

# THE IMPORTANCE OF WATER SAFETY AND SANITATION SYSTEMS PLANS IN FLOOD VULNERABLE RURAL COMMUNITIES

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**Abstract:** In the current context of climate change, it is considered that they will affect the distribution, duration and intensity of meteorological events, thus affecting the quality and quantity of water resources or infrastructure needed to provide safe water supply and sewerage services. The provision of safe drinking water is one of the most important public health requirements in most emergencies. As well as maintaining proper hygiene. This material is a synthesis of numerous studies in the field and aims to provide useful information on the actions that people should take in the event of a flood event. Communities are encouraged to develop customized water safety and sanitation plans for this type of event.

**Keywords:** floods, climate change, PSASS, rural communities

## 1. INTRODUCTION

Overall, in Europe, in the last 50 years, extreme rainfall such as torrential rains has become more intense and floods are the first problems facing the population.

The production of floods is closely related to the climatic characteristics, the morphological and hydrological characteristics of the river basin, but also to the anthropic interventions within the river basin. The degree of risk involved for the population is constantly increasing, especially due to the human factor.

IPCC (Intergovernmental Panel on Climate Change) defines climate change as a complex process of changing the characteristics of climate elements (temperature, precipitation, increasing frequency and intensity of meteorological phenomena) over long periods of time, over large areas due to natural changes or as a result of anthropogenic activity [1].

According to the IPCC, recorded data and climate projections provide clear evidence of the vulnerability of water resources and their dependence on climate change, with strong consequences for human society and ecosystems [1]. This information is intended to emphasize the importance of a well-organized structure, which takes into account both water and sanitation safety plans (hereinafter PSASS) in the event of extreme events, such as floods or droughts, and their

mitigation actions. At the same time, other natural hazards such as earthquakes, landslides, etc. should not be neglected.

In accordance with Directive 2007/60 / EC on the assessment and management of flood risk, floods are temporary water cover of land that is not normally covered by water. It includes floods caused by rivers, mountain streams, intermittent Mediterranean streams and floods caused by the sea in coastal areas and does not include floods caused by sewerage systems [2].

Different types of floods present different forms and degrees of danger to society, property and the environment, depending on the duration, speed, volume of water and other associated hazards.

As extreme hydrological phenomena, floods can affect many aspects of human life due to their destructive effects and the substantial costs required to mitigate them. In this sense, it is essential to identify floodable areas and classify vulnerability to floods (high, moderate or low probability of occurrence).

Communities need to be informed about their vulnerability to floods, and it is imperative to accept the risk involved and learn how to live with floods.

The social effects of floods can consist of loss of life, illness, poisoning or disruption of basic services or utilities (such as water supply, gas, electricity) resulting in disruption of life in affected communities. Depending on the situation, water sources can be contaminated (bacteria, due to the sewerage system, agricultural or chemical waste) and if proper protection measures are not taken, various waterborne diseases can result and epidemics can break out.

## 2. METHODS AND MATERIALS

This material is addressed to all stakeholders, providing useful information on the actions they should take in the event of floods to reduce their negative social effects. The article is a synthesis of the most important materials in the field, developed by WHO, UNICEF and other organizations that aim to promote access to safe water and hygiene during floods.

The main topics covered are water supply to rural

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communities and ensuring hygiene conditions at various stages of such an event.

### 3. PSASS IN CASE OF FLOODS

In order to deal with flood hazards, it is necessary for decision makers and society to take an effective approach to flood management. Thus, the aim will be to identify the best solutions for the community (e.g. territorial development / planning, measures in case of emergency, increasing the level of information of the population on the appropriate behavior in case of floods, etc.).

Ensuring sufficient quantities of drinking water and minimum hygiene conditions must be a priority in the management of flood situations (both in the pre-event stage and as well as during and in the recovery phase).

The Vision 2030 study conducted by WHO (World Health Organization) in collaboration with DFID (Department for International Development) assesses how climate change will affect the medium-term drinking water supply systems and the steps to improve / upgrading existing systems. The need to integrate drinking water and sanitation issues into integrated water resources management is also highlighted [3].

In rural areas, centralized water supply systems do not permanently cover the entire locality or provide only through street wells, and the sewerage system usually does not exist. Most houses have wells dug or drilled at shallow depths. They are extremely vulnerable to flood pollution. It should be noted that in such situations and power supply can be disrupted for a longer period of time. The damages produced in Timiș County in 2005 by the surrender of the Timiș River dams were enormous, figures 1a and 1b [7].



**Figure 1b.** Flooded street in Foeni commune, Timiș County

Effective integration of emergency preparedness planning is therefore necessary, as is the implementation of the established plan. The plans must be consistent with the different types of floods and their impact on the population, respectively. The effects of flooding could last from a few days to a few months, so it will be different for each situation. Stage intervention may be required (immediately after the flood, short-term to medium-term actions or long-term actions).

After a flood event, it is important for people to have access to water in sufficient quantity and quality (for example, drinking water quality requirements are more demanding than those for washing, cooking or cleaning water). The main parameters to be considered for water supply are pH, turbidity, level of fecal contamination, water salinity [4].



**Figure 1a.** Flooded street in Otelec commune, Timiș County

#### 3.1. WATER SUPPLY

Floods can affect all elements of a water supply system: from the water source (river basin and aquifer) to the capture, treatment and distribution of water, as well as managing the demand and use of water on premises. Water supply systems must always meet safety requirements.

Table 1 Minimum water quality and quantity requirements according to [4]

Parameter	Drinking water quality requirements
pH	between 6.8 and 7.2 - to allow efficient chlorination
Turbidity	<5NTU - not to exceed 5 NTU before chlorination or 20 NTU before use of sand filters
Level of fecal contamination	Number of thermotolerant coliform bacteria / 100 ml = 0
Salinity	< 1000 mg/l (TDS = Total Dissolved Solids) or 1300 $\mu$ S/cm (WHO)

It is recommended to ensure a minimum of 15 liters of water / person / day for drinking, washing, cooking, sheltering animals and for other purposes (7.5 l / person / day being the minimum necessary for survival).

A common practice of water supply to rural communities affected by floods, immediately after such an event, is the supply of drinking water with the help of cisterns (which must be clean). Even if it is not a sustainable method, it is considered to be a quick way to ensure a minimum of water needed by the population, in safe conditions. To this end, strategic locations (such as dispensaries, shelters or any other space with a high concentration of people) must be identified and known, thus facilitating access to water

and distributed emergency kits to support flood-affected communities [4].

Distribution of bottled water is another immediate option to provide safe drinking water for survival in the early stages of an emergency, figure 2.



**Figure 2.** Distribution of bottled water by authorities

In many rural communities, deep wells or boreholes are the main sources of water supply. In case of floods it is mandatory to check the water quality, and any (possible) source of contamination must be removed.

For the correct disinfection of the wells, it is recommended to rehabilitate and recondition them beforehand, followed by complete emptying, cleaning them and subsequent disinfection of the water. For this purpose, chlorogenic substances or disinfectants that have a sanitary approval for use for this purpose will be used, such as: lime chloride, sodium hypochlorite, chloramine, etc.

At the household level there are various ways to obtain safe drinking water, namely by chemical disinfection, boiling, chlorination or the use of ceramic filters or sand filters. It should be noted that the water whose quality was affected by the floods can NOT be used for brushing teeth, washing hands, washing food and preparing food, washing dishes, etc. It is necessary to periodically analyze the water by the responsible factors to ensure that the population performs water treatment properly. Household water treatment must be continued until local authorities announce that the water is safe for consumption again [4; 5].

If there is no simple and quick way to remove a dangerous contaminant, to avoid unnecessary water treatment, it is recommended to look for another source of water supply [4].

As important as safe water supply is the avoidance of water contamination with pathogens during its collection, storage and consumption.

In some areas, the population may be totally dependent on centralized water supply systems, and a failure (partial or total) of the system during a flood affects citizens. In this case, it may be necessary to install mobile water treatment plants to replace the existing systems until they are operational again.

Such a mobile water purification unit by microfiltration is presented in figure 3 and operates within the Department of Hydrotechnical Engineering of the Politehnica University Timișoara.



**Figure 3.** Water purification unit by microfiltration, UPT, Department of Hydrotechnical Engineering

Another important aspect of ensuring safe water after floods is the identification of a local source of water, groundwater, rainwater or surface water. Aquifers are usually the safest sources of water, but even in this case, before using them it is essential to check if any source of contamination has been removed.

### 3.2. ENSURING THE PROPER HYGIENE

Water supply systems, wastewater disposal systems, and sanitation systems, and public health, are absolutely interconnected - an aspect often neglected or even unknown, especially in rural communities. Health protection is always one of the major concerns in emergencies. A particularly important role in this regard is played by the promotion of population hygiene in such situations. Key activities include:

- Proper use and maintenance of water supply installations and sanitary facilities;
- Proper hand washing during critical periods;
- Control of vectors for transmission of hydric diseases, respectively disease transmission;
- Solid waste management, including their storage;
- Wastewater management;
- Cleaning of flooded houses [6].

Adequate drainage at wastewater collection points is required to eliminate the risk of transmission of pathogens or reproduction of vectors of transmission of waterborne diseases. Vectors (mosquitoes, flies, rats and mice, cockroaches, ticks, fleas, lice or mites) can carry parasites from one host to another. If intervention is required, control of the vector should take place as soon as possible. At the same time, people need to have the knowledge and means to protect themselves from waterborne diseases or vectors that can transmit those diseases.

Of particular importance is the proper disposal of fecal materials and other solid waste, the speed of reaction being essential. It is forbidden to use water

from boreholes or wells in the immediate vicinity of latrines to prevent possible illness. If it is demonstrated that the water is polluted and decontamination is difficult, alternative sources of water supply / supply must be considered.

#### 4. CONCLUSIONS

Floods endanger the water supply of communities, with the danger of pollution of the water source or damage to its treatment and distribution facilities. Floods can also make it difficult to maintain proper hygiene, which can cause various diseases.

The purpose of an extended PSASS for floodable areas (PSASS-floods) is to include in water risk management the impact of climate change on water resources. This can reduce the incidence of waterborne diseases and, why not, even deaths.

It is necessary to develop materials that promote water safety plans and sanitation in case of floods to educate the population in rural areas, be they local authorities, ordinary citizens or children. Equally

important is the development of PSASSs for other emergencies, such as droughts, earthquakes or any other hazard that may pose a risk to the community.

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