

Summary of Model Guidelines

for Mainstreaming Water and Sanitation in Emergencies,
Protracted Crises, LRRD and Disaster Preparedness Operations



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WATER AND SANITATION INTERVENTIONS FOR NON-DISPLACED POPULATIONS IN ACUTE NATURAL DISASTERS

Characteristics and impacts

- ▲ Physical damage to watsan infrastructure: destruction of storage systems, transmission lines and point supplies.
- ▲ Contamination of water supplies: organic material, debris, corpses, and in case of sea flooding, saline intrusion.
- ▲ Potential for impact on water sources, e.g. alteration in flow direction or outlets. (especially in the case of earthquakes and landslides, and potentially with hurricanes and cyclones).
- ▲ Temporary displacement of people, usually to nearby areas; in case destruction is widespread, displacement may be longer-term or permanent or and/or further away geographically.

Main objective and priorities for response

Saving and preservation of life through rapid response

- ▲ Provision of clean water in sufficient quantities in the fastest possible time.
- ▲ Immediate provision of means to safely dispose of excreta and management of solid waste.
- ▲ Hygiene promotion focussing on interventions most likely to reduce the transmission of disease; e.g. handwashing at critical times, safe disposal of excreta, safe storage and handling of drinking water.
- ▲ Design of interventions focussing on rapid solutions, where possible maximising the use of local resources; however, it may be necessary to import temporary infrastructure and technologies where this expedites a response.
- ▲ Always involve communities and staff of local watsan institutions where possible, but avoid loss of operational speed.
- ▲ Although cost is a concern, timeliness of interventions is of primary importance and it may be necessary to initially deploy systems that are more costly or complex as compared with existing levels of service or national standards.
- ▲ Establish benchmarks for service delivery as soon as possible; SPHERE and national standards should both be consulted with a view to replacing initial emergency measures with interventions appropriate to the specific context.

Typical response interventions

General	Rapid assessments	<ul style="list-style-type: none"> ▲ Rapid collection of public information. ▲ Rapid area or community assessments. ▲ Rapid household-level surveys. ▲ Rapid water and sanitation system damage assessments (usually focussing on urban systems but e.g. in droughts the focus may be small water points over a large area).
	Improve coordination	<ul style="list-style-type: none"> ▲ Facilitate improved watsan relief coordination at all levels and with all involved parties to avoid duplication and increase cost effectiveness of response (e.g. government authorities, NGO's, UN, Red Cross, military, private sector).
	Repair electricity systems	<ul style="list-style-type: none"> ▲ In order to generate electricity for pumps and other watsan equipment. ▲ Alternatively electricity can be produced by supplying generators.
	Advocacy	<ul style="list-style-type: none"> ▲ Implementing agencies lobby government authorities or other sector agencies regarding issues that are directly or indirectly related to watsan delivery. ▲ DG ECHO: advocate to with regional or national government on watsan related issues and working conditions for implementing partners.
Water	Water treatment	<ul style="list-style-type: none"> ▲ Chlorinate water, preferably at system level, or otherwise at household level. ▲ Simple technology is often sufficient and can later be taken over by communities.
	Distribution of materials for water supply	<ul style="list-style-type: none"> ▲ Chlorine solutions (avoid tablets, provide clear usage instructions, monitor residual levels), ORS (incl. usage instructions), water filters, water containers/packs (filled if required) etc. All items must be appropriate to locally assessed needs.
	Rapid cleaning and chlorination of boreholes and wells	<ul style="list-style-type: none"> ▲ Focus on wells and boreholes that may yield clean water. If flooding was caused by seawater, cleaning will probably not immediately reduce salinity levels. ▲ Test for faecal coliforms, turbidity and taste after cleaning, and for salinity in case flooding was by sea water. ▲ Where higher than normal levels of chemical constituents, (e.g. iron, fluoride etc.) are suspected test for them and include appropriate treatment as required.
	Repair of affected water systems	<ul style="list-style-type: none"> ▲ Focus on repairs that can immediately increase the availability of good quality water. ▲ Implement mitigation measures at the same time, if possible; control water quality. ▲ Local watsan institutions may often still function and staff can assist; always seek to work with and through them where possible.
	Development of new water systems	<ul style="list-style-type: none"> ▲ Only consider this option where new systems can be implemented very quickly and no better alternatives exist (e.g. repair of existing systems). ▲ May be required in areas to which people have been displaced for temporary shelter. ▲ Simple technology is often sufficient and can later be taken over by the communities. ▲ Design of systems should include mitigation measures (e.g. raising of boreholes). ▲ Consult with the community, especially women, over preferences for service delivery.

WATER AND SANITATION INTERVENTIONS FOR NON-DISPLACED POPULATIONS IN ACUTE NATURAL DISASTERS

Water (continued)	Provision of material assistance for communities or water institutions	<ul style="list-style-type: none"> ▲ Examples: fuel, lubricants, spare parts, pumps, generators, cars, trucks, computers. ▲ Used to increase the production of clean water as far as required and as far as the items cannot be financed/obtained by the community and/or water authority itself.
	Water tankering	<ul style="list-style-type: none"> ▲ Only consider where no other (less costly) solutions can be provided quickly enough. ▲ Chlorinate the water and monitor residual chlorine levels. ▲ Replace tankering <u>as soon as possible</u> by other, less costly systems.
	Redirection of supplies to drinking water	<ul style="list-style-type: none"> ▲ Example: redirect irrigation water or water for soft drinks temporarily to drinking water uses. ▲ Chlorinate the water and monitor residual chlorine levels.
Environmental Sanitation	Construct emergency toilet facilities	<ul style="list-style-type: none"> ▲ Defecation fields or trenches, or simple public pit latrines. ▲ Always take local practices and designs into account; consider issues of privacy and security for women and girls. ▲ Always construct the facilities away from water sources and areas prone to further damage.
	Distribution of sanitary kits	<ul style="list-style-type: none"> ▲ Examples: soap, sanitary pads for women, culturally suitable material for anal cleaning, toothpaste and brushes, etc. Items should always be based on locally assessed needs.
	Clearing and burial of corpses and cadavers	<ul style="list-style-type: none"> ▲ Act in accordance with local customs wherever possible; consult the population. ▲ Dead bodies will usually not lead to widespread disease transmission; people handling dead bodies can easily avoid risks through simple precautions. ▲ Graves should be at least 30 m away from drinking water sources and 1.5 m above the water table with a 0.7 m unsaturated zone. ▲ Surface water from graveyards must not enter inhabited areas.
	Removal of wastes and waste waters	<ul style="list-style-type: none"> ▲ Where required for immediate hygiene and/or operational purposes, remove solid waste, silt deposits, stones and rubble, and drain/remove excess waters.
	Vector control	<ul style="list-style-type: none"> ▲ Residual spraying, larviciding, provision of mosquito nets, drainage or filling of standing water pools, provision of drainage at new water points, removal of organic waste. ▲ Take safety precautions for both implementing staff and beneficiaries.
Hygiene Promotion	Promotion through face-to-face messaging, TV or radio, newspapers, posters, etc.	<ul style="list-style-type: none"> ▲ Direct interaction by extension staff and through selected and trained beneficiaries. ▲ Promote/explain the most important messages: <ul style="list-style-type: none"> ▲ dangers of contaminated water sources for human consumption. ▲ where to obtain clean water for drinking. ▲ use of chlorine solutions (avoid tablets) and ORS. ▲ boiling of untreated water for drinking. ▲ importance of hand washing at critical times. ▲ prevention of vector-borne diseases. ▲ proper use and maintenance of toilet facilities. ▲ Methods may comprise: <ul style="list-style-type: none"> ▲ verbal announcements (loudspeaker), home visits and one-to-one messaging. ▲ group discussions and/or story telling. ▲ messaging by popular or important persons at the site or on TV, radio or posters. ▲ verbal or written warnings about unsafe behaviors. ▲ reinforcing positive behaviors through pictures, radio, theatre or film. ▲ Ensure cultural and religious appropriateness of messages and methods. ▲ Focus on limited number of most critical messages. ▲ Communication strategies should always be adapted according to local context and culture (i.e. assess literacy rates and most common channels of popular communication). ▲ Wherever possible field test the promotion methods and messages with beneficiaries before use.



WATER AND SANITATION INTERVENTIONS FOR NON-DISPLACED POPULATIONS IN ACUTE CONFLICT SITUATIONS

Characteristics and impacts

- ▲ Local watsan institutions may be partly functional or completely inoperable due to lack of staff/committee members; physical damage to watsan infrastructure may result from conflict.
- ▲ Disrupted access to facilities and increased dangers with regard to population groups attempting to access services due to armed conflict; potential for using access to services as a leverage over certain groups within an affected population.
- ▲ Displacement of people (often very rapidly), usually out of the conflict area, often crossing borders and congregation in unplanned camps or camps with inadequate levels of service for the size of population received.
- ▲ Increased danger of conflict over water as a resource; corruption, misuse of water/tariffs, vandalism, blackmail and use for illegal activities.
- ▲ Difficulties to arrange permission for access and work to be done on the part of implementing agencies.

Main objective and priorities for response

Saving and preservation of life through rapid response

- ▲ Provision of clean water in sufficient quantities in the fastest possible time.
- ▲ Immediate provision of means to safely dispose of excreta and management of solid waste.
- ▲ Hygiene promotion focussing on those interventions most likely to reduce the transmission of disease; e.g. handwashing at critical times, safe disposal of excreta, safe storage and handling of drinking water.
- ▲ In circumstances where security (including further conflict-related flare-ups), corruption or the potential for misuse of water as a resource is likely, household level water systems should be considered over public (communal) systems where feasible.
- ▲ Always involve communities and staff of local watsan institutions where possible, but avoid loss of operational speed.
- ▲ In acute conflict areas, implementing agencies may be forced to apply “hit and run” operations, going in quickly, implementing high priority interventions and leaving before the next round of violence flares up again.

Typical response interventions

General	Rapid assessments	<ul style="list-style-type: none"> ▲ Rapid collection of public information. ▲ Rapid area or community assessments. ▲ Rapid household-level surveys. ▲ Rapid water and sanitation system damage assessments.
	Improve coordination	<ul style="list-style-type: none"> ▲ Facilitate watsan relief coordination from the start at all levels and with all involved parties to avoid duplication and increase cost effectiveness of response (e.g. government authorities, NGO's, UN, Red Cross, military, private sector). When liaising with opposing parties avoid becoming part of the conflict or being perceived as supporting any particular group.
	Repair electricity systems	<ul style="list-style-type: none"> ▲ In order to generate electricity for pumps and other watsan equipment. ▲ Alternatively electricity can be produced by bringing in generators (also more suitable if future conflict flare-ups could damage the power plant again).
	Advocacy	<ul style="list-style-type: none"> ▲ Implementing agencies lobby for issues that are directly or indirectly related to watsan with local parties, including parties involved in the conflict, if necessary. ▲ DG ECHO: advocate with national governments or leaders of conflict groups on watsan related issues and working/security conditions for the implementing partners.
Water	Distribution of materials for water supply	<ul style="list-style-type: none"> ▲ Chlorine solutions (avoid tablets, provide clear usage instructions, monitor residual levels), ORS (incl. usage instructions), water filters, water containers/packs (filled if required), etc. Materials should be relevant to locally assessed needs.
	Repair of affected water systems	<ul style="list-style-type: none"> ▲ Only focus on repairs that immediately increase the availability of good quality water. ▲ Select systems that are less likely to be damaged again or that can be protected against further violence. ▲ If feasible consider the possibility of implementing household water systems. ▲ Control water quality through disinfection measures.
	Development of new water systems	<ul style="list-style-type: none"> ▲ Only consider where new systems can be implemented very quickly and no better alternatives exist (e.g. repair of existing systems). ▲ Simple technology is often sufficient and can later be taken over by communities. ▲ Where there is the potential for new conflict flare-ups the focus should preferably be on small-scale and/or household water systems if possible/technically feasible. ▲ Consult with the community, especially women, over preferences for service delivery.
	Provision of material assistance for communities or water institutions	<ul style="list-style-type: none"> ▲ Examples: fuel, lubricants, spare parts, pumps, generators, cars, trucks, computers. ▲ Provide to increase the production of clean water as far as required and as far as the items cannot be financed/obtained by the community and/or water authority itself. ▲ Avoid provision of items that may cause conflict, are prone to misuse, or are likely to be confiscated or stolen (e.g. by fighters, institutional staff, or during a future conflict).

WATER AND SANITATION INTERVENTIONS FOR NON-DISPLACED POPULATIONS IN ACUTE CONFLICT SITUATIONS

Water (cont.)	Water tankering	<ul style="list-style-type: none"> ▲ Only consider where no other (less costly) solutions can be provided as quickly. ▲ Assess whether security allows for water tankering. ▲ Chlorinate the water and monitor residual chlorine levels. ▲ Replace tankering <u>as soon as possible</u> by other, less costly systems.
	Redirection of supplies to drinking water	<ul style="list-style-type: none"> ▲ Example: redirect irrigation water or water for soft drinks temporarily to drinking water. ▲ Chlorinate the water and monitor residual chlorine levels.
Environmental Sanitation	Construct emergency toilet facilities	<ul style="list-style-type: none"> ▲ Defecation fields or trenches, or public simple pit latrines. ▲ Always take local practices and designs into account; consider issues of privacy and security for women and girls. ▲ Construct the facilities away from insecure areas, preferably close to people's houses or where security threats are minimal.
	Distribution of sanitary kits	<ul style="list-style-type: none"> ▲ Examples: soap, sanitary pads for women, culturally suitable material for anal cleaning, toothpaste and brushes, etc. Selected items should always be based on locally assessed needs.
	Clearing and burial of corpses and cadavers	<ul style="list-style-type: none"> ▲ Act in accordance with the customs and culture where possible; consult the population. ▲ Dead bodies will usually not lead to widespread disease transmission; people handling dead bodies can easily avoid risks through simple precautions. ▲ Graves should be at least 30 m away from drinking water sources and 1.5 m above the water table with a 0.7 m unsaturated zone.
	Repair of excreta disposal systems	<ul style="list-style-type: none"> ▲ Surface water from graveyards must not enter inhabited areas. ▲ Only where this directly increases the disposal capacity or improves hygiene. ▲ Select systems that are less likely to be damaged again or that can be protected against future violence; otherwise assess the possibility of implementing household excreta disposal systems. ▲ Where time and other factors allow implement mitigation measures simultaneously.
	Removal of wastes and waste waters	<ul style="list-style-type: none"> ▲ Where required for immediate hygiene and/or operational purposes, remove solid waste, silt deposits, stones, rubble and other wastes, and drain/remove excess surface waters.
Hygiene Promotion	Promotion through face-to-face messaging, TV or radio, newspapers, posters, etc.	<ul style="list-style-type: none"> ▲ Direct messaging through extension staff and trained beneficiaries. ▲ Promote/explain the most important messages: <ul style="list-style-type: none"> ▲ dangers of contaminated water sources for human consumption. ▲ where to obtain clean water for drinking. ▲ use of chlorine solutions (avoid tablets) and ORS. ▲ boiling of untreated water for drinking. ▲ importance of hand washing at critical times. ▲ prevention of vector-borne diseases. ▲ proper use and maintenance of toilet facilities. ▲ Methods may comprise: <ul style="list-style-type: none"> ▲ verbal announcements (loudspeaker), one-to-one messaging and home visits. ▲ group discussions and/or story telling. ▲ messaging by popular or important persons at the site or on TV, radio or posters. ▲ verbal or written warnings about unsafe behaviors. ▲ reinforcing positive behaviors through pictures or film. ▲ Ensure cultural and religious appropriateness of messages and methods. ▲ Focus on limited number of most critical messages. ▲ Communication strategies should always be adapted according to local context and culture (i.e. assess literacy rates and most common channels of popular communication). ▲ Wherever possible field test promotion methods and messages with beneficiaries before use.



WATER AND SANITATION INTERVENTIONS FOR NON-DISPLACED POPULATIONS IN POST-ACUTE AND CHRONIC SITUATIONS

Characteristics and impacts

- ▲ The “critical” phase of an acute emergency which requires fast, often temporary, solutions is very often quite short, usually a matter of weeks or even days; this initial period quickly evolves into a more stable phase requiring more permanent and durable interventions, which share characteristic of chronic scenarios.
- ▲ Post-acute and chronic scenarios are characterised by the need to (re)-establish permanent and durable watsan services which can be sustained by the local populations and institutions responsible for their delivery, thereby returning to a “normal” situation, at least to pre-event levels of service or higher depending on resources available and the scale of needs.

Main objectives and priorities for response

To identify and respond to acute needs where these exist; to prevent the impact of a crisis on services from worsening; to carry out short-term rehabilitation work; and to lay the basis for development efforts in water and sanitation, thereby assisting those most affected to regain a degree of self-sufficiency.

- ▲ The emphasis is on recovery and rehabilitation of water and sanitation services and a return to self-sufficiency, including disaster preparedness and mitigation activities where recurrence of hazard events is likely.
- ▲ Water supply and sanitation services and hygiene promotion interventions should be designed and planned to be more durable and permanent and must take into account national capacities, norms and technical standards.
- ▲ The focus on rehabilitation should be on projects that are appropriate, cost effective and wherever possible lay the basis for sustainable service delivery; efforts to link relief to rehabilitation and development should include:
 - ▲ Working together with central or local government agencies in the entire project cycle.
 - ▲ Adopting ‘demand-driven’ approaches based on motivation, self-help and community-management models.
 - ▲ Wherever possible designs should be based on national norms, standards and national sector policies, and technologies that can be operated and maintained locally.
 - ▲ Communities and local watsan institutions should be involved in developing solutions based on their preferences, capabilities and capacities.
 - ▲ The needs of vulnerable groups and women are especially important to consider in the design process.
 - ▲ Coordination with other implementing parties is essential to make optimal use of knowledge, experience and resources, as well as to avoid unintended negative consequences, such as over-extraction of groundwater resources.
 - ▲ Where disasters are recurrent events, there should be a focus on disaster-prone designs and mitigation measures.

Typical response interventions

General	Implement and reinforce social infrastructure in the communities	<ul style="list-style-type: none"> ▲ Encourage demand creation for services (especially sanitation) by working with communities. ▲ Facilitate the establishment of community committees to educate, train and promote health, hygiene and other subjects; analyse problems and preferences relating to water and sanitation. ▲ Utilise existing community-management structures, or establish new ones where required, to organise project implementation and longer term maintenance. ▲ Development of community health and disaster preparedness plans. ▲ Strengthen management capacity of committees through training and coaching.
	Improve the capacity of local agencies	<ul style="list-style-type: none"> ▲ Strengthen local NGOs and government authorities in management as well as in the use of appropriate technologies and tools to be able to implement relief and recovery programmes.
	Advocacy	<ul style="list-style-type: none"> ▲ Implementing agencies to lobby for longer term watsan related issues with donors, district authorities and even national authorities. ▲ DG ECHO: advocate with involved governments on longer term watsan related issues.
Disaster Preparedness	Improve the disaster preparedness capacity of support agencies	<ul style="list-style-type: none"> ▲ NGO’s, local/district authorities, companies, etc. that assist communities and institutions during and after the disaster with relief, recovery and disaster preparedness programmes. ▲ Assist agencies to assess their development and preparedness requirements. ▲ Assist agencies to develop and implement disaster preparedness plans (see below).
	Improve district level disaster preparedness coordination mechanisms	<ul style="list-style-type: none"> ▲ Develop a platform with NGO’s, authorities, companies, and community representatives for coordination, development and implementation of an interdisciplinary district-based disaster preparedness plan. ▲ The disaster preparedness plans of individual organisations should fit within the framework of the district disaster preparedness plan. ▲ Further coordination mechanisms can include staff training, mock-exercises, contingency planning etc.
Water	Water resources assessments	<ul style="list-style-type: none"> ▲ Assess how water resources can be further developed without damaging the environment. ▲ Assess whether the resources and facilities can be protected against future disasters. ▲ Assess the impact of changes in water use on livelihoods, especially in case of drought. ▲ In case water resources extend beyond the local level, the assessment must also cover the larger context as well (i.e. water resource mapping of larger aquifer systems).
	Rehabilitate community water systems	<ul style="list-style-type: none"> ▲ Assist communities to rehabilitate water systems, including mitigation measures where possible and appropriate; establish systems for regular control of water quality.
	Implement new community-managed water systems	<ul style="list-style-type: none"> ▲ As far as possible prioritise, plan, design and implement in conjunction with beneficiary participation.

WATER AND SANITATION INTERVENTIONS FOR NON-DISPLACED POPULATIONS IN POST-ACUTE AND CHRONIC SITUATIONS

Water (continued)	Implement new community-managed water systems (continued)	<ul style="list-style-type: none"> ▲ Assist communities to implement systems as part of the community development plan, both with organisation (i.e. building community management capacity) and infrastructure. ▲ Implement disaster preparedness and mitigation measures where possible and appropriate. ▲ Use simple, appropriate and locally established technologies to contribute to sustainability. ▲ Consider the introduction of appropriate technologies if conventional designs are too expensive or may lead to sustainability problems. ▲ Assist the community to set up a simple system for regular water quality control.
	Rehabilitate urban water systems	<ul style="list-style-type: none"> ▲ Assist water institutions to execute vulnerability assessments and to develop and execute rehabilitation, mitigation and disaster preparedness interventions that improve physical infrastructure and organisational capacities; where systems were inoperable prior to the emergency investigate the causes and assess whether it is worthwhile to take action. ▲ Strengthen management and administration through staff training and long-term coaching.
	Construction of new urban water systems	<ul style="list-style-type: none"> ▲ Should only be carried out when essential for public health; work in collaboration with relevant institutions; only undertake if there is low risk of further damage by conflict or misuse. ▲ Include in disaster-resistant designs and locate in areas least prone to future disasters. ▲ Provide long-term training and coaching of the institution's staff and management.
	Provision of material assistance for communities or water institutions	<ul style="list-style-type: none"> ▲ Provide items (e.g. fuel, lubricants, spare parts, pumps, generators, cars, trucks, computers, etc.) that enable communities or water institutions to increase the production of clean water as far as required, but that cannot be financed by the community and/or water institution itself. ▲ In case service delivery needs to be increased other water systems may need to be implemented.
	Contingency water facilities	<ul style="list-style-type: none"> ▲ Examples: public water facilities in areas where people can take refuge during disasters, drilling and management of contingency boreholes (especially in droughts).
Environmental Sanitation	Implement and improve facilities at water points	<ul style="list-style-type: none"> ▲ Examples: fencing of water points, improved water catchment for drought-prone areas, drainage works to control and divert excess water, and construction of washing slabs as far as these have been prioritised by the community.
	Construct toilet/latrine facilities	<ul style="list-style-type: none"> ▲ Develop the design together with beneficiaries; include mitigation measures. ▲ In some instances new appropriate technologies can be introduced, e.g. double vault latrines which are less prone to damage by floods, earthquakes etc. and suitable in areas with high groundwater tables or unstable soils and do not need to be replaced as often.
	Implement other sanitation facilities	<ul style="list-style-type: none"> ▲ To be prioritised by the beneficiaries. Develop the designs with beneficiaries and assist them to plan and implement interventions; e.g. surface drainage works, solid waste disposal etc. ▲ Include mitigation measures where required and appropriate.
	Vector control	<ul style="list-style-type: none"> ▲ Residual spraying, larviciding, drainage or filling of standing water pools, provision of mosquito nets, etc. Provision of drainage at new water points, solid waste disposal. Take safety precautions for staff and beneficiaries.
	Contingency sanitation facilities	<ul style="list-style-type: none"> ▲ Public sanitation facilities in safe areas where people can take refuge during future disasters.
Hygiene Promotion	Community level hygiene and health promotion	<ul style="list-style-type: none"> ▲ Hygiene and health promoters meet regularly with heads of households (female/male), and other groups (e.g. children at school). Activities include: <ul style="list-style-type: none"> ▲ explanations, discussions and training about health and hygiene related issues and subjects of importance identified by the participants. ▲ identification and discussion with participants of high-risk watsan behaviours. ▲ Methods: group discussions, household visits, story telling, participative games and exercises, drama/theatre performance, posters, learning through enquiry by beneficiaries, etc. ▲ Ensure cultural and religious appropriateness of messages and methods. ▲ Focus on limited number of most critical messages. ▲ Communication strategies should always be adapted according to local context and culture (i.e. assess literacy rates and most common channels of popular communication). ▲ Field test promotion methods and messages with beneficiaries before use. ▲ Support capacity of local health or hygiene outreach workers (Ministry of Health or other) to complement messages associated with water and sanitation projects.
	Mass media hygiene promotion	<ul style="list-style-type: none"> ▲ Media: radio, TV, newspapers, cinema, loudspeaker announcements. ▲ Information about use of different water sources, use of chlorine solutions (avoid tablets) and ORS, boiling of untreated water for drinking; hand washing, proper toilet use and maintenance; prevention of vector-borne diseases, etc. ▲ Methods: story telling or soap series on TV/radio, verbal or written warnings about unsafe behaviours, slogans, messaging by popular or important persons (on radio, TV or posters), reinforcing positive behaviors through pictures or film. ▲ Communication strategies should always be adapted according to local context and culture (i.e. assess literacy rates and most common channels of popular communication). ▲ Field test promotion methods and messages with beneficiaries before use. ▲ Focus on limited number of most critical messages.



WATER AND SANITATION INTERVENTIONS FOR DISPLACED POPULATIONS IN ACUTE EMERGENCIES

Characteristics and impacts

- ▲ The rapid displacement of populations, whether through natural disaster or conflict, can lead to the congregation of large numbers in unplanned settlements, posing serious public health risks if adequate water and sanitation facilities have not been installed in advanced.
- ▲ Wherever possible it is preferable to avoid displacement through provision of assistance in and around affected communities, as long as this does not expose the population to further risk; take measures to ensure that affected population do not become overly dependent on assistance.
- ▲ Where this is not possible it is preferable to settle displaced people among a receiving host community where existing watsan and other infrastructure can be utilised, even if this needs to be expanded. This often provides a better, cheaper and quicker alternative and will continue to benefit the host community in the longer-term.
- ▲ Where displacement can be anticipated it is preferable to provide properly planned and prepared temporary camps or shelter areas, with access to minimal levels of service. Rapid movement of displaced persons into unplanned settlements is the worst-case scenario because of the danger that facilities are not sufficiently in place in time and the often high costs involved in the rapid provision of services. Proper planning for temporary camps should include as a first step, protection of the water source(s) to be used for drinking purposes and the location of sanitation facilities.
- ▲ An option may be to provide temporary relief services, while at the same time establishing planned temporary camps with the intention of moving people to those locations as soon as they are ready. A crucial decision in this context may be whether it is best to put energy, resources and time into developing planned temporary settlements or to keep people in the unplanned settlements while starting to prepare for a direct return to their own homes, if possible. It is important that the options are properly communicated to the displaced people and that – within the boundaries of what is possible and permitted – they select the preferred option.
- ▲ Displaced people, especially those in unplanned settlements, usually have very few coping mechanisms left and may therefore be much more (or entirely) dependent on external assistance for their survival.
- ▲ Where possible prevent displacement through the provision of assistance in and around people's home areas, Watsan services in temporary settlements may attract people to, and maintain them in, settlements which could have negative health or security implications and can lead to resentment on the part of the host community and/or authorities, where there is a perceived imbalance in levels of service.

Main objectives and priorities for response

Saving and preservation of life through rapid response

- ▲ Provision of clean water in sufficient quantities in the fastest possible time.
- ▲ Immediate provision of means to safely dispose of excreta and management of solid waste.
- ▲ Hygiene promotion focussing on those interventions most likely to reduce the transmission of disease; e.g. handwashing at critical times, safe disposal of excreta, safe storage and handling of drinking water.
- ▲ Always involve displaced beneficiaries where possible, but avoid loss of operational speed.
- ▲ The focus of design should be on rapid solutions, where possible maximising the use of local resources; however, it may be necessary to import temporary infrastructure and technologies where this expedites a response.
- ▲ Although cost is a concern, timeliness of interventions is of primary importance and it may be necessary to initially deploy systems that are more costly or complex as compared with existing levels of service or national standards.
- ▲ Once services are established operational costs should be reduced as far as possible (e.g. by replacing water tankering with less costly solutions) and designs should be made to provide a basis for more permanent solutions if appropriate.

Typical response interventions

General	Rapid assessments	<ul style="list-style-type: none"> ▲ Rapid collection of public information. ▲ Rapid area or community assessments. ▲ Rapid household-level surveys. ▲ Rapid water and sanitation system damage assessments.
	Improve coordination	<ul style="list-style-type: none"> ▲ Facilitate watsan relief coordination from the start at all levels and with all involved parties to avoid duplication and increase cost effectiveness of response (e.g. local authorities, NGO's, UN, Red Cross, military, private sector).
	Advocacy	<ul style="list-style-type: none"> ▲ Implementing agencies: lobby with authorities or other players for issues that are directly or indirectly related to watsan. ▲ DG ECHO: advocate with central governments or local authorities as necessary on watsan related issues and working conditions for the implementing partners.
	Distribution of materials for water supply	<ul style="list-style-type: none"> ▲ Examples: chlorine solutions (avoid tablets, provide clear usage instructions, monitor residual levels), ORS (incl. usage instructions), water filters, water containers/packs (filled if required), water cookers, etc. ▲ Items must be appropriate to locally assessed needs.
Water	Development of new or expansion of existing water systems	<ul style="list-style-type: none"> ▲ Required where displaced people settle in camps or temporary shelter areas. ▲ Initially time is a crucial factor in the selection and design of the water system. ▲ Simple technology is often sufficient and quicker to construct and its management often more successfully handed over to the beneficiaries in the future. ▲ Consult with the community, especially women, about preferred design and locations.

WATER AND SANITATION INTERVENTIONS FOR DISPLACED POPULATIONS IN ACUTE EMERGENCIES

Water (continued)	Provision of items to host communities or water institutions	<ul style="list-style-type: none"> ▲ Where displaced persons have settled among a host community it may be necessary to expand and/or improve the existing water systems. ▲ Ensure the implementation of proper water quality control mechanisms. ▲ In case of settlement among a host population provide consumables and inputs that enable the host community and/or its water institution to directly increase the production of clean water (e.g. fuel, lubricants, spare parts, pumps, generators, cars, trucks, etc.). ▲ Try to avoid items that may cause conflict, are prone to misuse, or are likely to be stolen. Written contracts and administrative procedures may be necessary to clarify issues.
	Water tankering	<ul style="list-style-type: none"> ▲ Only consider where no other (less costly) solutions can be provided quickly enough. ▲ Chlorinate the water and monitor residual chlorine levels. ▲ Replace <u>as soon as possible</u> by other, less costly systems.
	Redirection of supplies to drinking water	<ul style="list-style-type: none"> ▲ Example: redirect irrigation water or water for soft drinks temporarily to drinking water. ▲ Chlorinate the water and monitor residual chlorine levels.
Environmental Sanitation	Construction of temporary toilet and other sanitary facilities	<ul style="list-style-type: none"> ▲ Implement temporary toilet facilities as quickly as possible (e.g. defecation fields, trenches or public simple pit latrines). ▲ Take into account the sanitary practices and toilet designs of the displaced population, and the host population where appropriate. ▲ Promote proper use and maintenance of the facilities. ▲ Where possible implement household rather than public toilets, as these are more likely to be cleaned and maintained. Encourage users to construct own latrines, but provide assistance to the most vulnerable households. ▲ Other temporary sanitary facilities may include solid waste disposal systems, vector control campaigns, burial of the dead, drainage works, etc. (see the other 'Acute' sheets for more details).
	Expansion of existing sanitation systems	<ul style="list-style-type: none"> ▲ Where displaced persons have settled among a host community it may be necessary to expand and/or improve the existing sanitary systems of the host community in order to cover the needs of both the host and the displaced communities.
	Distribution of sanitary kits	<ul style="list-style-type: none"> ▲ Provide: soap, sanitary pads for women, culturally suitable material for anal cleaning, toothpaste and brushes, and other sanitary items based on assessed needs. ▲ In case of settlement among a host community provide the items to both the displaced and the host population.
Hygiene Promotion	Promotion through face-to-face messaging, TV or radio, newspapers, posters, etc.	<ul style="list-style-type: none"> ▲ Personal messaging through extension staff and trained beneficiaries. ▲ Promote/explain the most urgent messages, for instance: <ul style="list-style-type: none"> ▲ dangers of contaminated water sources for human consumption. ▲ where to obtain clean water for drinking. ▲ use of chlorine solutions (avoid tablets) and ORS. ▲ boiling of untreated water for drinking. ▲ importance of hand washing at critical times. ▲ prevention of vector-borne diseases. ▲ proper use and maintenance of toilet facilities. ▲ Methods may comprise: <ul style="list-style-type: none"> ▲ verbal announcements (loudspeaker), home visits and face-to-face interaction. ▲ group discussions and/or story telling. ▲ messaging by popular or important persons at the site or on TV, radio or posters. ▲ verbal or written warnings about unsafe behaviors. ▲ reinforcing positive behaviors through pictures or film. ▲ Ensure cultural and religious appropriateness of messages and methods. ▲ Focus on limited number of most critical messages. ▲ Communication strategies should always be adapted according to local context and culture (i.e. assess literacy rates and most common channels of popular communication). ▲ Wherever possible field test promotion methods and messages with beneficiaries before use.



WATER AND SANITATION INTERVENTIONS FOR DISPLACED POPULATIONS IN SETTLEMENTS IN POST-ACUTE AND CHRONIC SITUATIONS

Characteristics and impacts

- ▲ Chronic displacement often deprives people of livelihood opportunities, reduces traditional coping mechanisms and makes them more dependent upon humanitarian assistance than non-displaced populations. In cases where displacement occurs across borders, legal status and issues such as land-tenure can complicate the long-term provision of services.
- ▲ Post-acute and chronic scenarios are characterised by the need to (re)-establish permanent and durable watsan services which can be sustained by the local populations and institutions responsible for their delivery, thereby returning to a “normal” situation, at least to pre-event levels of service or higher depending on resources available and the scale of needs.
- ▲ Situations involving displaced populations can easily turn onto protracted situations (over many decades) requiring a level of care and maintenance that goes beyond the provision of temporary facilities.

Main objectives and priorities for response

To identify and respond to acute needs where these exist; to prevent the impact of a crisis on services from worsening; to carry out short-term rehabilitation work; and to lay the basis for development efforts in water and sanitation, thereby assisting those most affected to regain a degree of self-sufficiency.

- ▲ The emphasis is on consolidation of water and sanitation services towards more sustainable and self-sufficient services in which beneficiaries play an increasing organisational, and where possible financial role, including mitigation and disaster preparedness activities where disaster recurrence is likely.
- ▲ Post-acute or chronic types of watsan interventions generally gear-up within three months after the start of the settlement.
- ▲ Address the linking of relief to rehabilitation and development by including the following issues:
 - ▲ beneficiary involvement should be increasingly encouraged, including as far as possible elements of initiative, self-help and beneficiary management; but this will often require greater support from implementing agencies than situations where people are not displaced. Active participation should be encouraged, including representation of women and vulnerable groups (children, the elderly etc.).
 - ▲ implementing agencies must take into account national norms, standards and sector policies in the development and design of interventions, including issues such as cost recovery and long-term maintenance and management of systems.
 - ▲ in case settlements are located in disaster prone areas focus on solutions least prone to known, or likely hazard events.

Typical response interventions

General	Implement and reinforce social infrastructure in the settlements	<ul style="list-style-type: none"> ▲ Execute as part of a community-based intervention strategy. ▲ Establish (neighborhood) health and hygiene committees with people volunteering to educate, train, and promote health, hygiene and other subjects. ▲ Community groups elect a project committee for the planning and organisation of community health projects, such as water, sanitation and other projects of importance for health. ▲ Assist the community to execute a vulnerability analysis in their part of the settlement. ▲ Development of a plan that includes health and disaster preparedness projects (including mitigation measures where applicable and required). ▲ Strengthen management of the committees through training and coaching.
	Integration with district authorities and institutions	<ul style="list-style-type: none"> ▲ Establish cooperation platforms with relevant authorities and institutions in the area in order to integrate settlement watsan services with institutional service providers where possible and appropriate. ▲ Establishing linkages between displaced populations and local authorities also helps to avoid negative impacts or tensions with host populations. Support these initiatives with funding, training, and coaching as far as needed.
	Advocacy	<ul style="list-style-type: none"> ▲ Implementing agencies: advocate watsan issues for populations forced into settlements with local and/or district authorities and even national authorities e.g. water for displaced persons in case there is tension over different water uses in the area. ▲ DG ECHO: advocate with involved governments on issues such as support/facilitation by national and other authorities of the watsan work done by ECHO and their partners or the facilitation of balanced decision-making in disputes over water resource allocation between displaced and local populations.
Water	Water resources assessments	<ul style="list-style-type: none"> ▲ Assess how water resources can be further developed without damaging the environment. ▲ Assess whether the resources and facilities can be protected against future disasters. ▲ In case the water resources reach beyond the local level, the assessment must extend to cover the larger context as well (i.e. water resource mapping of larger aquifer systems).
	Expansion and/or improvement of the water systems	<ul style="list-style-type: none"> ▲ Where appropriate and possible transfer from agency run systems to a community-based management model with the beneficiary population taking over responsibility for administration and operation. The implementation agency should normally expect to remain involved to provide monitoring, coaching and full or part provision/payment of key resources or spare parts. ▲ Transform expensive services (e.g. water tankering) into less costly and, where possible, improved services (e.g. pipeline systems, boreholes with hand, solar or wind driven pumps). ▲ Where required, the quality of the water should be improved with cost-effective approaches such as settlement tanks, roughing and/or slow sand filtration followed by chlorination. Also, point of use solutions may be applied, e.g. the selling or distribution of chlorine solutions and /or household level water filters. Implement a system for regular water quality testing.

WATER AND SANITATION INTERVENTIONS FOR DISPLACED POPULATIONS IN SETTLEMENTS IN POST-ACUTE AND CHRONIC SITUATIONS

Water (cont.)	Expansion and/or improvement of the water systems (continued)	<ul style="list-style-type: none"> ▲ Establish a system of water point caretakers. ▲ Expansion and improvement of the services the pre-event levels, or better if those services were sub-standard (take into account the higher risks for epidemics in settlements due to crowding etc.). Any proposed design level of service should refer to national standards and technical norms, if available.
Environmental Sanitation	Sanitary assessment	<ul style="list-style-type: none"> ▲ Execute a sanitary assessment as part of a community-based strategy; in addition assess specific needs, for example the requirements of vulnerable groups including sick people, HIV/AIDS patients, the elderly, handicapped, children, etc.
	Implement and improve facilities at water points	<ul style="list-style-type: none"> ▲ These include interventions such as fencing to protect a water supply point from animals, drainage works to control and divert excess water and construction of washing slabs as far as these have been prioritised by the community.
	Construct private toilet/latrine facilities	<ul style="list-style-type: none"> ▲ Design the facilities with input from the beneficiaries to ensure they are adapted to local habits, culture and preferences. For security and comfort reasons, especially for women and girls, toilets should be near people's houses. Include mitigation measures if necessary. ▲ National standards and design norms should be consulted and met where possible. ▲ As far as possible construction should be done by the beneficiaries themselves. Facilitate this by: awareness creation and information campaigns; provision of required tools; donation of key components (i.e. reinforced concrete slabs). Encourage communities to construct facilities for vulnerable households and monitor replication and uptake. ▲ Where settlements will stay for a year or longer it may be appropriate to introduce technologies such as double vault latrines; in this design the pits do not need to be as deep as other latrine types and can be emptied in a rotation, also reducing space requirements.
	Implement other sanitation facilities	<ul style="list-style-type: none"> ▲ To be prioritised by the beneficiaries (i.e. drainage, solid waste management); designs should be developed in consultation with beneficiaries and preferably implemented on a self-help basis. ▲ Include mitigation measures where required and appropriate.
	Vector control	<ul style="list-style-type: none"> ▲ Residual spraying, larviciding, drainage or filling of standing water pools, provision of mosquito nets, removal of organic matter etc. Take safety precautions for staff and beneficiaries.
Hygiene Promotion	Community level hygiene and health promotion	<ul style="list-style-type: none"> ▲ Hygiene and health promoters meet regularly with heads of households (female/male), and other groups (e.g. children at school). Activities include: <ul style="list-style-type: none"> ▲ explanations, discussions and training about health and hygiene related issues and subjects of importance identified by the participants. ▲ identification and discussion with participants of high-risk watsan behaviours. ▲ Methods: group discussions, household visits, story telling, participative games and exercises, drama/theatre performance, posters, learning through enquiry by beneficiaries, etc. ▲ Ensure cultural and religious appropriateness of messages and methods. ▲ Focus on limited number of most critical messages. ▲ Communication strategies should always be adapted according to local context and culture (i.e. assess literacy rates and most common channels of popular communication). ▲ Field test promotion methods and messages with beneficiaries before use. ▲ Support capacity of other health or hygiene outreach staff working with the displaced population to complement messages associated with water and sanitation projects.
	Mass media hygiene promotion	<ul style="list-style-type: none"> ▲ Media: radio, TV, newspapers, cinema, loudspeaker announcements. ▲ Information about use of different water sources, use of chlorine solutions (avoid tablets) and ORS, boiling of untreated water for drinking; hand washing, proper toilet use and maintenance; prevention of vector-borne diseases, etc. ▲ Methods: story telling or soap series on TV/radio, verbal or written warnings about unsafe behaviors, slogans, messaging by popular or important persons (on radio, TV or posters), reinforcing positive behaviors through pictures or film. ▲ Communication strategies should always be adapted according to local context and culture (i.e. assess literacy rates and most common channels of popular communication). ▲ Field test promotion methods and messages with beneficiaries before use. ▲ Focus on limited number of most critical messages.



WATER AND SANITATION DISASTER PREPAREDNESS INTERVENTIONS

Characteristics

- ▲ Disaster reduction interventions include both the development and strengthening of emergency response capacity (*preparation*) and physical measures to protect water and sanitation infrastructure against the impact of a disaster (*mitigation*).
- ▲ Disaster preparation can include:
 - ▲ capacity building interventions in which communities and public institutions are (better) organised and prepared to respond to a disaster, including the provision of specialist equipment and development of contingency plans;
 - ▲ material interventions, e.g. preparation of materials, goods, food stuffs, etc. required to survive a disaster event; and
 - ▲ technical interventions, such as the establishment of early warning and communication systems.
- ▲ Disaster mitigation covers:
 - ▲ household level interventions such as raising or strengthening of latrine pits subject to flooding.
 - ▲ community or public interventions such as the protection, strengthening and/or re-location of water supply infrastructure, increasing the water retention capacity of collection systems in drought prone areas, or the construction of river-training spurs or planting of vegetation to protect embankments.
 - ▲ An overall improvement in the design, siting and construction quality of system components to withstand the impact of natural disasters, taking into account known or likely hazard types.
- ▲ Advocacy to highlight the importance of disaster mitigation and raise awareness at all levels, from community to central government, about the importance of investing in preparedness and mitigation activities.
- ▲ Certain hazards – such as flooding, cyclones and hurricanes – occur at fairly predictable times of the year, therefore disaster preparedness and contingency planning should become a routine event prior to the disaster season wherever possible.

Main objectives and priorities for implementation

To reduce or remove entirely the negative impacts of a (recurrent) disaster event on access to adequate levels of water and sanitation service, and to reduce the likelihood of increased incidence of water and excreta-related disease, both during and following the disaster itself.

- ▲ Demonstration activities should be followed up to ensure replication, long-term impact and sustainability; water and sanitation preparedness activities should be integrated into a holistic plan, which will include other essential elements such as preparation of food, key medications, an evacuation plan etc.
- ▲ Disaster preparedness activities require training and awareness raising, as well as actions to strengthen the linkages with, and coordination between, community-based structures and local government or relevant government disaster management agencies.
- ▲ Disaster preparedness interventions must be hazard specific and feasible for local (community-based) operation and maintenance.

Typical response interventions – disaster preparation

Establish or reinforce community committees which can be mobilised in the event of a disaster	<ul style="list-style-type: none"> ▲ Committees may need institutional strengthening and capacity building. ▲ Train committee members in first aid, search & rescue, needs assessments, temporary shelter, disease control, water safety, communications, logistics, etc. ▲ Roles and responsibilities of each committee member need to be made clear.
Form linkages between communities, institutions and local government for early warning dissemination and relief protocols	<ul style="list-style-type: none"> ▲ Links with meteorological, seismographic, gauging or other institutes that could provide early warning information and local government or police/emergency services. ▲ Early warning systems need to be in place, tested and maintained; messages must be in an understandable/accessible channel, radio communication, etc.
Support to local organisations (NGOs, local/district authorities) in emergency preparations and hazard assessments	<ul style="list-style-type: none"> ▲ Assess the organisation's preparedness requirements and develop a disaster preparedness plan, based on the known or likely hazards. ▲ Regular re-assessments and re-planning are required to keep the plan up to date. ▲ Preparation activities may include training of management and staff, provision/ repair of material/equipment (e.g. water trucks, central water supply points, etc.).
Pre-positioning of preparedness items and/or provision of preparedness items to households	<ul style="list-style-type: none"> ▲ Preparedness items need to be distributed, or be put ready for distribution, at a safe location, at specific times of the year near areas prone to natural disasters. ▲ When preparedness items are provided, these need to be accompanied by information and/or training on how to use them.
Distribution of watsan items to households	<ul style="list-style-type: none"> ▲ Examples: water containers/packs, chlorine solutions, ORS, water filters, cookers, soap, sanitary pads, culturally suitable anal cleaning material, toothpaste, etc. ▲ Provide on the basis of assessed and anticipated needs prior to disaster season.
Provision of preparedness items to communities or institutions	<ul style="list-style-type: none"> ▲ Examples of watsan related items: fuel, lubricants, spare parts, pumps, generators. ▲ Other items: emergency shelters and rescue boats (train people on their use). ▲ Avoid items that may cause conflict, or are prone to misuse, corruption or stealing.
Development of water and sanitation facilities in refuge areas	<ul style="list-style-type: none"> ▲ Watsan facilities in so-called safe havens may need to be developed, e.g. hand pumps and toilet facilities on easily accessible high grounds in flood prone areas.
Community training	<ul style="list-style-type: none"> ▲ Focus on recognising warning signs and taking timely precautions. ▲ Individuals are encouraged to save dry food, fuel and cash for an emergency.
Demonstration of mitigation works	<ul style="list-style-type: none"> ▲ Mitigation works may include raising boreholes/latrines, or deepening of boreholes; demonstration works require measures for follow-up to ensure replication.

WATER AND SANITATION DISASTER PREPAREDNESS INTERVENTIONS

Typical response interventions – mitigation

General	▲ Reinforce, protect and locate buildings used by water and sanitation institutions and system components.
	▲ Make use of good quality building materials and good workmanship during the construction of watsan infrastructure.
	▲ Provide standby generators to watsan institutions, in case power plants fail; construct all-weather access roads to essential water and sanitation infrastructures.
	▲ Carefully locate watsan infrastructure in less disaster-prone areas and away from potential hazards (trees, utility poles etc.).
	▲ Introduce radio communication equipment, or mobile phones during known disaster seasons (if appropriate).
Water and Environmental Sanitation	Measures specific for flood prone areas <ul style="list-style-type: none"> ▲ Select sources in watersheds least prone to flooding and protect watersheds and sources (e.g. through local re-forestation or terracing). ▲ Construct improved foundations, water retention structures, riprap to riverbanks, and stronger concrete and masonry in spring protections, infiltration galleries, intakes, etc. ▲ Create overflow systems to avoid over-topping of dams and water retention structures. ▲ Dredge rivers and canals to avoid rapid run-off. ▲ Build watsan facilities on raised platforms and/or protect them by dykes, walls, etc. ▲ Install stronger, better-anchored and entrenched sewage, water and drainage pipes and use flexible joints.
	Measures specific for hurricane prone areas <ul style="list-style-type: none"> ▲ Protect watersheds: prevent deforestation, reforest and execute contour ploughing. ▲ Keep water source sites clear of loose debris. ▲ Reinforce above ground watsan infrastructure (especially where pipelines cross rivers, elevated and ground-level water tanks, etc.). ▲ Cover collection boxes and (channels of) spring protections with protective slabs. ▲ Implement stronger foundations, wider and stronger dams (improved screens and parapet walls), riprap to riverbanks, stronger concrete and masonry construction. ▲ Improve drainage near spring protections, infiltration galleries, intakes, treatment plants. ▲ Entrench main pipelines and sewers, reduce the number of river crossings, fix mains at downstream sides of bridges, promote and execute vegetation for slope stabilisation. ▲ Install wood sheeting or gabion baskets along the bank of infiltration galleries creating sedimentation areas as a protection during periods of heavy rains. ▲ Construction of strong roofs at pump houses and other roofed watsan infrastructure. ▲ For river intakes: installation of stop-locks upstream and installation of intake of sediment tank several feet upstream of weir. ▲ Raise infrastructure that can be flooded due to heavy rains and place flood walls or dikes. ▲ Construct wave protected embankments at dams and river intakes. ▲ Reduce the height of watsan structures where possible. If high water tanks cannot be avoided, fill them with water and close valves (install valves if necessary) during periods of high winds.
	Measures specific for earthquake prone areas <ul style="list-style-type: none"> ▲ Protect watersheds: prevent deforestation and promote and execute reforestation. ▲ Use flexible joints in pipe and sewer connections, adequate pipe material and wall crossings. ▲ Storage reservoirs should be as low as possible. ▲ Include sheet piling, extended wing walls and flexible joints in intakes and dams. Additionally for dams: sloping banks below and above water line, parapet walls. ▲ Ensure that foundations of watsan structures are well-tied together, and the walls securely fixed to the foundations and roof (where appropriate), using adequate braces. Study buildings and structures that have survived previous earthquakes. ▲ Boreholes: stronger casings + wider than usual gravel pack with slightly larger diameter gravels.
	Measures specific for volcanic areas <ul style="list-style-type: none"> ▲ Careful select watersheds used for supply of drinking water systems. ▲ Use of appropriate pipe materials and flexible joints; anti-rust measures may be required to prevent water pollution and protect pipes from the effects of volcanic ash. ▲ Design and construct above ground watsan infrastructure (e.g. tanks) to withstand ash loads. ▲ Take fire prevention measures in watsan structures and in the areas around them. ▲ Provide adequate water storage and water-piping capacity for fire-fighting.
	Measures specific for landslide prone areas <ul style="list-style-type: none"> ▲ Protect watersheds: prevent deforestation and actively promote and execute reforestation. ▲ Protect and stabilise sloping areas through planting of vegetation and other measures. ▲ Use suitable pipeline materials (e.g. strongly anchored GI at parts subject to land slide or slip). ▲ Pipelines should follow the topography. ▲ Strong reinforcement, entrenchment and anchoring of structures that cross or are located in landslide prone areas, including slope stabilisation measures, planting of vegetation etc.



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