



# Building Back Better: Kerala Addressing Post-Disaster Recovery Needs

## SUMMARY

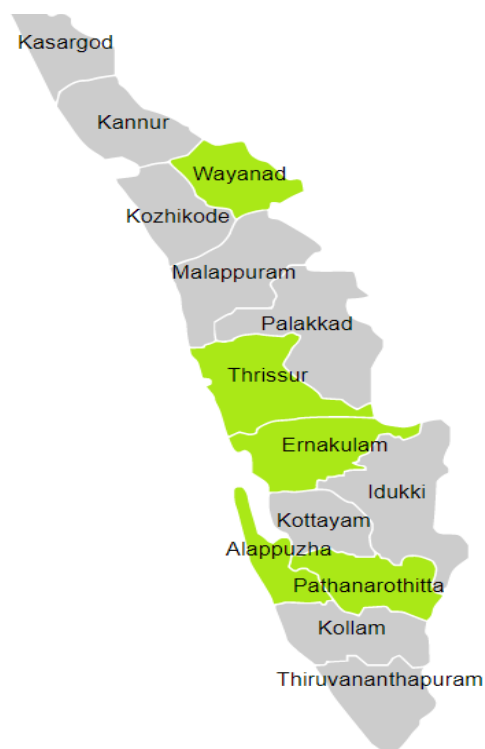
UNICEF was part of the front-line response to the 2018 floods and their devastating consequences in the Indian State of Kerala. UNICEF's work focussed on supporting WASH services and equipment in affected communities. UNICEF, with the support of national and regional-level administrations, local non-governmental organisations (NGOs), community-level organisations as well as national and local radio stations, set about responding to urgent WASH needs in order to 'build back better'.

UNICEF continued to provide leadership in coordinating and responding to the emergency caused by the floods, while also worked towards strengthening the linkage between humanitarian and development programming. The WASH team at the Tamil Nadu field office invested in stronger systems during times of stability to mitigate the impact and cost of emergencies and making humanitarian and development programme efforts complementary to each other. UNICEF was consistently on the ground working in close coordination with Kerala government and a range of partners to scale up its responses and respond to immediate needs of affected children and their families. Through a detailed post-disaster needs assessment, the office informed its risk-informed programming approaches and provided support for building institutional capacity to improve risk mitigation and recuperate to the damage. The activities of this project and its results are described in this field note for emergency WASH professionals.

## Introduction

From June to August 2018, the Indian state of Kerala experienced the worst flooding since 1924. The state received a cumulative rainfall of 1,806.6 mm (average), an excess of 42 percent, over the

**Figure 1: Flood-affected districts rehabilitated by UNICEF in Kerala, India**



course of just two-and-a-half months. Between 15 to 18 August 2018, all 14 districts of the state were on a red alert and the floods posed major water, sanitation and hygiene challenges in Kerala.

The devastating floods affected 5.4 million people, displaced 1.4 million people and took 433 lives.<sup>1</sup> 5,645 relief camps were established, mostly in schools, hospitals, auditoriums, and government institutions. Relief camps had limited toilets and septic tanks/leach pits which overflowed during the floods.

The Kerala floods required the largest deployment of India's National Disaster Response Force (NDRF) in a single state since the Force's inception. The force sent a total of 59 teams to relocate the affected population.

<sup>1</sup>UNDP, 2018.

The post-disaster needs assessment conducted by the UN under the leadership of the Government of Kerala estimated the total recovery needs at USD 4.4 billion, with USD 190 million required for water and sanitation.

The UN Secretary-General publicly expressed his concern about the devastation and the UN Resident Coordinator extended the support of all United Nations agencies to the State of Kerala. UN Disaster Management Teams closely liaised with the National Disaster Management Authority (NDMA) and the Indian Prime Minister's Office. A temporary task force was set up in the capital city of Thiruvananthapuram with 35 UN officials and consultants. The task force coordinated with the state government and district administration. District-level teams were deployed in five of the eight worst affected districts: Alleppey (also known as Alappuzha), Pathanamthitta, Ernakulam, Wayanad and Thrissur.

The five districts were chosen in accordance with the governments' need for support. Alleppey and neighboring Ernakulam district experienced the worst flooding due to a network of canals and lagoons. Wayanad, Thrissur and Pathanamthitta districts faced flooding and landslides. In these districts, toilets with septic tanks were flooded and overflowed. Faecal sludge contaminated water sources, like open dug wells and spring-based wells, increasing health risks for water and vector-borne diseases. This phenomenon was particularly acute in Wayanad district, which has the largest tribal population in Kerala and areas of limited accessibility.

Kerala was declared open defecation free in 2016, however, 56 percent of households are connected to septic tanks which require periodic emptying. There are only three centralized faecal-sludge treatment plants in the state, keeping sewerage treatment limited to a small percentage of the urban population. The sludge collected from septic tanks by private tankers is dumped into open streams/ rivers, paddy fields, and other areas.

The gravest concerns in the post-disaster phase were related to sanitation, health and hygiene, as well as access to and quality of drinking water. Access to piped water was disrupted for 20 percent of the state's population (6.7 million people). As per KWA data, more than 60 percent of the population in affected districts exclusively depend on private wells for drinking water. An estimated 317,000

shallow wells were damaged and contaminated in the six worst-affected districts. 95,146 toilets in 981 *gram panchayats* (GPs) or village councils were rendered completely dysfunctional due to floods. The extent of damage is further described in Table 1.

## Description of Intervention

Some of UNICEF's key interventions in this case are highlighted below.

### WASH Sector Coordination

In August 2018, UNICEF carried out an initial assessment in Wayanad district to inform a WASH-related response plan. This was complemented by a staffing surge of WASH experts from UNICEF's other field offices ensuring streamlined coordination to integrate WASH and Disaster Risk Reduction (DRR).

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The UNICEF WASH team worked closely with the respective state government departments, namely the State Sanitation Mission, the Local Self Government Department (LSGD), the Water Resource Department, the Kerala Water Authority, the National Health Mission and five district administrations: Alleppey, Pathanamthitta, Ernakulum, Wayanad and Thrissur. UNICEF also supported the deployment of technical personnel in ten districts of Kerala. Technical support has focused on the rehabilitation of wells, water treatment, water quality monitoring, and faecal dislodging and treatment activities.

UNICEF supported the Government of Kerala's post-disaster needs assessment measuring the social impact of the disaster. UNICEF coordinated 33 agencies on various aspects of WASH recovery during the initial weeks of the flood response. Several partners provided programmatic and

operations capacity to complement the government-led early recovery programmes. Programme cooperation agreements included the WASH, health, nutrition, and communication for development sectors.

Qualitative findings and local data were provided by the NGO-led Joint Detailed Needs Assessment,

**Table 1: Damage to life and infrastructure due to Kerala floods<sup>2</sup>**

<b>Villages affected</b>	1,259 across 14 districts (of 1,664 total villages)
<b>People evacuated</b>	233,179
<b>Relief camps</b>	5,645 (Highest number recorded during the emergency)
<b>People recorded in relief camps</b>	1.34 million (Highest number recorded during the emergency)
<b>Piped water supply disruption</b>	Access for 6.7 million people disrupted
<b>Shallow wells damaged and contaminated</b>	317,000 (In the six worst-affected districts)
<b>Toilets made completely dysfunctional</b>	95,146 toilets (In 981 <i>grampanchayats</i> )
<b>Houses fully or partially damaged</b>	220,000 (partially-damaged); 16,000 (fully destroyed)
<b>Health facilities</b>	332 (partially- or fully-damaged)
<b>Schools affected</b>	1,613
<b>Cropland affected</b>	57,000 hectares
<b>Roads affected</b>	3,652.5km (district roads); 1,821.5km ( <i>panchayat</i> roads); 106 km (state highways).

supported by UNICEF. UNICEF and the UN also captured human interest stories to complement the overall findings and provide a strong contextual base. UNICEF will continue to play a key role in supporting vulnerable populations gain and maintain access to WASH in emergencies leading efforts to coordinate the overall emergency

<sup>2</sup>UNDP; Kerala State Disaster Management Authority.

## KEY POINTS

- UNICEF led state and district-wide WASH emergency response coordination (in five districts).
- UNICEF partnered with the Kerala state government to lead a Post Disaster Need Assessment of damage to and loss of WASH infrastructure and services.
- Partnerships were built with NGOs and CSOs to support local-level implementation of WASH interventions and nurture these partnerships for long-term engagement to help Kerala build back better WASH infrastructure.
- Small-scale mobile sludge treatment units were provided to ensure hygiene in camps.
- UNICEF developed static-sludge treatment units for improved faecal sludge management.
- Rehabilitation of WASH infrastructure at the household and institutional level was prioritised by UNICEF as part of its integrated response

response effort through the Inter-Agency Group (IAG). The group comprises of voluntary organisations and a team of multi-sectoral specialists WASH health, nutrition, and education that helped the state administration in times of natural disasters.

## Water

### Integrating Wash and Health During Disasters

At the *panchayat* level, UNICEF WASH officials worked closely with Cholera Rapid Response Teams for disease surveillance and disinfection of water sources. They simultaneously distributed materials on water treatment, water quality assessment in wells, and hygiene maintenance. Further, technical guidance was provided for the inclusion of a WASH protocol for cholera treatment facilities in districts and sub-district hospitals.

### Disinfection and Rehabilitation Of Dug-Wells

During the floods, cleaning, disinfecting and rehabilitating dug wells across Kerala were major challenges and urgent needs. UNICEF established

contact with Suchitwa Mission and Kerala Water Authority (KWA), providing support for the development of guidelines, protocols, standard operation procedures (SOP) and technical notes. At the district and sub-district level, UNICEF extended technical support to the LSGD in a massive exercise for the cleaning of shallow dug wells. 500 water quality testing kits were provided in the five most affected districts to health inspectors/frontline workers.

Partner NGOs provided volunteers for household visits to assess the condition of dug wells. UNICEF provided hands-on training to 214 officials and NGO partners on basic water quality testing in emergencies and developed an operational plan. Water quality monitoring operations helped to test 150 wells for residual chlorine and 112 wells for turbidity. SOPs for the rehabilitation of dug wells were developed and 350 panchayat members were trained.

### Reviving Spring-Based Wells

UNICEF, through programme cooperation agreements with the Wayanad Social Service Society, rehabilitated 25 spring-based drinking-water sources and 10 community wells to benefit 210 affected families in Wayanad. The projects started with introductory orientation meetings in each village where local stakeholders were brought on board.

Local communities worked to clean the spring water sources, removing animal carcasses and filtering the ponds of silt and other residual materials. The *gram panchayat* and beneficiary committees were made jointly responsible for the operation and maintenance of the water supply systems.

UNICEF used these rehabilitated springs and wells as models to showcase technologies for flood-resilient, community-based, low-cost rehabilitation in hard to reach areas.

### Water Treatment Units

Despite several rounds of chlorination and water treatment, water quality in many flooded areas did not show encouraging results. The state government undertook a major initiative to test water quality in private wells which discovered a high-level of coli form and residual chloride. UNICEF, in close coordination with district

**Figure 2: Water quality testing by NGO teams in Pathanamthitta**



administration and LSGD, provided 170 water treatment units in the five most affected districts. These water treatment units were designated for installation at community sites used as relief camps during the floods (schools, hospitals, bus stands, etc.), ensuring access to safe drinking water in the case of another disaster. 155 nodal persons/LSGD officials were trained in the operation and maintenance plan of these units to ensure optimal utilisation.

## Sanitation and Hygiene

### Mobile Sludge Treatment Units

The Suchitwa Mission, State Pollution Control Board (SPCB), LSGD and district administrations worked together to manage the faecal sludge situation. Private contractors and industrial effluent treatment plants continuously collected sludge. UNICEF coordinated with the WASH Institute in Dindigul, Tamil Nadu, which mobilized mobile sludge treatment units (MTUs) that served 105 relief camps.

Seeing the state of faecal sludge management (FSM) in Kerala and the specific challenges due to the floods, a mix of on-site and off-site sanitation measures were suggested as an appropriate solution, as only a very small percentage of the state is connected to sewer networks.

UNICEF trained 675 LSGD and district administration officials as well as community leaders on desludging and sludge treatment. 13 septic tanks in five districts were rehabilitated and used to demonstrate their ability to rehabilitate flood-prone areas. SOPs for rehabilitating septic

tanks were developed, and 350 local governance body members (at *panchayati raj* institutions) were oriented to these SOPs.

### Development of Sewerage Treatment Plants

UNICEF coordinated and facilitated a state-level workshop for 70 officials on appropriate toilet technologies. UNICEF extended financial support and technical assistance for two new faecal sludge treatment plants (STPs) in Wayanad and Thrissur an effort to encourage replication in Kerala. UNICEF developed pilot projects setting up sewage treatment plants in select districts where the problem was most accentuated during floods.

UNICEF also supported the district administration's commission of an STP with the support of its technical partner, PriMove. The establishment of Wayanad's FSM pilot project has encouraged risk-informed programming, innovation, and scaling up in other districts, as well. Thrissur district also developed a unique waste management system by commissioning its own waste treatment plant.

### Wash Advocacy, Partnerships, and Communication

Several knowledge products were developed covering WASH aspects of the Kerala floods including:

- Guidelines for cleaning and disinfecting wells;
- WASH protocol for cholera prevention and control in health care facilities;
- Guidelines for MTUs;
- SOPs on the rehabilitation of dug wells and septic tanks damaged due to floods and landslides;
- A concept note with recommendations to improve drinking water safety, strengthen the water quality surveillance system, and related feedback mechanisms;
- A concept note with recommendations for alternative drinking water supply options that are less susceptible to flooding;
- A summary document on the post-flood status of household faecal sludge and solid waste disposal.

UNICEF designed and supplied information, education and communication (IEC) materials related to health, WASH and nutrition to all partners. UNICEF engaged with multiple stakeholders to use IEC tools to reach the broader population with relevant WASH messages. Partnerships included: radio stations (All India Radio (AIR), FM Radio, AIR Thiruvananthapuram,

BBC, and community radio); faith-based organisations; NGO networks; the state's culture department; and the Suchitwa Mission.

Around 2,900 frontline workers/community mobilizers/*anganwadi* (pre-schools) workers trained to conduct WASH IEC activities at the household and community-level. Digital posters on hygiene practices were disseminated through social media and banners were shared with *anganwadis*.

UNICEF contacted hard-to-reach communities (where most vulnerable populations were living during the floods) through community radio.

During the floods, radio channels stopped normal programming in order to spread emergency messages, receive calls from the affected population, support family tracing, and assist in distributing relief materials. UNICEF also arranged training with the AIR, the national radio broadcaster, to build the capacity of community radio operators.

## Outcomes

Overall, UNICEF reached approximately 850,000 people through a combination of services in water, sanitation, hygiene and DRR.

### Wash Sector Coordination

UNICEF's coordination of 33 humanitarian agencies in five districts in the WASH emergency response bolstered the government's recognition of NGOs as credible partners.

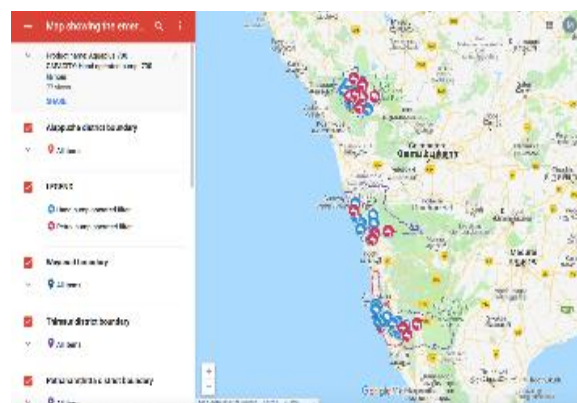
WASH sector coordination helped streamline information-sharing between the government, the UN, and NGOs catalysing proactive flood-response activities and saving many lives. The WASH, health, nutrition, child survival, education and disaster-risk reduction sectors actively coordinated to ensure synergies and increased effectiveness during the crisis.

### Water

500 water quality testing kits were provided in the five most affected districts. This included pool testers (100 units/district), turbidity tubes (100 units/district) and 10,000 Phenol Red and DPD tablets (1,000 tablets/district) for water-quality monitoring.

214 officials were trained on basic water quality testing in emergency situations (PH, turbidity, and chlorine levels). LSGD officials were trained on

Figure 4: Google Map of water filters



Accessible at:

<https://drive.google.com/open?id=1493Y7m8SE5zkSH5ApW>

water testing in wells (150 for residual chlorine and 112 for turbidity) on the different methods that can be used for reducing turbidity (for instance, use of alum), conduct chlorination, as well as the process for dewatering and rehabilitating open wells.

25 community spring-based drinking water sources and 10 community wells were rehabilitated in Wayanad benefiting 210 of the most vulnerable tribal families in Wayanad. These rehabilitated springs and wells serve as models for flood resilient rehabilitation. About 25 volunteers were oriented on retrofitting structurally-damaged wells in Pathanamthitta.

170 water treatment units/water filters were provided in the five-most affected districts. 155 individuals were trained with an operation and maintenance plan to ensure optimal utilisation (units can be used on a day-to-day basis to ensure safe drinking water for the community and can be quickly mobilised for any future disaster event).

As part of UNICEF's long-term commitment to build back better, all water filters have been geo-tagged to map locations as well as all other relevant information.

### Sanitation and Hygiene

MTUs treated 918,000 litres of sludge in Alleppey, Pathanamthitta, Ernakulum and Thrissur districts. More than 50,000 people benefited directly, while an estimated 200,000 people benefited indirectly from this support. Additionally, functionality was restored in sanitation facilities at 3,291 schools through cleaning and minor repairs in coordination with the WASH Institute.

675 local government officials, district administration and community leaders were oriented on the importance of desludging and sludge-treatment protocols. Topics covered in the orientation included: faecal-oral transmission (F-diagram);leach pit and septic tank toilet technologies; the importance of faecal sludge and septage management; liquid and solid waste management; disaster management during an emergency; as well as an explanation and demonstration of MTUs. The MTU demonstrations inspired innovation as the SPCB created similar MTUs on houseboats for Alleppey.

A workshop on appropriate toilet technologies for 70 government nodal department officials was facilitated. This resulted in a Suchitwa Mission note focused on appropriate toilet technologies for waterlogged areas. UNICEF developed a concept note related to advocacy with government on existing FSM systems in Kerala as well as key challenges, opportunities, recommendations, and appropriate toilet/sanitation technologies for waterlogged areas.

Roughly 4,000 hygiene kits (which consisted of hand-washing liquid, bathing soap, detergent soap, bucket, mug, mop, washing powder, etc.), were provided in the three worst-affected districts: Alleppey, Pathanamthitta, and Wayanad.

Since the flood crisis, UNICEF has started the construction of two static sewerage treatment plants in the worst affected districts of Wayanad and Pathanamthitta. In the process of guiding new infrastructure creation, various departments built their skills in green field project development and management, including procurement practices and tendering. Business models and operational guidelines are also being developed to facilitate the operation and maintenance of STPs.

### Wash Advocacy, Partnerships and Communication

UNICEF experts provided early assistance to government agencies in laying down guidelines, protocols and standard operating procedures. This helped in providing scientifically-proven and accurate information to field-level functionaries who were conducting flood relief work.

Around 7 million people were reached by sanitation and hygiene awareness messages.1,082,821 people (including 325,000 children) were reached with interpersonal communication (IPC) activities on child survival (including hand-washing with soap, toilet use, household water treatment,

household-level cleanliness, water chlorination, hygiene promotion, exclusive breastfeeding, and complementary feeding). *Loyola Extension* 300 youth volunteers were trained in Social Behavior Change and Communication (SBCC) to communicate WASH and health messages to more than 20,000 in Alleppey, Pathanamthitta, and Wayanad. An estimated 2,900 frontline workers/community mobilizers were trained to conduct IEC activities at household, *anganwadi* and community levels on key WASH practices.

Social behavior-change communication (SBCC) materials were developed and disseminated. IEC materials included two, three-minute videos as well as flow charts on multiple issues.10 video clips on handling solid waste after the floods circulated through social media platforms and twelve five-minute radio programmes were aired in 30 episodes of All India Radio on waste segregation, bio-composting and the prevention of leptospirosis.61 episodes of programmes of *Athijeevanam*, child survival, and development for the flood-affected people of Wayanad were aired in tribal dialects for four months.

More than 200 public service ads related to child survival aired during three months. Eight live radio shows with Government officials and experts were conducted in relation to flood response.

## Lessons Learned

The following are lessons learned from the 2018 Kerala flood WASH interventions:

### WASH SECTOR COORDINATION

Table 2: Intervention WASH Targets

Results	Sector Target	UNICEF Target	Achievement
<b>Number of people with access to sufficient water</b> (of appropriate quality and quantity for drinking, cooking, and maintaining personal hygiene)	10 million	1 million	509,000
<b>Number of people with access to toilets and washing facilities</b> (that are culturally-appropriate, secure, sanitary, user-friendly, and gender appropriate)	10 million	1 million	580,300

- Converging programmes with other sectors (like health, nutrition, and child survival) enabled integrated messaging for communities; helping communities understand interlinks and adopt the required behavior changes.
- Coordinated efforts across sectors and all levels of government led to improved programme implementation and outcomes.
- NGOs provided an important link between the government, funding agencies, and communities. Their broad networks and understanding of local contexts were important in supporting programme implementation during the emergency situation.
- Capacity building of panchayati raj institutions (or local rural bodies) and self-government staff on in emergencies resilience needs to be taken up in Kerala and other disaster-prone states.

### Water

- Data collection and analysis is crucial to inform policy advocacy and future programming. This was particularly clear as related to water quality for dug wells after the floods.
- Building disaster-resilient WASH infrastructure and the capacity to manage the WASH-related elements of disaster situations can help governments adapt and adopt changes easily.
- Evidence demonstrated that turbidity could not be controlled in dug wells, even after chlorination. UNICEF's advocacy with the Additional Chief Secretary and Public Health Director of the Health Department led to the government's decision to use alum before chlorinating water sources. This proved critical because chlorinating water sources without removing turbidity did not ensure safe drinking water. UNICEF rehabilitated 13 flood-affected dug wells to showcase technologies.
- As part of UNICEF's focus on evidence-based programming for the post-flood response, data from the water quality tests was analysed with the participation of key local partners. The analysis showed that there was extensive bacteriological contamination of open wells. This evidence will help guide future planning and programming of relevant departments under the Build Back Better Kerala initiative.

- Water filtration systems were sorely needed to ensure drinking water quality in the post-flood period. As part of disaster preparedness efforts, districts showed interest in installing standby water filters at public water points. UNICEF mapped the locations of these water supply sources on Google Maps to ensure accountability and provide a tracker for operations and maintenance support. The full mapping effort can be accessed [here](#).

### Sanitation and Hygiene

- The introduction of new technologies in sanitation (such as MTUs) helped in solving the crisis and driving local innovations in the sector.
- The inadequacy of faecal sludge treatment facilities became very prominent during the floods.
- A lack of a sewerage networks and treatment facilities in Kerala (despite 100 percent toilet coverage) exposed a critical gap during the floods. This lesson will guide future policy and programming in the sanitation sector.
- The establishment of Wayanad's FSM pilot project has encouraged risk-informed programming, innovation, and scaling in other districts as well. Thrissur district developed a unique waste management system by commissioning its own waste treatment plant.
- The state government can design a geography-specific FSM strategy and protocol. Capacity building at the institutional level will be key to integrating appropriate faecal sludge treatment processes (ideally owned and managed by municipal governments, with technical assistance from UNICEF) to the entire sanitation value chain
- Stakeholders in the sanitation sector had inadequate capacity (in terms of technology access, emergency supplies, and human resources) to cope with this unprecedented disaster. The technology of MTUs was new to Kerala and there was much government interest in MTU procurement for future use. The government has shown keen interest in procuring day-to-day septic waste management as well as important technology for disaster situations.
- UNICEF's MTU intervention helped in transferring knowledge and sharing technology



to instigate innovation in disaster-resilient infrastructure and strengthening supply mechanisms in the sector.

For most of Kerala, laying new sewer networks would be difficult because its cities are densely inhabited and the homestead pattern in villages is typically a continuous spread with very little separation between rural and urban areas. To prevent the deterioration of water quality, the development of innovative onsite sanitation systems is crucial and will contribute to solving faecal pollution.

### Wash Advocacy, Partnerships and Communication

- Social media platforms provide an important and effective means of communication in emergency situations. However, mechanisms to control the circulation of rumours and myths in a panic-stricken environment need to be investigated. Clear guidelines, protocols and SOPs can help in this area.
- Community radio emerged as a potent and credible communication tool during the floods. It helped in reaching remote areas and catalysed evacuation processes saving many lives. As per the [United Nations Central Emergency Response Fund \(CERF\) 2018 report](#), radio reached over 2 million population in Kerala which was achieved through partnerships with the largest public broadcaster, All India Radio (AIR) and community radio stations and BBC Media Action using both public service announcements and radio programme series.
- Short videos with demonstrations and highlighting the do's and don'ts were well-received vis-à-vis print media. The circulation of audio-visual IEC material was also more successful through social media.
- Active and timely partnerships as well as proactive communication helped to keep the death toll and spread of disease to a minimum. This ensured a swift transition from the relief effort to recovery during the floods.

### Next Steps

In order to meet its target of 1 million people (both in water and sanitation), UNICEF is continuing a long-term intervention-based engagement in Kerala with a focus on the worst-affected districts.

The key areas of the ongoing engagement are based on the tenet 'building back better', specifically for the sewerage infrastructure development and the improved water provision.

As a part of its long-term engagement in building a new Kerala, UNICEF is also facilitating social sector recovery and disaster risk reduction (DRR) planning at the local and district level to strengthen risk-informed planning processes.

After the Kerala flood WASH interventions, the following next steps were identified:

### WASH Sector Coordination

- Investing in stronger systems during times of stability mitigates the impact and cost of emergencies when they arise. Though a few states in India have begun to reflect flood-resilience designs for water and sanitation systems, there must be a greater emphasis given to institutionalize emergency preparedness activities. For instance, UNICEF and Kerala Water Authority can collaborate to strengthen water quality monitoring and surveillance systems and encourage the participation and support of concerned public and the private sector and advocate for the preparation of a road map for safely managing water supply in the state.
- Systems and programmes for evidence-based policy advocacy need to be strengthened. For instance, UNICEF supported the Kerala Water Authority
- The Kerala State Disaster Management Authority (KSDMA) may lead the interlink between various departments and reinforce convergence between them by developing shared activities and budgets.
- A roster of reliable NGOs with critical sector skills and regional/local expertise should be developed by the government and UNICEF to facilitate rapid partnership building modalities during emergencies.
- A people-centred approach is an important pillar of a successful emergency response. Local governments, communities, faith-based institutions, NGOs and cooperatives need to work together in strengthening modalities of participation, accountability, transparency, and grievances redressal mechanisms.

## Water

- Investment in technology to enable households to test water quality of dug wells and ensure water safety.
- UNICEF and the Kerala Water Authority can further support in building the capacities of the LSGD and SPCB staff to improve the current systems for management of monitoring, evaluation and performance of water quality information of the state level, through the design and development of an integrated online (web-enabled) dashboard.
- Post floods, UNICEF will continue its efforts to nurture disaster-resilient, community-based water management systems with a focus on flood preparedness in the future.

## Sanitation and Hygiene

- The state and local governments should research and consider new technologies and innovations emerging in the sector.
- Promising evidence-based, local technologies and innovations need funding for research and development to encourage replication and scaling up.

- Kerala needs to assess its sewerage needs. It needs to start immediate infrastructure planning and implementation as part of its Build Back Better initiative. Technical assistance from the UN and other multilateral agencies will help accelerate the process.
- Sewerage management training and capacity development is required at all levels, especially at district and sub-district levels.

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## About the Series

UNICEF's Water, Sanitation and Hygiene (WASH) country teams work inclusively with governments, civil society partners and donors, to improve WASH services for children and adolescents, and the families and caregivers who support them. UNICEF works in over 100 countries worldwide to improve water and sanitation services, as well as basic hygiene practices. This publication is part of the UNICEF WASH Learning Series, designed to contribute to knowledge of good practice across UNICEF's WASH programming. In this series:

*Discussion Papers* explore the significance of new and emerging topics with limited evidence or understanding, and the options for action and further exploration.

*Fact Sheets* summarise the most important knowledge on a topic in few pages in the form of graphics, tables and bullet points, serving as a briefing for staff on a topical issue.

*Field Notes* share innovations in UNICEF's WASH programming, detailing its experiences implementing these innovations in the field.

*Guidelines* describe a specific methodology for WASH programming, research or evaluation, drawing on substantive evidence, and based on UNICEF's and partners' experiences in the field.

*Reference Guides* present systematic reviews on topics with a developed evidence base or they compile different case studies to indicate the range of experience associated with a specific topic.

*Technical Papers* present the result of more in-depth research and evaluations, advancing WASH knowledge and theory of change on a key topic.

*WASH Diaries* explore the personal dimensions of users of WASH services, and remind us why a good standard of water, sanitation and hygiene is important for all to enjoy. Through personal reflections, this series also offers an opportunity for tapping into the rich reservoir of tacit knowledge of UNICEF's WASH staff in bringing results for children.

*WASH Results* show with solid evidence how UNICEF is achieving the goals outlined in Country Programme Documents, Regional Organisational Management Plans, and the Global Strategic Plan or WASH Strategy, and contributes to our understanding of the WASH theory of change or theory of action.

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