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MAXIMIZING THE BENEFITS FROM WATER AND ENVIRONMENTAL SANITATION

Ultra-rapid well construction: Sustainability of a semi-household level, post-emergency intervention

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After cyclone Gafilo hit Madagascar in March 2004, an emergency relief project was implemented by an international NGO in the flood-hit region around the town of Maroantsetra. With wind speeds of over 300 kilometres per hour, whole villages had been destroyed, forests uprooted, bridges swept away and crops damaged. A deluge of rainfall caused massive flooding and most water sources became heavily contaminated with faecal matter. Immediately, several (household level) emergency actions were undertaken. To mitigate against future contamination of open water sources, a permanent solution was pioneered through the very rapid construction of more than 200 new wells equipped with hand pumps, making use of an innovative well jetting technique. Thanks to its potential to rapidly reach large numbers of people in an affordable manner, jetting is now being integrated in ongoing development project.

Emergency response

After cyclone Gafilo hit Madagascar in March 2004, an emergency relief project was implemented by an international NGO in the flood-hit region around the town of Maroantsetra. In the flooded areas, rapid action was called for to avoid an epidemic because of the cross contamination between flooded latrines, open ground defecation and the many open wells. By helicopter, thousands bottles of Sûr'Eau chlorine solution were dropped near inundated villages that could not be reached otherwise[1]. Afraid to abandon their houses to thieves, people continued to literally live in the floods, drinking the contaminated water from the floods. Follow up visits by boat and the use of radio messages ensured that people knew how to use the product properly.

In the town of Maroantsetra itself water receded quite rapidly. A team immediately implemented an open well disinfection campaign. In just over a week, some 1,400 private and public wells were disinfected using chlorine solution. However, during this time it became clear that most wells were very poorly constructed. Many were little more than dug-in rusty barrels and few had a head wall high enough to prevent floodwater entering. It was obvious that even under normal circumstances the water in these wells was highly susceptible to contamination: improvement was urgent.

Mitigation: bio-sand filtration in town

In town, the immediate emergency phase was quickly over and it was time to think about mitigation: actions that would minimize the impact of future cyclones and flooding[2]. Initially, Emergency Response NGO Medair decided to rehabilitate and improve a number of open public wells in town. This was done through local contractors, who repaired the wells, cast proper drainage platforms and flood-proofed the wells by raising the head wall above average flood levels. However, this could only serve relatively few people, given the high number of private wells in the town.

To address this, the NGO introduced household-level bio-sand filters[3]. Complete training was done to cover all aspects for a successful business – from construction and

Box 1. Jetting explained

Jetting is a rapid method for well construction that works by flushing a well screen into a shallow aquifer. In this instance, a PVC pipe fitted with a well screen consisting of a non-return valve and a length of perforated drainage pipe wrapped in geo-textile, is connected to a small motor pump. The jet of water from the end of the screen fluidizes the sandy soil and the pipe can be easily pushed down. In Madagascar, between 500 – 1000 litres of water are needed to jet a well up to 4 meters below the water table. The amount needed can be minimised by starting to jet at the bottom of a hole dug down to the water table.

Once the screen has reached the desired depth (ideally at least 2 metres below the water table), the permeability of the well is increased by gradually reducing the flow from the pump while sometimes also pouring a coarser mix of sand down the hole. The upward flow of water continues to carry fine particles to the surface, but the larger grains sink against the flow and settle around the well screen, thus forming a gravel pack. The well is then finished in a normal manner.

In practice, jetting is limited to a depth of about 8 metres and works well in unconsolidated alluvial sediments and coastal regions where the ground is sandy. BushProof staff has obtained excellent results in recent emergencies, including Sudan (Darfur), Sri Lanka (tsunami) and Madagascar, where 200 new wells equipped with Canzee hand pumps were produced at a maximum rate of 50 per week. However, the technique is equally suitable for development situations.

Photograph 1. It only takes about 2 minutes to jet a well screen 4 - 5 meters into the aquifer

maintenance, to promotion and business planning. Although slow, there is a clear demand for the bio-sand filter from both within the town and the surrounding rural communities. The filters are sold at a 30% profit making it a sustainable part time business. These micro-enterprises have continued to produce and sell filters since the NGO left. On the other side of the island the same NGO sold more than 600 filters to cyclone victims. This reinforced the fact that it is possible to create sustained demand for the filters even in a post-emergency setting. The higher number of filters sold was probably due to a much stronger NGO presence in this area. In both cases however, it is recommended to create a partnership with a dedicated developmental partner to continue support with marketing and quality control after the emergency NGO pulls out.

Mitigation: Well jetting in villages

While the town dried up within some days, many villages remained inundated for weeks. Once the water receded it became clear that the 'normal' drinking water situation was much worse than in town. Hand dug wells of any kind were virtually non-existent and many people took their water directly from rivers, ponds or rice fields. Nobody used latrines: open defecation was practised, ironically often near traditional water sources.

BushProof therefore developed a radical concept which would serve their long-term water needs while making use of available short-term emergency funding: extremely rapid well construction at semi-household level. Using the expertise of SWS Filtration Ltd, techniques were adapted for well jetting, a well-known but little used method of well construction. As a result, over 200 wells were constructed within 3 months – sometimes at a rate of 50 per week. Due to the very low cost of jetted water points, a high density of pumps per head of population could be achieved. This allowed the project to work at *semi-household level*, by constructing one well for every family/neighbour group, made up of 5 - 10 neighbouring households clustered closely together. Several reasons were important in the decision to work on household level: improved ownership and sustainability, longer lifespan of the pump (less intensive use), convenience and the health benefits of having larger quantities of water close at home.

Choice of pump

Each well was equipped with a Canzee hand pump to ensure a high standard of water quality[5]. The choice for this pump was based on its ingenious simplicity: it has no conventional piston or seals. The pump contains no significantly wearing parts and needs no maintenance. The few parts that can eventually break down are very easily repaired, using parts that can be made by the pump users themselves. Ideal for installation on shallow wells, the Canzee is robustly constructed and lifts water from at least 10 meters. In Madagascar, the Canzee is the only available low-lift hand pump that can be installed on jetted wells[6].

Community participation process

Despite a very fast approach in a post-emergency setting, the project contained significant beneficiary participation. The sequence of events started with FM radio announcements and letters to the village authorities, providing global information

Photograph 2. The pump is installed by the well users themselves

on the project. This was followed rapidly by a visit of a team of socio-organisers. During a village meeting, they explained the project opportunity in detail and what would be required in terms of participation. This discussion was immediately followed by the construction of a sample well. This gave the villagers the opportunity to see the jetting process and actually try out the well and hand pump on offer.

Based on the number of wells available per village (1 well for 100 people) the villagers were encouraged to join up with their neighbours and form well user groups. This automatically ensured the formation of strong groups made up of people that actually got along with each other. Each group then submitted an official request for a well during a final village meeting. Here, a large village map was drawn on the ground. The map showed major paths, rivers and houses. A representative from each prospective well user group then came forward and placed a mark (coconut shell or piece if wood) on the map, to indicate where they wanted a new well built. These requests were then compared with the actual number available to the village. If there was a difference, the villagers discussed among themselves which groups were close enough to share one water point between them. This continued until an agreement was reached that both the village and the project were happy with. This discussion process was particularly valuable for increasing the ownership and value placed on each pump.

Obscure arrangements…?

At the end of the meeting an agreement was signed between the NGO and the local authorities. This confirmed the number of pumps available to the village, their locations and outlined the responsibilities of the villagers. These included the collection of gravel, sand and clay (for grouting the well pipe). In terms of labour, the villages provided two people per well to help build the concrete pump foundation. Furthermore, they also dug a 1000 litre reservoir lined with a tarpaulin and filled it with the water needed to jet. Finally, they dug a second hole down to the water table at the exact site of the new well (usually between 1 and 4 meters deep). A clear deadline was set by which the sand, gravel and hole was to be completed: however, often the whole process from first contact to the start of construction lasted no more than 1 week.

While construction of the wells was going on, each well user group nominated 2 members for a village water committee. These people were directly involved with the well construction and pump installation. A basic training course was given in how the pump worked, during which the committee members actually installed their own pump themselves, including gluing the joints, cutting rubber replacement discs for the valves, and the final installation. This increased the sense of ownership and provided a deeper understanding on how the pump worked.

The open process also provided absolute transparency between the stakeholders. In one village, the local mayor approached the project staff and asked for a well near his house. This request could be politely rejected because the whole community had already agreed on the well locations. There was no room 'on the side' for obscure arrangements!

Mistrust towards NGOs

Before the project gained momentum, it became apparent that there was a lot of mistrust from the side of villagers towards NGOs. Often they doubted that promises made would result in concrete benefits. As a result, their motivation to provide participation was initially very low. This was a problem, because project funding would be available for a few months only. The NGO therefore decided to place 'organisers' in each village for one full week prior to the start of construction. By simply observing a dedicated NGO presence in the village, the people were inspired with the trust needed to complete the agreed participation. On arrival, the organisers would often find no more than 20% of sand and gravel prepared. However, within 24 hours of their presence this usually increased to more than 80%. This illustrated that poor participation was not due to the lack of motivation, but a disbelief that the project would be realised as promised. Most likely, this was based on negative experiences with other NGOs that often conduct endless participatory meetings, create village groups and gather baseline data, without following up quickly with concrete action.

Due to the speedy process adopted by this project – whereby all wells were constructed within 3 months – the aid organisation quickly earned the nickname 'NGO No Blabla', which was taken as quite a compliment. It showed also that quality participatory processes do not necessarily have to take a lot of time.

Photograph 3. A life saved? If conditions are right, jetting will provide safe water faster and more affordably than other techniques

Long-term sustainability

The project proved very successful. Within 3 months only, 204 new wells were installed in numerous villages. The extreme rapidity of the project, the deceptive simplicity of constructing jetted wells and the user-friendliness of the Canzee hand pump made headlines in Madagascar. The project was visited by many people, including top government officials, donors and other NGOs. Because of the surprising cost-efficiency of the project, other NGOs have now contracted BushProof for the installation of jetted wells in their project areas as part of an ongoing developmental project. The fact that the same budget is likely to produce 3-10 times more wells than using more conventional well construction techniques, makes jetting an attractive option. At the same time, such NGOs have more time available to work with the communities.

To facilitate for even better savings and to cater for growing demand, BushProof is now involved in setting up production of the Canzee pump in Madagascar. This will lower the cost even further, making affordable, household-level hand pumps widely available in the country. This will also make it much easier to obtain replacement pumps, further increasing the sustainability of jetted wells.

Potential for scaling up

In conclusion, jetting and Canzee pumps have proved to be a successful and very cost-efficient mitigation action, and the technique has become integrated in the national water sector with hundreds of additional wells under construction. The cost of a completed water point (inclusive of apron and Canzee hand pump) averages between 600 and 800 Euros, depending on the numbers constructed and accessibility of the project area. It takes no more than 2 working days for a team of locally recruited jetters, masons and pump installation teams to complete a well, but this time is spread over several days due to the need to let the concrete slab cure. Using several teams, it is entirely feasible to construct between 5 and 10 wells every day over longer periods of time.

Outside Madagascar, BushProof staff was able to gain experience with jetting in other emergencies, such as Darfur (Sudan) and more recently in Sri Lanka after the tsunami, but the potential of the technique is only just emerging. It will be worthwhile to explore in which other regions jetting can be applied, especially in a development setting. In combination with a fast project methodology, it is now possible to provide very large numbers of people with safe drinking water very quickly, even on a household level. This makes it possible to make a significant contribution towards achieving the Millennium Development Goals for Water, at a minimal cost. While the technique is not suited for all areas, in Madagascar alone over one million people could benefit from jetted wells equipped with low-cost pumps.

References

Note/s

1. Sûr'Eau is a Safe Water chlorine solution for household water treatment. It is marketed by PSI and is widely available in Madagascar.
2. Madagascar is very vulnerable to cyclones. Every year, the island is hit by several storms, although not all are of the same magnitude as Gafilo.
3. A wealth of information on bio-sand filtration can be found on www.biosandfilter.org.
4. Medair also introduced bio-sand filters on the west coast in another cyclone-hit area. Here, more than 600 filters were constructed and successfully installed at individual households in a number of villages.
5. The Canzee pump was developed by Richard Cansdale of SWS Filtration Ltd (richard@swsfilt.co.uk). His well jetting expertise has also been invaluable during the initial phase of this project. More information on the Canzee pump is available at www.canzee.com.
6. The NGO Taratra produces a good quality rope-washer pump. However, their workshop is located deep in the bush and pumps are difficult to obtain especially in large numbers. The pump is also more expensive than the Canzee and cannot be installed in the narrow-diameter jetted wells.

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