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WATER, SANITATION AND HYGIENE: CHALLENGES OF THE MILLENNIUM

Disaster management: water in and out

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DIFFERENT FROM USUAL development situations, during the first phase of a catastrophe or complex crisis, the approach to help people with water and sanitation has to be based on established routines and proper preparedness structures. Often, some highly sensitive issues cannot be taken into account in the same way as really desired, because of shortage of time and the need of immediate actions. Proper planning and a well established preparedness, however, reduces the impact of neglecting cultural understanding and sustainability perspective from the beginning (Koestler & Ommundsen 1998).

In a crisis situation, when a lot of people are on the move, water and sanitation issues become immediately a pressing issue with very strong time constrains both in terms of water needs for living and sanitation issues to reduce spreading of diseases. The focus on water supply and sanitation is what we call "water in and out" of a given situation. The water and sanitation experience from many different situations such as the Kosovo crisis (1999), the Turkey earthquake (1999), the Mozambique floods (2000), the Rwanda returnees (1996 onwards), etc. forces us to think in wider terms then what only relates to technical implementations and solutions. It seems that preparedness has to focus on disaster management with pre-established management structures covering the whole water sector, of which the sanitation becomes the crucial one.

Preparedness means having done the major work and thinking before it is needed. So, the following steps should be an integrated part of any preparedness scheme:

Observing and assessing at different scales
Focus on determinism in chaotic situations
Balancing different aspects to achieve equilibrium

Why is geology a key to disaster management?

Geology is the science of natural dynamic systems both in space and time. As the observer wandering through the desert or through the rain forest, I am listening to the infinite history of the earth condensed in this single moment of being. It is the training of perception we got during our studies, our travelling and our fieldwork around the world. A catastrophe is the immediate change of a dynamically grown environment and its impact on the human living situation. While observing and trying to perceive the different dimensions in space, history, culture and human needs, we elaborate the understanding to creatively find solutions for the disaster mitigation. Within this process of assessing such a chaotic situation, there are mainly three concepts to be followed.

Scaling: while taking care of a single refugee family, we cannot loose track of the overall solution in taking care of hundreds. While planning a refugee camp for 50 000 people, we cannot forget the human solution for a single individual. Scaling as learnt from geology to understand the formation of the Himalayan mountains based on looking at minor folds and faults in an outcrop. Scaling as visualizing the universe in a single sand grain.

Deterministic chaos: a refugee camp developing from bare ground and increasing in size from a few thousands to 40 000 within a few days, has something of a chaotic behaviour. However, learnt from the latest mathematics on fractals and chaos systems (e.g. J. Gleick 1987), we can apply the understanding that natural chaos has a deterministic structure. Processes of growth, of distribution, of water supply and water collection can be structurized from the beginning while still be part of the chaos.

Balancing to achieve equilibrium: in many geological processes, balance (mass balance, volume balance, gravitation, etc.) is the key in formulating and handling processes in a predictive way. Groundwater models are based on calculations about the volume of fluid into the system, kept in the system and released from the system. The system has to answer the request of equilibrium either in time or space, or both. For specific time periods, a system can be out of balance, typically a catastrophic situation, but the system will attempt to reach the state of equilibrium as soon as possible.

Based on these three concepts, we can develop a way to approach the often-difficult situations in complex emergencies and in natural disasters. Especially, focussing on the water and sanitation sector, and including all aspects of basic infrastructures, these concepts help to find creative solutions, which supportively fulfil the response on human needs.

SCALING

As indicated above, the fast shifting of view point during the establishment of water and sanitation installations in a refugee camp or a disaster hit area, helps to find creative solutions both in negotiations with local and national authorities and for concrete technical solutions (Fig. 1). In addition, aspects of an overall importance are better kept in focus. To illustrate this approach, I refer to the establishment of the Cegrane refugee camp in Macedonia in late

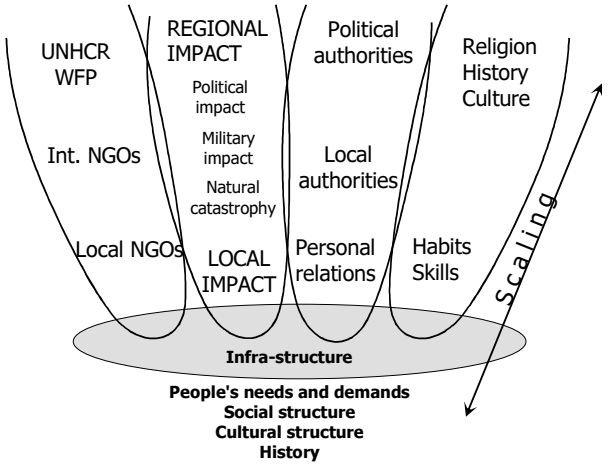

Fig. 1 Impact onto the infra-structure from different levels of a complex network. Scaling means to observe and investigate the impact at all levels while having the focus on the human issues.

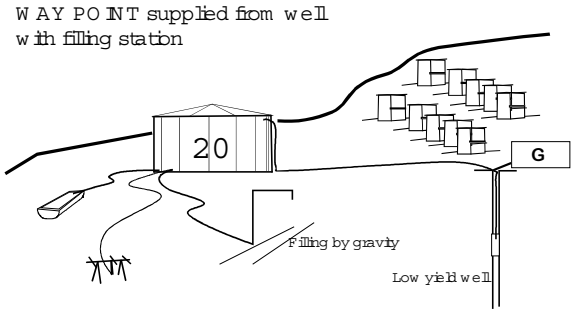

Fig. 2 Pre-defined solutions for different scenarios help to be prepared for chaotic situations and bring structures into planning, discussions and technical solutions.

spring 1999. During the Kosovo crisis, 100 thousands of Albanians were forced to move into Albania and Macedonia. Within very short time the first refugee camps were overfilled and new sites had to be found. One such new site was above the village of Cegrane on a gently dipping fluvial delta. The camp had to grow so fast (by 7000 people per night), that is was difficult to establish enough water and sanitation installations always fulfilling the minimum standard. For many days, there were more then hundred persons per latrine hole and water supply was close to five litres per person per day. The locality chosen for the camp implied some very specific conditions on the camp establishment at every scale. The ground water was very shallow below the camp and was the main source for drinking water in the village below (Fig. 3). The fluvial delta has a huge transmissibility for water, so that sewage would have easily entered the ground water after a very short period. Because of that, totally closed systems for all latrines had to be developed. Latrine blocks with 8 to 12 holes were constructed on specially welded containers, which were dig into the loose soil and gravel. Sewage was removed with vacuum trucks to avoid impact by overflow and infiltration within the camp. While the amount of water supply increased, spill water from washing and showering also heavily increased. This grey-water had to be collected also to avoid infiltration into the ground. A collection system was established to collect as much as possible of the grey-water for later transport to the nearby river.

While struggling with finding local solutions, the environmental impact had to be monitored at a larger scale. A few wells were drilled just above the village to monitor the ground water for later argumentation on water quality changes. Due to the fact that the control-wells were drilled within the first few days of the camp, it could be shown that the groundwater was already polluted and that the existence of the camp did not change the water quality.

Scaling is also the key to communication. During the work in the refugee camps both in Albania, Macedonia and earlier in Tanzania, communication has linked the individual needs to the overall organisation and administrations including

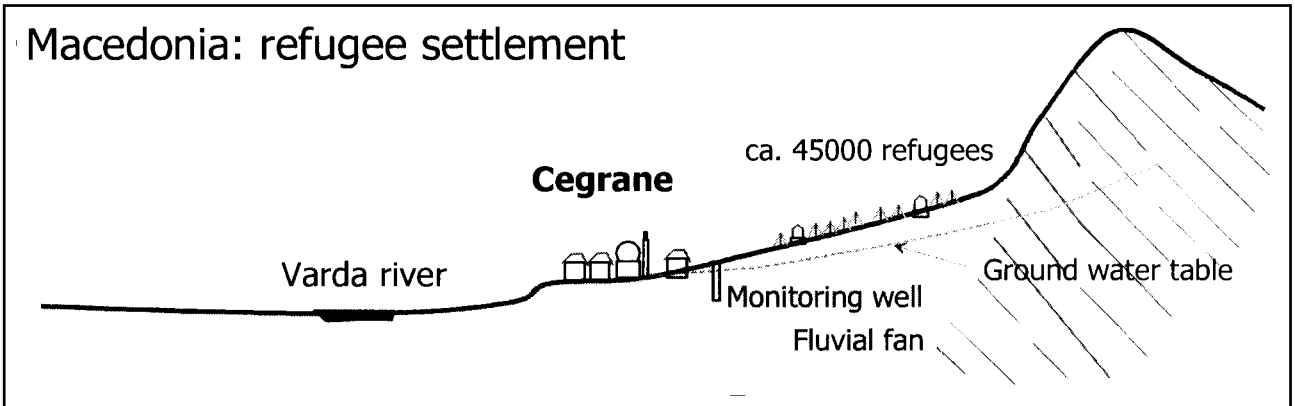

Fig. 3 Geological cross-section through the area of Cegrane, Macedonia, showing the critical localization of the refugee settlement above the village on the groundwater reservoir in the fluvial fan.

political planning and guiding. Communication is vital in finding the local potential and the individual skills to initiate a rebuilding process (e.g. Frost 1999).

DETERMINISTIC CHAOS

Although knowing that it is the character of catastrophes that the result is chaotic, we try to learn from each experience by careful analysis what are the deterministic aspects and the sound solutions for the water and sanitation sector for different scenarios. The flood in Mozambique and the earthquake in Turkey thought us many lessons on flood-specific and earthquake specific situations. Learning from the work of others, from experience made and exchanged at conferences, gives us a tool to make the chaos more deterministic.

As experienced during the earthquake in Turkey in August 1999, such huge natural catastrophes result in a highly chaotic situation. Not only the assessment on the human suffering and concrete needs is a difficult and immense task, but the understanding and coordinating of the political and organisational behaviour almost let you loose the hope to make an immediate impact for the people. The inter-organisational issues are often poorly coordinated and poorly trained in before hand.

It became soon evident that important water structures were cut, both water supply and sewage systems, which is very natural after earthquakes. Especially in the very heavily destroyed centres, repair of infrastructure takes far too long time, therefore, a fully new system for both water supply and sewage had to be installed at the centres with huge people accumulations. Long distance piping with flexible systems, water treatment from local rivers and lakes, building of latrine complexes with sewage collection are vital elements in a quick response.

Proper preparedness through training of staff and establishing of working structures including predefinition of equipment (e.g. Fig. 2) is the only way to bring some determinism into the chaos of disasters. While improving the preparedness we deliberate time and effort to focus on the human needs.

BALANCE – EQUILIBRIUM

Geologists are working with equilibriums in nature: equilibrium in gravity forces (i.e. slides, ground water flow), equilibrium in earth stresses (earthquakes), equilibrium in chemical reactions. The same focus should be part of our planning and thinking when dealing with human suffering in disasters. Family reunion is part of working with achieving a balance, moving people back to their homes, etc. etc. For the water and sanitation systems to be established, we have to handle the water, which enters the system of a refugee camp or highly populated area, and the water which has to be removed. If too much water is distributed for drinking, washing, showering, we have to construct systems also to handle the spill and rest water. Dramatically visualized in the Cegrane camp, when the closed latrine containers could not absorb the immense amount of rain water during a thunder storm, before the drainage system was fully established. Often, people from a nearby village can give important information on very local weather conditions in terms of droughts, heavy rain falls, snow accumulations, etc. During planning and implementation, balancing unexpected weather conditions become a natural part of water and sanitation engineering.

Water and sanitation is always deeply linked to cultural costumes, historical traditions and an understandable reluctance of changing habits. Also in these more personal and human aspects, a carefully handled approach with focussing mainly on the respect for the community in danger and suffering will balance between an immediate action and cooperative investment. Bringing the skills of the involved people in action and making them to an important part of the disaster response, will make the impact to a longer lasting one, will make it more sustainable. Sustainability is the effort to achieve dynamic equilibrium.

WATER IN AND OUT

From the planning to the implementation of technical solutions, we try to focus on the geological principles scaling, deterministic chaos and balance. While applying mathematical and philosophical concepts established in natural science, we gain a better overview, feel better prepared to assess and to handle the human problems in disasters and complex emergencies. Focussing on the water and sanitation sector, a balance has to be achieved between water which is given into the system and water which has to be removed from the system. It is the environmental entity which has to be kept in mind when planning for both a short and a long term solution. Examples from the Kosovo crisis, from the Turkey earthquake, from the floods in Mozambique have shown that immediate solutions had to be seen in the longer term perspective, because the duration of temporary installations might be very short in term of the overall situation, but permanent enough in a environmental perspective to have a severe impact.

References:

FROST, A.J. 1999: After the rain. African lessons for leaders and organisations. Knowledge Resources. Randburg SA.

GLEICK J. 1987: Chaos – Making a new Science. Viking, New York.

KOESTLER A.G. & OMMUNDSEN, G.H. 1998: Long-term perspectives in emergencies: sanitation and water. 24th WEDC Conference Islamabad 1998.

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