weeks during and following a climate event
		NL052 - [Proportion of population reporting an] increase in insecurity relating to practicing hygiene during and following climate events [as per IWISE scale]

System component	Objective	Example indicators
	Users are protected from uncertainty related to practicing hygiene	LL416 - [Proportion of households] that report good access to affordable products and services for improved hygiene activities (including handwashing)
		NL053 - [Proportion of household OR population reporting a] change in the frequency of times that they [or anyone in the household] has not had access to the hygiene products and facilities that they would like in the preceding 4 weeks during and following a climate event
		NL055 - [Proportion of household OR population reporting a] change in the frequency of times that they have had to change schedules or plans because of a lack of access to hygiene products and facilities in the preceding 4 weeks during and following a climate event
	Users are protected from GBV related to practicing hygiene	LL449 - [Number of] reported cases of GBV related to access to facilities and practicing hygiene behaviours before, during and following a climate event