Guidelines for Implementing WATSAN components in Flood Affected Areas

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WES-Net India
WATER AND ENVIRONMENTAL SANITATION

Guidelines for Implementing WATSAN components in Flood Affected Areas

Natural calamities such as earth quakes, Tsunami, cyclones and floods, apart from causing damages to the lives and properties, affect the water and sanitation services very badly. Damages caused to the water and sanitation services further aggravates the situation in the affected areas. Water and sanitation services, being fundamental and a life saving element to the affected communities, must be restored on an emergency basis. Any delay in ensuring the availability of safe and protected drinking water to the community and lack of sanitary services will trigger epidemics and make the affected communities more vulnerable. This guideline, prepared by the Water and Environmental Sanitation Network (WES-Net India), aims to assist organisations involved in the disaster relief and rehabilitation activities, especially in the flood affected districts in the states of Bihar and Utter Pradesh.

Water and sanitation relief and rehabilitation interventions must aim to;

- Assess the damages thoroughly for selecting appropriate interventions needed
- Undertake immediate relief measures to ensure availability of safe water and sanitary services
- Undertake necessary health and hygiene camps to prevent outbreak of water and sanitation related diseases
- Undertake necessary rehab activities to restore the services as early as possible

Please read on to know some of the key water and sanitation services to be taken up in the relief and rehab phases.

ii) Drinking Water Supply

❑ Assessment:

- ❖ Assess water requirements of the entire community. Ensure a minimum of 15 litres per capita.
- ❖ Visit all the existing drinking water sources to assess the damages thoroughly. List the condition of sources such as:
  - Whether the sources are submerged under water, or completely damaged or contaminated and;
  - Also evaluate whether or not the existing source can be restored immediately to resume the supply.
  - In case, there is no possibility of utilising the existing sources in the affected area, find alternative options through community consultation.

- Once a source is identified for the supply, as an immediate step, use H_2S (Hydrogen Sulphide) vial or any other method to ascertain bacteriological contamination. In case, the indicative test is positive, go for detailed bacteriological analysis in order to decide the type of water treatment needed.
- Later assess other physical, chemical parameters of the water. Use Government water quality laboratories or portable water testing kits for this purposes (refer the list of kits available in India).

Immediate relief measures :

- Filtering and boiling of water before drinking can be done till other options are ready. Organise intensive awareness campaign to educate the community on the ill effects of drinking contaminated water and what practice they need to adopt.
- In case of non availability of good water sources, supply packaged drinking water or water transported from the neighbouring areas through tankers while providing necessary storage facilities, both at community and household levels.
  - 1000 to 5000 litres capacity of syntex tank (HDPE) can be installed at the community level for storage.
  - Ensure at least two containers of 20 to 30 litres capacity are available at every household. In order to avoid water contamination at the time of handling, provide the containers with tap arrangement or provide a ladle for collecting water from the containers.
- Provide Chlorine or Halogen tablets for household level water treatment.
  - Read the specification thoroughly before advocating these tablets.
    - Chlorine tablet
      - On an average each tablet costs around 5 to 10 paise.
      - Refer dosage of chlorine tablets (product dependent). After adding the tablet, leave the water for 20 to 30 minutes and later filter the water with clean cloth.
      - Residual chlorine level should be around 0.2 mg/lit.
      - Please note that excess chlorine is not good for health and therefore advocating right dose is very important.
    - Halozen Tablet
      - On an average each tablet cost around 15 to 20 paise
      - Refer dosage of Halozen tablets (product dependent).
      - Comparatively better quality, but expensive.
    - PUR sachets or other disinfectants
      - In case the turbidity level is high, it is advisable to go for PUR or other equivalent products available in the market.
      - This helps to remove turbidity as well as disinfects the water.

- Remove silt and other debris collected in the drinking water wells/tanks and dewater them (also called flushing).
- Chlorinate the drinking water sources such as open wells, bore wells, etc., if entry of flood water is suspected (refer charts for dosage of chlorine). Train local youths on the procedures to be adopted while chlorinating the drinking water sources.
- Restore/renovate the bore well hand pumps / open wells etc., if necessary. Repair parapet walls of the wells and platforms of wells/hand pumps to prevent entry of wastewater/flood water into them.
- Take steps to drain stagnated water around the water sources to prevent further contamination.
- In case of piped water supply schemes, assess the damages to the source, tank, suction and distribution mains and undertake necessary repairs.
- Emergency water treatment through mobile rapid sand filtration units can also be considered. While introducing systems such as "massive RO plants", make sure that the community has necessary skills to run these systems and they will be able to source the required spares for future maintenance.

❑ Rehabilitation Phase

In the rehabilitation phase, as far as possible try to restore the existing water supply schemes before taking up any new schemes. Depending on the location, water supply system such as filter points, deep borewell hand pumps, mini water schemes, rain water harvesting or over head tank with distribution can be taken up. Please make sure that while implementing these activities, suitable design norms are followed in order to prevent damages in future disasters. Since the technical options may vary from place to place, only the general steps to be followed to install a new water system in the community is narrated below:

- Do thorough technical assessment – type of scheme, water demand, source potential, cost effective options, materials availability, skilled and unskilled labour availability for implementing scheme and budgeting (please refer chart for technical agency / consultant available across the country for this assignment)
- Organise the communities and involve them right from planning to evaluation of the project. Ensure that the representatives of the community have adequate skills and capacity to operate and manage the scheme after completion of the project.
- After installing any new water supply scheme, conduct detailed water quality tests to ensure the water supply from the scheme is harmless. Also, establish community based water quality monitoring and surveillance systems.

iii) Sanitation

❑ Assessment

- Assess the existing sanitation practices among the affected communities.
- Estimate the damages to the existing sanitation facilities.

- Assess, whether or not the existing facilities can be restored for immediate use?.
- In case of any difficulty in restoring the facility, identify appropriate locations for providing temporary sanitation facilities.

❖ Assess the potential risks to drinking water sources and to the community due to the damages caused to the sanitary systems. (Ex: after Tsunami or flooding, toilet pits/septic tanks/sewerage line etc.. would have been filled with water and these may be contaminating the ground water and the surroundings.

❖ Assess the solid waste and liquid waste collection, transport and disposal systems and the status of these after the disaster. Assess feasible options for the immediate disposal of the solid and liquid waste in the affected villages/in the temporary shelters where the communities are staying.

❑ Immediate relief :

❖ Disposal of Human Excreta

- **Temporary Arrangements**: In case the existing sanitation facilities are affected and these can not be renovated, temporary facilities can be arranged. Please note that these temporary toilets should be constructed at least 30 meters away from the drinking water sources.
  - i) **Trenches with Enclosures:** Trench toilet is nothing but making trenches of a 1ft width and 1foot 6 inches deep pits for required length. Provide enclosures with necessary partition. Ensure sufficient mud is available along the sides of the trench. Advise the people to use the pits for defecation and cover the faeces with mud. Provide separate enclosures for men and women. Trench toilets helps to avoid open defecation in the disaster affected areas.
  - ii) **Raised Latrines using RCC rings**: In the high water area, if trench toilet can not be provided, raised temporary toilets can be constructed by using RCC rings. Use 3 rings of feet dia and cover the sides with mud. Provide necessary superstructure.

- **Rehab phase : Permanent Arrangements:**
  - **Where water table is deep:** Leach pit toilets can be promoted in such areas. Either household or community level toilets can be constructed
  - **Where water table is shallow:** Promotion of leach pit/septic tank toilets would lead to contamination of the ground water and also these might be damaged during future floods as well. In such conditions, promote Ecosan toilets.

❖ Disposal of Stagnated Water/waste water & prevent from mosquito bits:

Water stagnation in and around the affected hamlets will lead to breeding of mosquitoes and other insects. In order to avoid this;

- Drain out stagnated water by clearing the outlet channels or using power pumps.
- Repair/clear the choked drains with silt and debris to make them functional.

- Fogging and spraying of chemicals to control breeding of mosquitoes should be taken up.
- Provide soak pits or kitchen gardens around water sources and houses to prevent stagnation of waste water if there is no drainage facility in the village.
- Provide mosquito nets, coils, cream or any other repellents to prevent mosquito bites.

❖ **Disposal of Garbage/litter:**

Piling of garbage/litter near camps/habitations leads to breeding of flies and insects. Filth and debris accumulated within the village/camp area should be cleared.

- Provide adequate waste collection bins at central locations and at households to ensure proper disposal of waste.
- Provide large pits outside the habitation for final disposal of the waste.
- Make necessary arrangements to remove the waste collected from camps/households.
- In the rehabilitation phase, compost pits can be promoted after necessary training to the communities to convert waste into manure effectively. The compost pits can be promoted at the household or community level, as found feasible.

❖ **Other components**

- Provide appropriate washing and bathing facilities at the camps/villages. Create separate facilities for men and women.
- Undertake repairs to water and sanitation facilities in the schools and aganwadis, if necessary.

iv) Hygiene Promotion and Awareness

Adopting good hygiene behaviours will help to prevent spreading of killer diseases such as diarrhoea, cholera and other faecal oral transmission of diseases among the affected communities.

❑ **Assessment:**

❖ Assess existing hygiene conditions around the villages/temporary shelters and prioritise these issues and incorporate them in the hygiene awareness activities.

❖ It is also important to identify various channels for creating awareness among the communities. Accordingly, developing tools and process of hygiene education to be adopted can be planned.

❑ **Hygiene Promotion**

❖ It is important to appoint staff/volunteers to promote hygiene awareness among the community.

❖ The following topics can be incorporated in the hygiene education activities:

- Chlorination of Water (at households/water sources)
- Safe water collection and handling(covering water pots, use of ladle or drums/pots fitted with tap for collecting water)

- Keeping surroundings of the water sources clean (by promoting soakpits/kitchen garden)
- Hand washing after defecation and before handling food
- Diarrhoea, dehydration symptoms, ORS solution preparation and administration
- Using toilets/temporary enclosures for defecation
- Disposal of garbage and waste water safely (provide bins/garbage pits)
- Washing vegetables properly before eating/cooking
- Using mosquito nets/repellents if mosquitoes are present

❖ In the emergency situations, prioritising hygiene messages is very important to address life saving messages immediately.

❖ Hygiene kits can also be distributed as part of relief package. Certain essential items such as soap, oil, comb, mirror, toothpaste & brush, sanitary napkins, ladle, etc,. These can be supplied as per the ground situation in every affected area.

❑ Health Camps

❖ Diarrhoea, Cholera, Dengue, malaria, filariasis, Kala-Azar and other water borne diseases are some of the common diseases witnessed in the affected areas. Having proper disease surveillance systems in place and organising necessary health camps are very important to control the disease out break. Organising camps and supplying of necessary medicines for disease identified can also be considered with the help of doctors.

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Reference Materials

Details of various WATSAN components

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EFFECTIVE SANITATION IN TAMIL NADU

Tsunami Response

WES-Net India
WATER AND ENVIRONMENTAL SANITATION

Why this Field Note, and Who is it for?

This field note is based on the findings of a rapid assessment conducted by the Register of Engineers for Disaster Relief (RED-R) in Tamil Nadu six weeks after the tsunami disaster, focussing on sanitation, hygiene and water quality in temporary relief centres. The resulting field note is intended for NGOs, Government departments and agencies involved in the provision of sanitation facilities.

The assessment identified a number of shortcomings, including:

- Non-use or misuse of toilets
- Open defaecation in relief centres
- Lack of appropriate standards
- Problems with technical design, especially relating to a high water table
- Handpumps too close to toilets
- Lack of gender sensitivity, in particular, in the design of facilities for use by women, children and men
- Inadequate arrangements for waste-water disposal

Effective hygiene promotion is absolutely critical in these circumstances. Whilst some hygiene points are covered here, others are the subject of a separate field note.

Scope of Field Note

This field note focuses on the safe disposal of human excreta and water water. To keep the field note focused, it does not refer to solid waste management, hospital waste disposal or other interventions. Sources of information on all aspects of sanitation are listed at the end of the note.

Common Minimum Standards

Minimum standards for sanitation in disaster response are defined by SPHERE, based on global experience.

Sphere standards provide a benchmark for all organisations involved in tsunami relief. It is important that the standards, and their underlying rationale and implications, are understood.

SPHERE standards for sanitation are summarised in Table 1. SPHERE guidelines (http://www.sphereproject.org) include detailed guidance notes on each standard and indicator.

Achieving and maintaining sphere standards, at least in the short term, will be difficult.

Given that sandy soils underlie most of the area and the low abstraction rates of hand pumps, the minimum 30 metres between latrine pit and handpump-based ground water drinking source is over - cautious. In these circumstances it is recommended that a 20 metre separation distance is used. For more details see http://www.bgs.ac.uk/hydrogeology/argoss/manual.html

One approach to sanitation, adopted in these guidelines, is based on a series of incremental improvements. Three steps are shown in the form of a ‘sanitation ladder’ (Figure 1).

Each step in the ladder is designed to reduce people’s exposure to health risks and improve the wellbeing of the affected population. For example, in designing a toilet, the specific needs of women for convenience, security and privacy should be prioritised. At the same time, it is necessary to safeguard the environment and control the risk of groundwater pollution.

Specific Problems and Potential Solutions

The RED-R assessment confirmed that many of the SPHERE standards have not yet been achieved. The assessment also identified a number of critical issues, technical and non-technical, that need to be addressed. These are listed below.

Table 1: SPHERE Standards for Sanitation

Standard	Indicators
People have adequate numbers of toilets, sufficiently close to their dwellings, to allow them rapid, safe and acceptable access at all times of the day and night	• A maximum of 20 people use each toilet • Use of toilets is arranged by household(s) and/or segregated by sex • Separate toilets for women and men are available in public places (markets, distribution centres, health centres, etc.) • Shared or public toilets are cleaned and maintained in such a way that they are used by all intended users • Toilets are no more than 50 metres from dwellings • Toilets are used in the most hygienic way and children's faeces are disposed of immediately and hygienically
Toilets are sited, designed, constructed and maintained in such a way as to be comfortable, hygienic and safe to use.	• Users (especially women) have been consulted and approve of the siting and design of the toilet • Toilets are designed, built and located to have the following features: – They are designed in such a way that they can be used by all; – Sections of the population, including children, older people; – Pregnant women and physically and mentally disabled people; – They are sited in such a way as to minimise threats to users; – Especially women and girls, throughout the day and night; – They are sufficiently easy to keep clean to invite use and do not present a health hazard; – They provide a degree of privacy in line with the norms of the users; – They allow for the disposal of women's sanitary protection, or provide women with the necessary privacy for washing and drying sanitary protection cloths; – They minimise fly and mosquito breeding. • All toilets constructed that use water for flushing and/or a hygienic seal have an adequate and regular supply of water. • Pit latrines and soakaways (for most soils) are at least 30 metres from any groundwater source (*see shaded box on page 1*) and the bottom of any latrine is at least 1.5 metres above the water table. Drainage or spillage from defecation systems must not run towards any surface water source or shallow groundwater source. • People wash their hands after defecation and before eating and food preparation • People are provided with tools and materials for constructing, maintaining and cleaning their own toilets if appropriate.

1. Connecting Sanitation with Hygiene

Emergency sanitation is not only a technical subject: facilities have to reflect people's customs and preferences. Much of the affected population did not use toilets before the emergency. The provision of sanitary hardware alone is unlikely to change this.

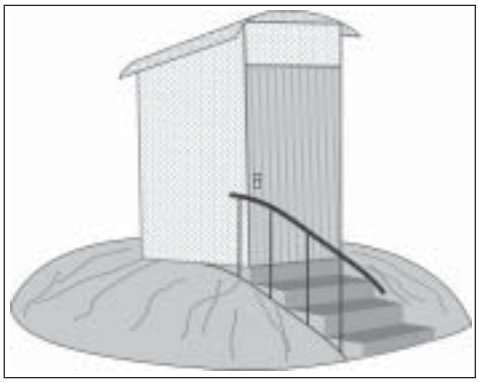
After clearing up scattered excreta, the first 'act of sanitation' involves the provision of basic sanitation facilities for men and women. To be effective, these must be linked to a hygiene campaign which makes open defecation in the relief centre unacceptable and shows people how to use and maintain the facilities provided. Emphasis should also be placed on encouraging children to use toilet facilities.

Such a campaign could be reinforced with a cadre of 'sanitation wardens' - men and women volunteers from the relief centre - to explain and if necessary enforce sanitation 'rules'. A mechanism must also be established to clear up the faeces of children and infants too young to use the toilets provided.

Figure 1: Sanitation Ladder

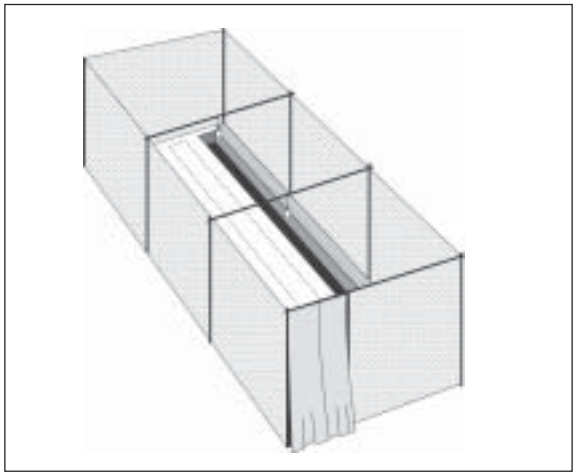
Note:
1. Water requirement increases from step 1 to step 3.
2. Hygiene education critical - messages must be consistent: New messages reinforce old ones.
3. Adequate bathing facilities should also be provided. This ladder only addresses sanitation.

Step – 3 Medium to Long Term Option



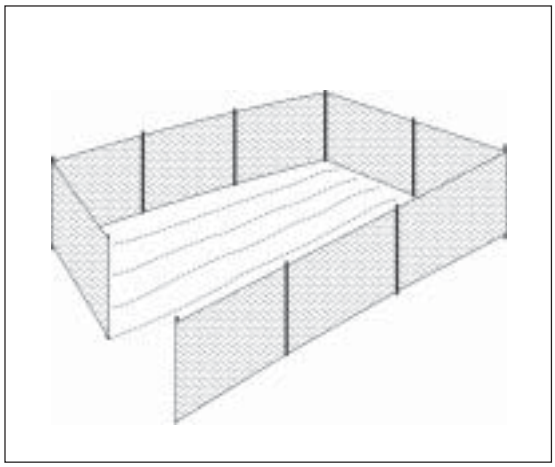
Raised Pit Toilet (Shared)

Step 2 - Short Term Option



Communal Trench Toilet

Step 1 - Immediate Option



Areas set aside for open defaecation

2. Connecting Sanitation and Hygiene with Water Supply

Sanitation and hygiene depend on an adequate supply of water. Even a 'water efficient' pour-flush toilet requires a minimum of 2 litres to operate. Hand-washing can increase this amount to 5 or more litres per person per day. Adequate arrangements for disposal of waste water are essential, or else the resulting mess could dissuade people from using toilets and favour mosquito breeding.

3. User Participation in Design

In order to help ensure that people use and maintain sanitation facilities, it is important to involve men and women in their design and placement. The differing needs of men, women and children need to be identified and addressed. This can be achieved through gender-segregated focus group discussions. If at all possible, a woman facilitator should work with the women's group.

In Naggapattinam, such a discussion led to a women's toilet being placed in an illuminated area, to provide users with additional security and convenience at night. Women can also be provided with an appropriate bathing facility, together with adequate arrangements for waste water disposal. *Understanding and addressing people's priorities improves the use and upkeep of sanitary facilities.*

4. Ground Conditions – Soil and Water Table

Ground conditions have a major impact on toilet design and location. In particular, in much of the affected area, the water table during the monsoon is less than 2 metres below ground level. There is a high risk of leach pits and soak pits contaminating groundwater. A second problem is the limited capacity of the sandy soils in the area to infiltrate waste water.

In crowded relief centres, particularly where groundwater is being used for domestic use, it is important that the risk of groundwater contamination is controlled. This should be reflected in the design and location of toilets.

Water sources themselves should also be protected – for example, by ensuring that hand-pumps are installed with a sanitary seal, platform and drain (Figure 2)

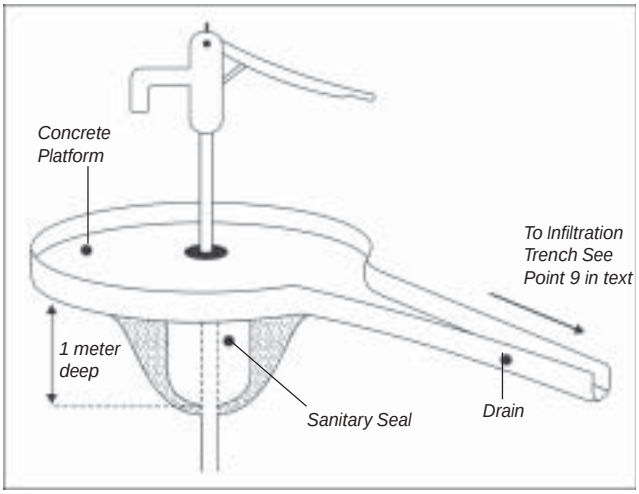


Figure 2: Protected Shallow Hand Pump

Before considering which toilet design to use, it is necessary to establish the depth of water table and establish where it will be by the end of the monsoon. Local knowledge, observations of open wells and if necessary, drilling a small hole with an auger will provide the answer.

If *the water table is less than two metres below ground level, it must be assumed that any hand-pump within 20 metres of a trench toilet, leach pit or soak-away is contaminated and the water is unfit for human consumption. Sanitary facilities must be located with this in mind.*

In fact, water quality studies have indicated that most shallow ground water in the area is already faecally contaminated. *As a rule, ALL shallow ground water should be treated before consumption.*

The following three designs are based on a high water table scenario (1 metre below ground level), as this is the most challenging situation facing those involved in emergency sanitation in coastal Tamil Nadu.

5. Communal Trench Toilet

Trench toilets are quick to build, simple (and safe) to use and require little water – enough for anal cleansing. They provide an immediate solution. Hand-washing facilities should also be installed – separate for men and women - with adequate provision for waste water disposal.

The main disadvantage of a trench toilet is ensuring its use and upkeep. Trenches can flood during heavy rain, unless a simple roof structure is provided. The use of bleaching powder in trenches is not advised, as it will kill the organisms that decompose the faeces.

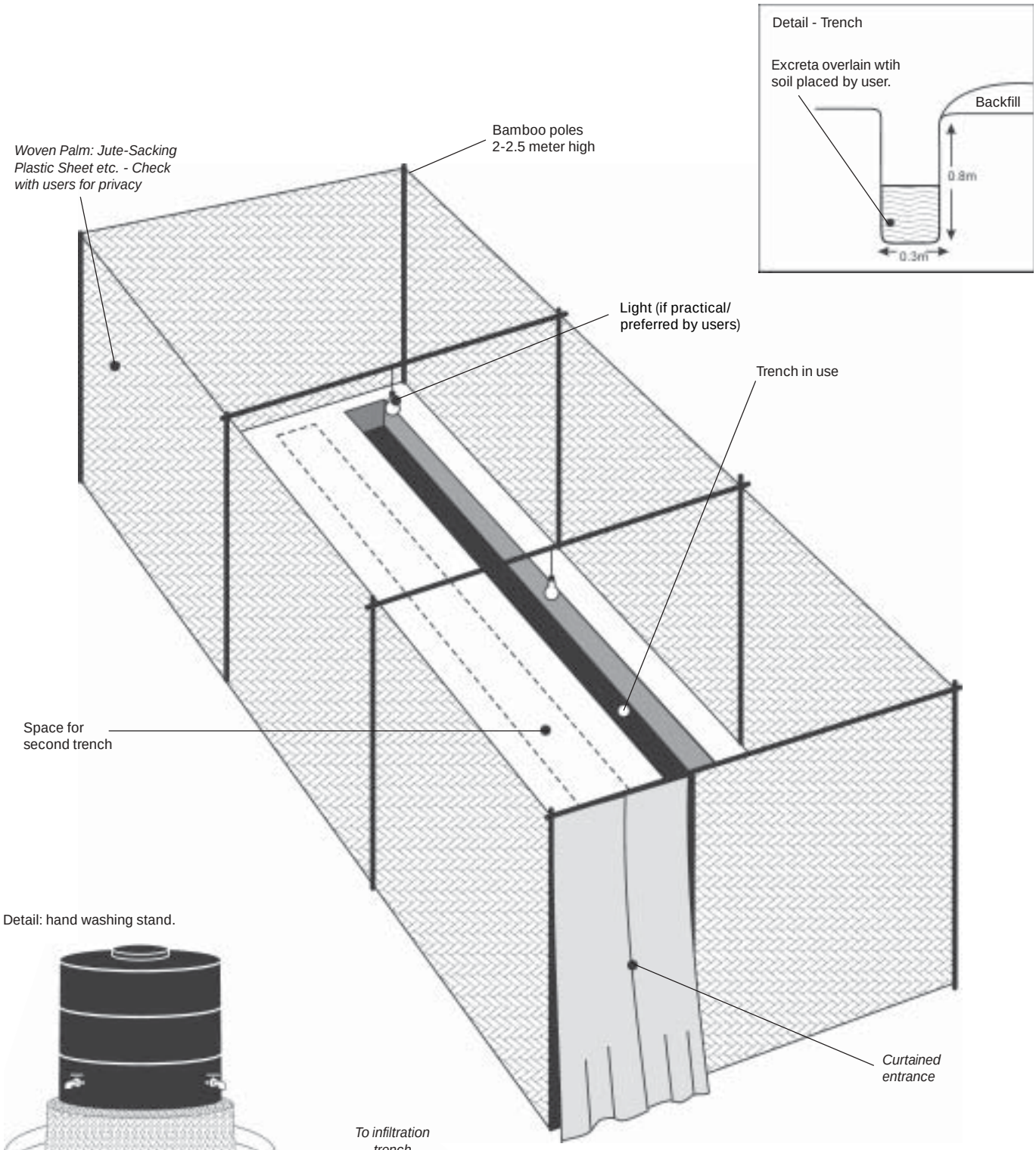
Users must be shown how to use a trench toilet – with male and female facilitators demonstrating to men and women separately. Users should be shown how to cover their excreta with a thin layer of earth to prevent fly-breeding.

Each trench should be about 0.6 to 0.8 metres deep and 0.3 metres wide. A 10 metre long trench can last 100 users about ten days before it is filled.

Depending on the number of users and the layout of the temporary shelter, sufficient space for two or three trenches can be provided (only one excavated at the outset), the privacy screen being placed accordingly.

Communal trench toilets can always be 'upgraded' to become longer-term propositions, for example, by providing plank type footrests and individual cubicles. However, ensuring their proper use and upkeep may be a problem.

Figure 3: Communal Trench Toilet



Hand washing stand (500L Syntax tank fitted with two ½" self-locking taps). Privacy screen should be provided for women with additional space for drying sanitary clothes.

Notes:

- *Location: If possible within 50m of peoples shelters*
- *Location: Not closer than 20m of drinking water source (if hand pump)*
- *Note importance of providing adequate water for hygiene, including women's hygiene*
- *Users must be instructed (demonstrated) how to use trench toilet*

Shared Toilets

Communal trench toilets provide an immediate solution to sanitation, but may not be appropriate for longer-term use, as people may want more convenient facilities located nearer their living quarters. SPHERE standards set the maximum distance between home and toilet as 50 metres. In practice, many people will not be prepared to walk that far.

Given the manner in which settlements have developed, in some cases this standard cannot be met for all households. However, three or four families living in the same area may agree to build, use and maintain a single toilet. Men and women use the same toilet. Alternatively, if two such toilets are built as one unit, separate facilities can be provided for men and women.

A shared toilet meets the 1:20 toilet to user ratio referred to by SPHERE. It can also reduce the problem of ground water contamination – as shared pits are relatively shallow compared to those designed for larger numbers of users.

All toilets – whether communal, shared or individual – must be provided with hand washing facilities with adequate arrangements for drainage.

The remainder of this field note is based on shared rather than family or communal toilets. However, the designs provided can be modified for to suit individual families.

6. Raised Leach Pit Toilet

Where the ground water table is within a few metres of ground level, technical options are fairly limited. A raised leach pit toilet is a relatively simple option to minimise groundwater pollution, but is relatively labour intensive and time consuming to build. Women users in particular may be reluctant to enter a raised toilet in public view, so additional screening may be needed – together with steps and a hand rail to ensure easy access to all users – including children, pregnant women and disabled people (Figure 4).

Recent assessments have shown that in many cases the design of raised pit toilets needs to be improved. Key points are shown in Figures 4 & 5.

Figure 4: Raised Pit Toilet (Shared by 3-4 Families)

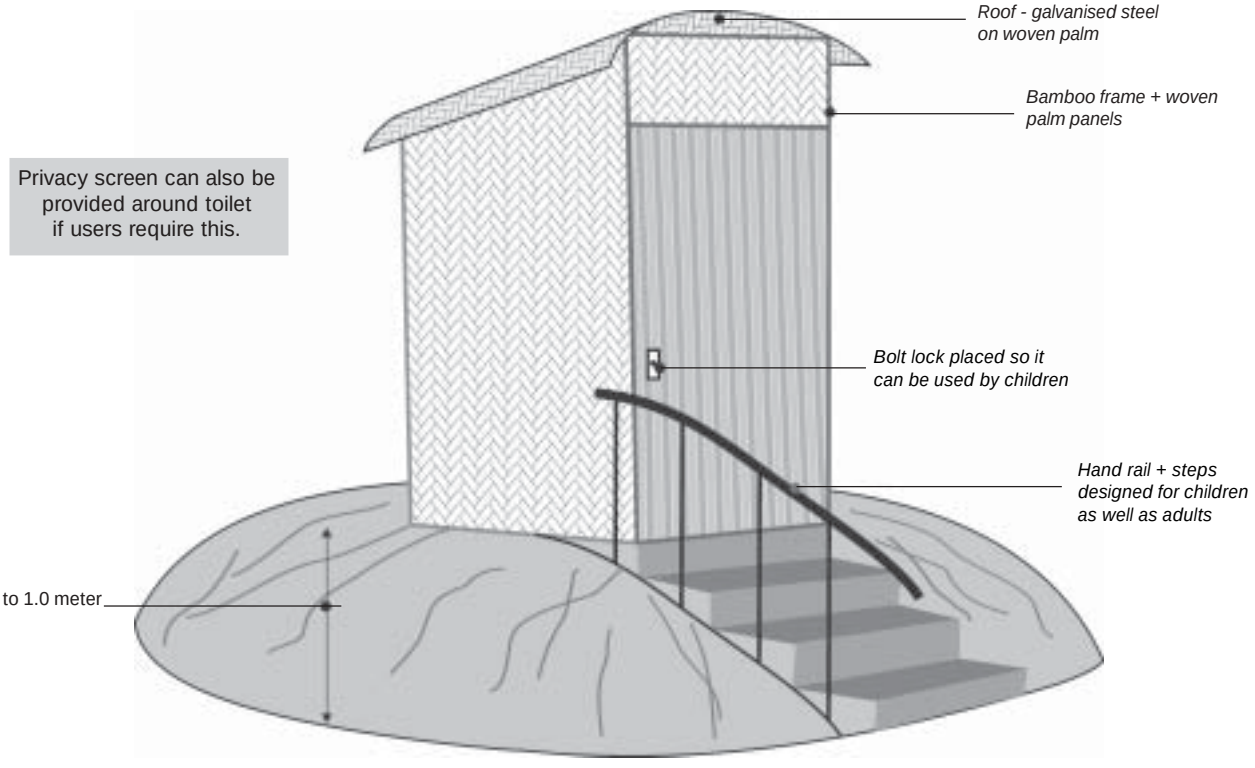
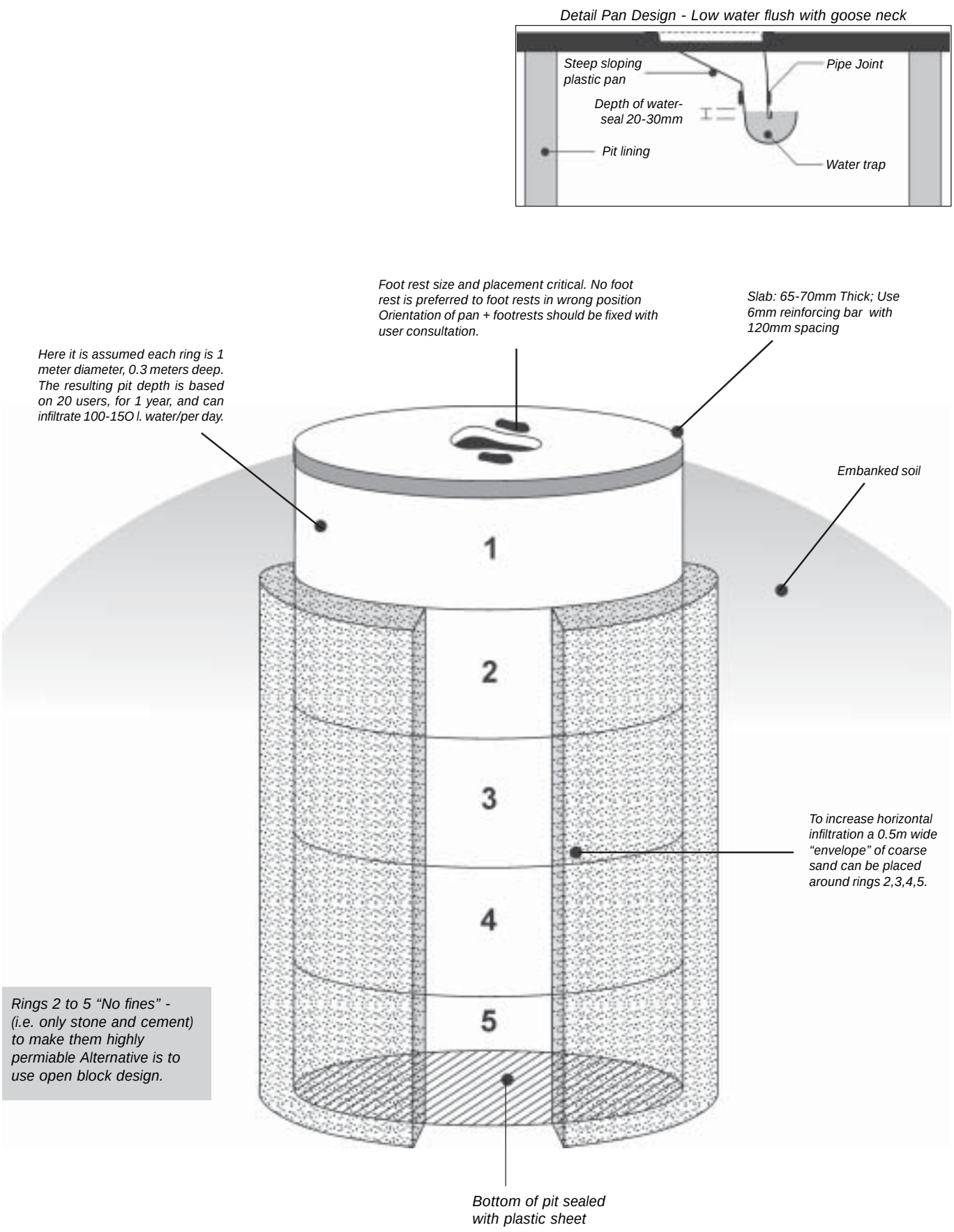


Figure 5: Detail of Raised Pit Toilet



7. Septic Tanks

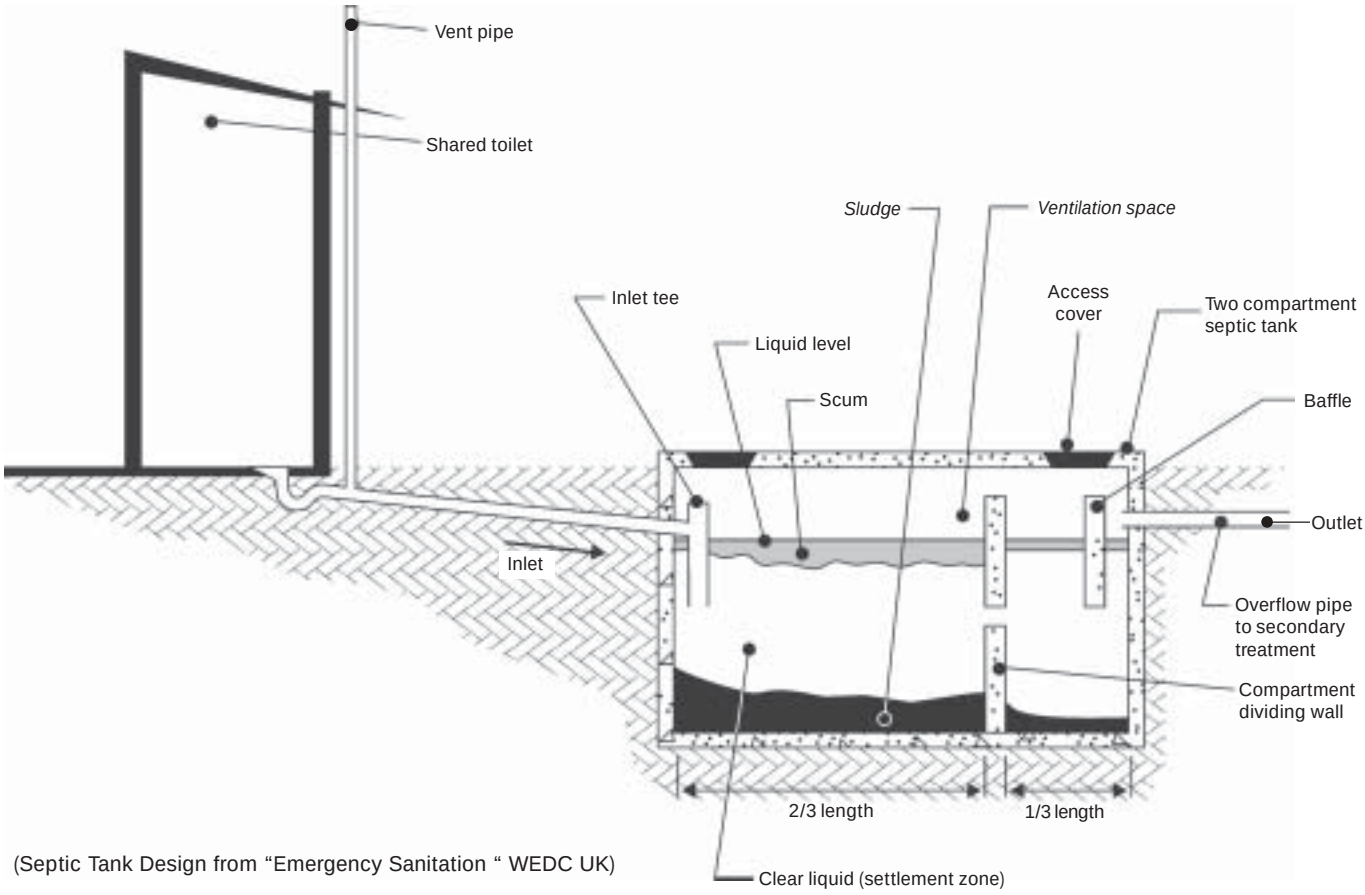
Septic tanks collect and treat excreta and wastewater. If properly designed and constructed, this can minimise the risk to groundwater pollution, albeit at considerably higher cost compared to a basic leach pit design. The design must be checked by a competent engineer. Construction and commissioning must also be carefully supervised.

Two major problems remain:

- The design must include provision for safe disposal of the final effluent, minimising risk of ground water pollution. For more details see Point 9
- Specific arrangements must be agreed for de-sludging. This will require specialised equipment, normally truck mounted. The question of vehicle access and safe disposal of sludge must be addressed.

A basic design for a septic tank system is shown in Figure 6. However, the specific problems mentioned above must be resolved before selecting this option. An overflowing septic tank system can be a major health risk.

Figure 6: Septic Tank Design



(Septic Tank Design from "Emergency Sanitation " WEDC UK)

Notes:

1. Tank Design is critical + needs to take into account 3 factors
   Sludge volume
   Volume required to store waste water - based on 24 hour retention period
   Ventilation space
2. For more on infilteration of septic tank effluent see Point 9
3. The minimum size required to produce calm conditions in a septic tank is 1.3 m^3.
4. Location of tank must facilitate desludging: this normally requires a vehicle mounted suction pump.

8. Ecological Sanitation

An alternative to a raised pit pour flush toilet is known as Ecological Sanitation – *ecosan* for short. There are two types of ecosan toilet. A *desiccating toilet*, which precludes the use of water for anal cleansing and manages urine and faeces separately, is unlikely to be culturally acceptable.

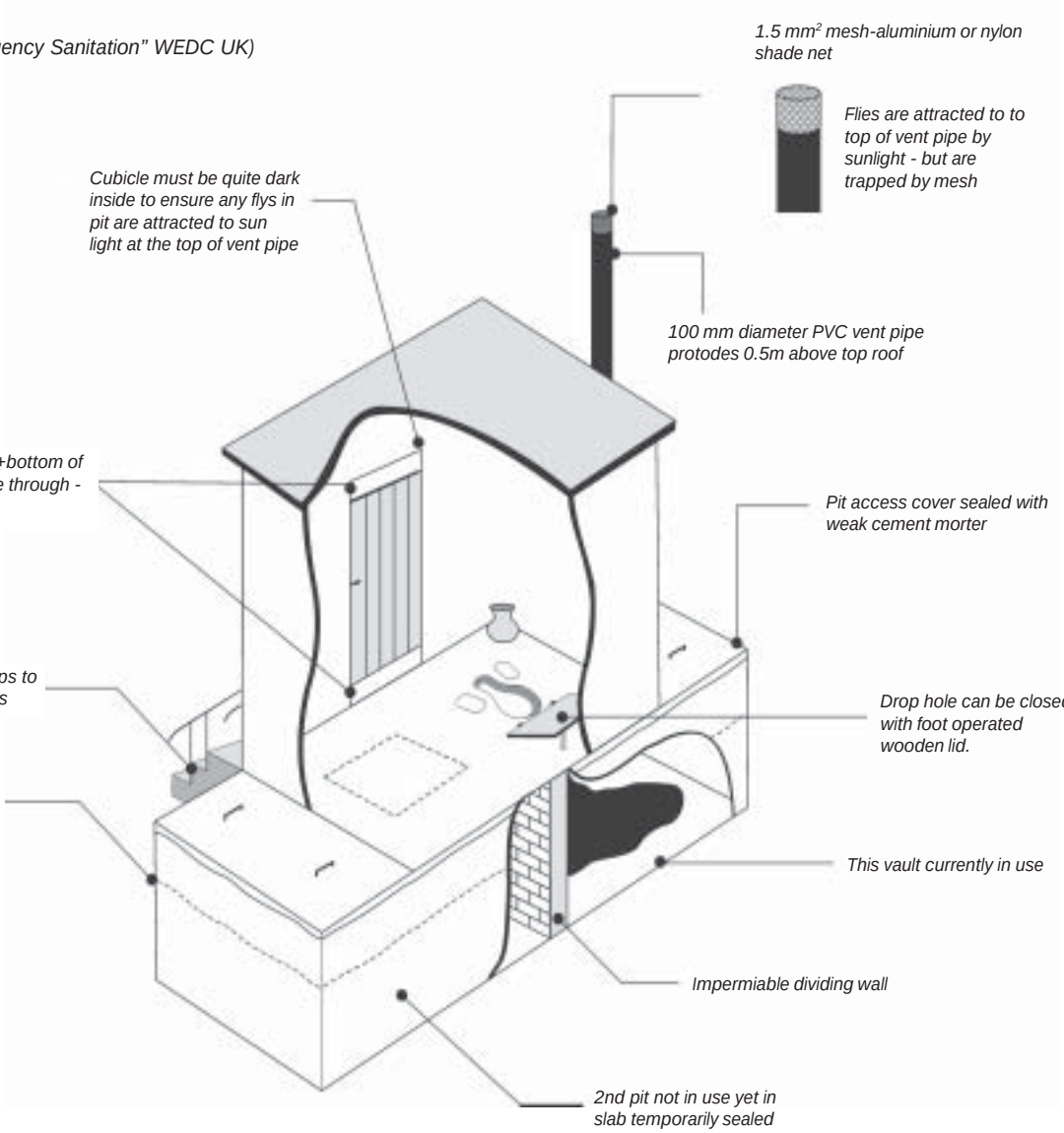
By comparison, an aerobic *composting toilet*, which manages urine, faeces and limited quantities of water together, may be a viable option, although it needs to be piloted first. In this case, bacteria, worms and other organisms break down faeces. Water input has to be regulated, to the extent that whilst some water can be used for anal cleansing, a pour flush system would not be appropriate. Hence the design is based on a ventilated improved pit toilet. Separate bathing facilities are needed to ensure people do not fill the vault with waste water.

A possible design, based on a double vault system, is shown below. This includes ventilation to ensure air flow through the cubicle and vault, and a fly trap, (Figure 7).

All composting latrines require considerable user awareness and understanding. They are more appropriate when the affected population has some experience of this type of technology. In these circumstances, the option must first be explained and then demonstrated.

Figure 7: Double-Vault Composting Toilet

(Design from "Emergency Sanitation" WEDC UK)



9. Waste water disposal

Whilst many organisations are constructing toilets, the disposal of waste water has not received much attention. The result is stagnant pools of water, providing a breeding ground for mosquitoes, and discouraging people from approaching a toilet or bathing area. Poorly designed drainage may also result in the pollution of ground-water based drinking water supplies.

The main design factor for wastewater disposal is the soil's infiltration rate. Table 2 gives guidance on infiltration rates for different soil types. It is important to note that different rates apply for 'clean' water (for example, from tank overflows) and waste water from septic tanks, leach pits, communal kitchens, etc, which carry a high load of suspended particles, fats and detergents.

Infiltration rates will be limited where the water table is close to ground level. Soak pits or infiltration trenches that intercept the water table will fill rapidly and will be unable to cope with large volumes of wastewater. In addition, there is a high risk of groundwater pollution. The "20 metre rule" (*established on page 1*) must be adhered to when locating drainage systems. Achieving a 1.5 metre vertical separation between pit bottom or trench bottom and the water table is also a difficult challenge, especially during the monsoon when the soil becomes fully saturated.

In these situations, the preferred method is to use a **shallow infiltration trench**, rather than a deeper soak-pit. A generic design, using a slotted or drilled 100 mm PVC pipe in a narrow gravel filled trench, is shown in Figure 8. The trench is narrow, as only the sidewalls are used for infiltration.

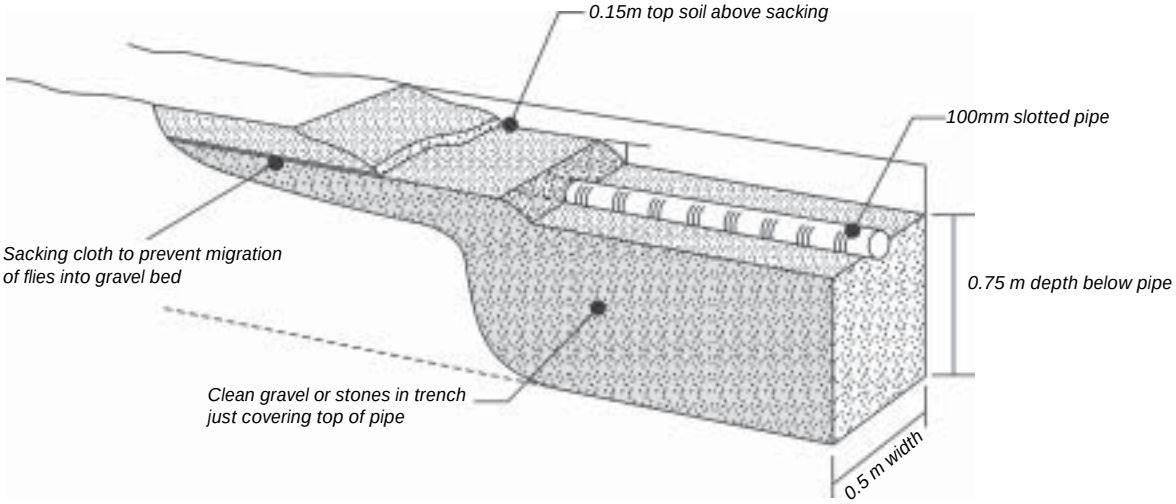
The top of the pipe is covered in sacking, itself covered with a 150 mm layer of topsoil. This allows air to enter and gases to escape, but prevents the topsoil mixing with the gravel and blocking the trench. The trench can be covered with a temporary roof structure during the monsoon to prevent the ground being saturated during periods of heavy rainfall.

Table 2: Average Infiltration Rates (From "Emergency Sanitation" WEDC UK)

Soil Type	Description	Infiltration Rate litres/m2/day	
		Clean Water	Waste Water
Gravel, coarse and medium sand	When moist does not stick together	1,500	50
Fine sand	When moist, sticks together but does not form a ball	1,000	30
Sandy loam	Moist soil; forms a ball, but still feels gritty between fingers	600	25
Porous silt	Moist soil forms a ball, does not feel gritty,	350	20
Silty clay	Moulds easily, smears when ribbed but does not go shiny	200	10
Clay	Moulds easily, forming a shiny ball, sticky when wet	70	Not suitable

Note: Shaded row common in affected area. An example showing how to use this table is included in Figure 8. Infiltration rate at 30L/m^2 /day (waste water) is typical in coastal Tamil Nadu.

Figure 8: Infiltration Trench



Note:
Infiltration occurs through side of tranch rather bottom, so width is not as important as length. Trench must not intersect water table + can be built up above ground level.

Design Process:

1. Calculate surface area of trench wall required to infiltrate waste water.
   Infiltration Area (m^2) = daily waste water flow (litres) ÷ soil infiltration rate (see table 2)
2. Calculate total lengh of side wall required
   Total length = infiltration area ÷ depth of trench below pipe of wall
3. Length of trench = total length of wall /2

Additional Sources of Information

These guidelines have been developed by adapting material from four sources of information, all of which are available (and downloadable) from the internet. These are shown in the following table.

Table 3: Sources of Information

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Emergency Sanitation The Green Book WEDC	http://wedc.lboro.ac.uk/publications/	Comprehensive handbook covering all aspects of emergency sanitation
ARGOSS Manual	http://www.bgs.ac.uk/hydrogeology/argoss/manual.html	Guidelines for assessing risk to groundwater pollution from leach pits

User Notes

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EFFECTIVE HYGIENE IN TAMIL NADU

Tsunami Response

WES-Net India
WATER AND ENVIRONMENTAL SANITATION

This field note is based on the findings of a rapid assessment conducted by the Register of Engineers for Disaster Relief (RED-R) in Tamil Nadu six weeks after the tsunami. The resulting field note is intended for NGOs, Government departments and agencies involved in the promotion of hygiene.

The assessment concluded that in many temporary shelters and relief centres:

- Hygiene promotion does not address major health concerns
- Open defecation is widespread
- Toilets are not being used or maintained
- Child's faeces are not disposed of safely
- The special needs of women and adolescent girls are not considered

Why Hygiene?

Together with the provision of water supply and sanitation infrastructure, effective hygiene can have a profound impact on reducing exposure to environmental health risks. Equally, interventions in water supply and sanitation are unlikely to have a major impact on health without hygiene.

Why Hygiene Promotion?

The tsunami has created crowded conditions for people in temporary shelters, increasing their vulnerability to a variety of diseases. Many of these are linked to water and sanitation. At the same time, what were relatively safe practices (such as open defecation on a beach) are now high-risk in a relief centre. Finally, many people may not feel responsible for their new and temporary surroundings, leading to unsanitary conditions. For these reasons, hygiene promotion is not an option but an absolute necessity.

What is hygiene promotion?

The goal of hygiene promotion is to assist people to understand and adopt practices designed to reduce their exposure to disease. In the current situation, hygiene promotion can:

- Encourage people to use and maintain toilets and bathing facilities properly
- Discourage open defecation
- Reinforce practices such as washing hands with soap (in particular, after defecation and before eating)
- Improve drinking water quality by promoting safe water collection and storage
- Reduce health risks faced by women relating to poor menstrual hygiene

Hygiene behaviour and infrastructure for healthy living should go hand-in-hand.

It is important to identify key risk behaviours and establish who is practicing these. Hygiene interventions should be prioritised accordingly. It is particularly important to work with women and adolescent girls and understand their priorities and needs. At the same time, men cannot be ignored, specially if they continue to practice open defecation in relief centres.

Principles for Hygiene Promotion

The guiding principles of hygiene promotion are summarised in Table 1.

Table 1: Guiding Principles of Hygiene Promotion

Work with a small number of risk practices	To control diarrhoeal diseases the priority hygiene behaviour should include hand washing with soap or appropriate local substitute. Hands should be washed after defecation or disposal of child's faeces.
Identify specific audience who practice out high risk behaviour	For each promotion activity, identify the audience and decision-makers. These may include women, children, opinion leaders, village heads etc.
Identify motives for behaviour change and replacement practices	Reasons for pursuing good hygiene practices may not always be linked to health, such as proper disposal of child's faeces may create greater respect among the neighbours. Therefore working with the target population can help identify a motivational strategy for behaviour change.
Make hygiene messages positive	People's attention would last longer if they are entertained and recall better when they laugh. Programmes attempting to frighten the audience may alienate them and therefore there should be no mention of diarrhoea, death or doctors.
Identify appropriate channels for communication	Traditional and existing channels are easier to use than new ones. Therefore understand how the target audience communicates, e.g. percent of population attending religions functions, listening to radios etc.
Develop cost effective mix of channels	The same messages given by a number of channels can reinforce the messages. Also, while mass media may be cheaper, face to face communication may be more effective though expensive.
Plan, execute, monitor and evaluate hygiene promotion carefully	Information is required on the outputs (radio spots, house visits etc.) and population covered regularly. Also, indicators for the impact of behaviour change should be collected and fed back into the planning process.

Source: Emergency Sanitation (WEDC, UK)

Suggest Areas of Intervention

The following intervention areas for hygiene promotion are suggested, based on observed health risks:

- Proper use and maintenance of sanitation facilities.
- Safe disposal of children's faeces.
- Hand washing with soap after defecation, before food preparation or eating
- Safe storage and handling of drinking water
- Menstrual hygiene

In practice health risks may vary from one place to another, and need to be established, by observation and dialogue. It is most effective to concentrate on one or two key risk practices at any one time. These should be selected to deliver the greatest health impact.

Hygiene Promotion Plan

Before starting any hygiene promotion activity, it is important to develop a hygiene communication plan. This plan should:

- Identify key risk behaviours to target for each community
- Identify communication methods to be used for promoting correct hygiene behaviour for identified risk behaviours
- Identify facilitators for the activity
- Plan the activities-maintaining frequency and consistency.
- Identify existing capacity and capacity building needs of the hygiene promoters
- Develop a monitoring strategy to gauge the effectiveness of the promotion campaign and, if needed, to change the hygiene promotion strategy

Hygiene Promotion - Activities

This section details activities that could be taken up as part of a hygiene promotion plan. Some of these are linked to the technical options in the Sanitation field note.

Safe disposal of children's faeces

Infant and children's faeces are usually left in the open or are disposed in a refuse pit in the temporary relief centres. This may be linked to a misconception that child faces are safe. Whilst young children cannot be expected to use an adult toilet, a number of steps can be taken:

- Educate mothers/child caretakers on safe disposal of infant and children's faeces. These must be put in a latrine pit and covered in soil to minimise fly breeding. This may have to be linked with a system in which the centre is cleaned up on a daily basis.
- Show caregivers how to train older children to use a toilet. Clearly, the toilet design must encourage access and use by children.

Hand washing with soap

Hygiene promotion in temporary shelters do not pay enough attention to hand washing, focusing instead on cutting nails and wearing clean clothes, which are often the focus of hygiene promotion activities in the relief centres. In fact, hand washing with soap before eating and after defecation substantially reduces the risk of contracting diarrhoea.

The RedR assessment found that most people in the centres have soap and use it for bathing. The problem is that there is no soap where people wash hands after defecation – which is either on the hand pump near the toilet or just outside their houses. People must understand the need to use soap for hand washing after defecation. A place to keep the hand washing soap can be provided in the newly constructed toilets.

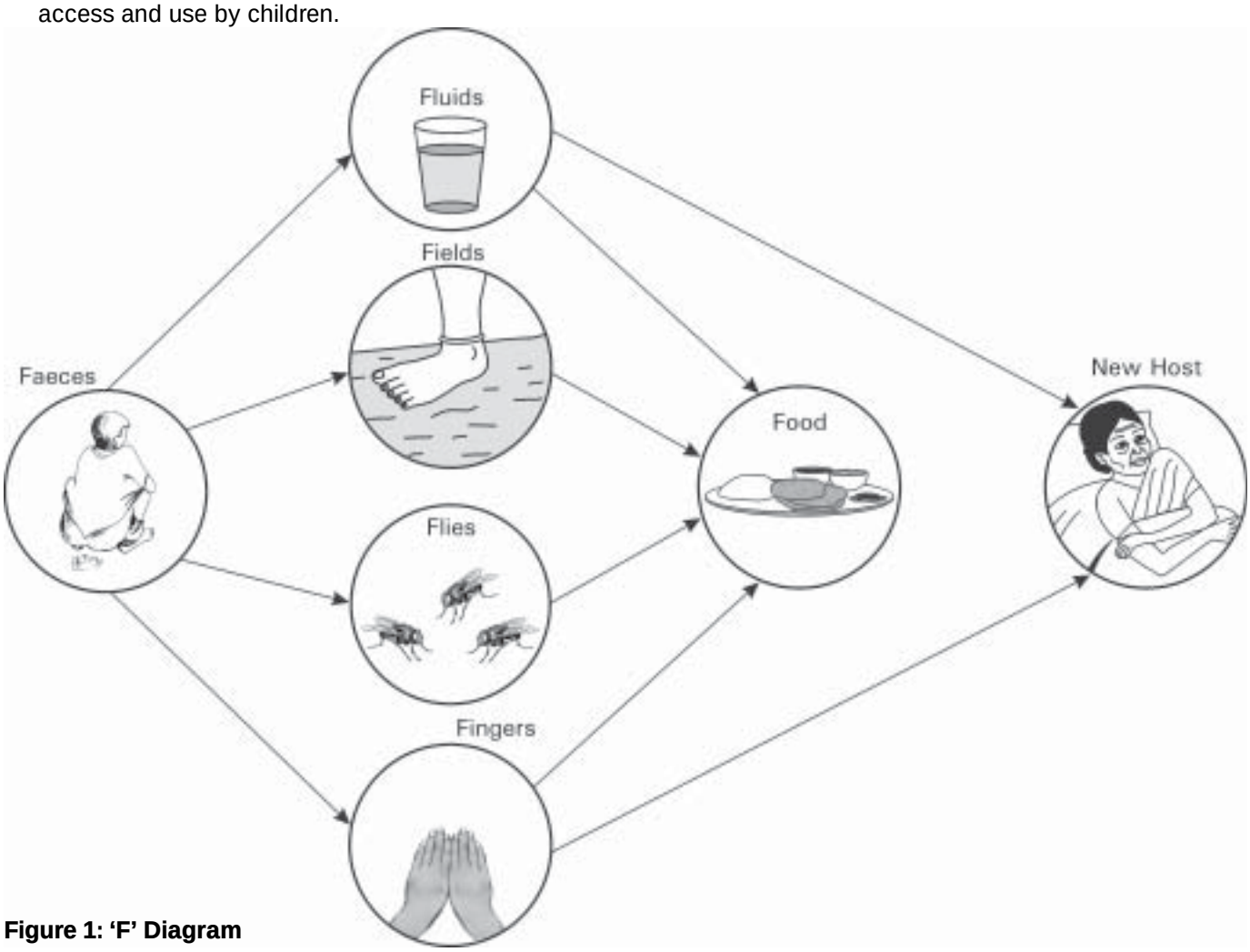

Figure 1: 'F' Diagram

Activities that can be taken up to promote hand washing include

- Adapt the 'F' diagram (Figure 1), for example, to show how unwashed hands transmit disease. The 'F' diagram can even be explained with a role play.
- Organize demonstrations of how and when to wash hands with soap.
- Link up with the AWW and ANM to reinforce hand-washing messages as they go about their normal work.
- Organize entertainment activities focussing on the importance of the hand washing – linking up with the school or setting up a theatre group.
- Ensure soap – and sufficient water - is available for hand washing near the place of defecation.

Safe handling of drinking water

The RedR assessment found that people frequently dipped their fingers in water vessels as they removed a glass of water. Without proper hand washing this will contaminate drinking water. (Unwashed) water vessels are frequently dipped into storage tanks to retrieve water. In the home, pots are usually kept on the floor, uncovered. As chlorination is not uniform, it is very likely that drinking water is thus rendered unfit for consumption.

Activities that can be taken up to promote safer water handling include:

- Identify and mark the safe sources of drinking water in the temporary relief centre and ensure that residents understand the risks of drinking from the unsafe supply.
- Equally, ensure residents understand what non-potable water can be used for, including bathing and clothes washing.
- Demonstrate the right and wrong way of retrieving water.
- Demonstrate the importance of appropriate storage; identify vessels (with a narrow mouth/tap, that can be used) kept clean, covered and stored at a height from the ground.
- Use chloroscopes and H_2S strips to demonstrate how water can become contaminated and establish a basic surveillance system, working with self help groups, school children or youth.

Women's health and hygiene

In nearly every temporary relief centre, it was found that women were not consulted and therefore their security, privacy and health needs were largely ignored by NGOs and government extenders who are predominantly men. This has resulted in the women being unable to keep themselves clean – especially so during menstruation. Most have no appropriate place to dry their menstruation cloths after washing.

With a female facilitator:

- Arrange consultations with women's groups to identify their privacy, security and hygiene needs.
- Inform women the need to use clean cloths during menstruation.
- Identify and demarcate private areas for women to wash and dry their menstrual cloths. Cloths need to be washed with soap and dried in the sun.
- Work with the women to identify methods (and areas) for proper disposal of sanitary pads if used. Used sanitary pads may be disposed by burning and or burial in a demarcated area.
- Ensure toilet design is appropriate for men and women, and that the specific needs of pregnant women are not overlooked.

Proper use and maintenance of sanitation facilities

A majority of the people living in the temporary relief centres practiced open defecation prior to the tsunami. Based on the RedR assessment, privacy has been identified as a concern by most women. While there is a demand for toilets, especially from women, they do not know how to use them, though in some places they are being used. Men however prefer to go for open defecation even at present.

Some activities to encourage people to use and maintain toilets are given below.

- Consultations (with men and women, separately) to present and select sanitation options and their most appropriate location. If shared toilets (used by 3 to 5 families) are being considered, it must be discussed with the families concerned.
- Demonstrate how to use and clean the toilets – ensuring that people are equipped to do this. Most people have been practicing open defecation before the tsunami. It cannot be assumed that they will know how to use the toilets.
- People also need to be warned against possible misuse. Converting a toilet into a bathing room will rapidly flood it. Separate bathing facilities with adequate drainage should be provided.
- Mobilize the residents to set up systems to clean and maintain toilets, and also clear up children's faeces. This can be linked to a system of sanitation wardens who can help explain what to do - and what not to do.
- In order to mobilize communities for camp cleaning different methods can be used. One way is to organize a clean centre campaign with the district administration. This could be linked with the Clean Village Campaign and award schemes.

Communicating Change

In order that people understand the need for behaviour change, hygiene promotion has to be *interesting and relevant*. Simply passing on instructions in a top-down manner is ineffective. Written flyers and pamphlets are of limited value, as a significant proportion of the population, both men and women, cannot read.

Whilst there is no blueprint, the approaches suggested in the following table can be used. Apart from focusing on relatively few practices, it is often effective to use a number of approaches to target a particular practice. This helps people remember and internalize the practices.

Facilitators

Facilitators are required to implement a hygiene promotion plan, working directly within the community. They are often the single most important factor in determining the success of a hygiene promotion plan. At least one man and one woman should be selected and trained to work in each temporary shelter. It is important to select the 'right' people as facilitators. Whilst some criteria can be used to guide their selection, ideally the displaced community should participate in this process.

Possible selection criteria include:

- Members of the community
- Ability to communicate in the mother tongue and local dialect
- Respected figure in the community
- Reasonably well educated and quick learners
- Motivated to improve living conditions

Table 2: Approaches to Communication

Approach	Potential use
Campaigns – linked to large group meetings and audio visual media (Radio & TV)	Clean community campaign – possibly linked to incentives such as Clean Village Campaign and Nirmal Gram Puraskar
Large Group Meeting	• Eliciting a group decision – for example, an agreement to ban open defecation, appoint sanitation wardens or set up a system to ensure upkeep of community toilets • Feedback to community on results of focus group discussions, for example, about toilet design and location, for a larger group decision
Focus Group Discussion (typically gender segregated) - may be reinforced by participatory assessment of hygiene and sanitation problems	• Identifying priorities and specific needs of women and/or adolescent girls • Demonstration of different toilet options using models to elicit preferences • Discussing with women the best options for place of washing and drying menstrual cloths • Eliciting priorities and needs of a socially marginalised group within the centre population
Schools	Key hygiene messages, in particular, use of toilet and hand-washing with soap. A school provides an excellent place to reinforce safe domestic practices. School children can also help monitor and improve environmental conditions in a relief centre
Visits to other centres	Taking representative groups of delegates to see a clean centre, a successful approach or to demonstrate a toilet design can be a very strong way of eliciting change
Religious and cultural events	Discussions on proper handling of drinking water and food hygiene – but not sanitation
Plays and puppet shows	Demonstration of how faecal-oral diseases are transmitted and how transmission can by broken through hygiene practice
Household visits by AWW or ANM	Domestic and personal hygiene, including menstrual hygiene Safe water storage and handling in the home
Posters and wall paintings	Used to convey key hygiene practices/ A wall-painted ‘monitoring chart’ focusing on hygiene and sanitary conditions in centre, can be linked to a ‘clean centre’ campaign
Audio Visual Media Radio & TV	‘Video on wheels’ shows and radio programmes on transmission of diseases. Community Radio programmes discussing hygiene in temporary centres and sharing information on key practices.

Monitoring

A simple monitoring system focusing on hygiene practices will help monitor the progress being achieved. The following checklist can be used or adapted for this purpose.

Table 3: Monitoring Checklist

Intervention Area	Indicators
Safe excreta disposal	(based on SPHERE standards) • People use toilets • Children's faeces is disposed off hygienically and immediately • Toilets are used in the most hygienic way • Parents are aware of the needs to dispose children's faeces safely
Hand washing with soap	• Women and men know the importance of hand washing for getting rid of germs from hands • People wash hands after defecation and handling children's faeces and before handling food • Children can demonstrate method-rubbing with an agent/soap
Safe handling of drinking water	• A safe/protected source is used for fetching drinking water • Observation shows proper storage of drinking water - clean, covered narrow mouth vessel, long handle ladle, disinfection method (if any) • Observation shows hands not being dipped into the drinking water at the time of collection from the water source. • Pots not being dipped in storage tanks at water collection points.
Women's health and hygiene	• Appropriate areas for use by women - bathing, urination, defecation and during menstruation • Women know about menstrual hygiene and have private areas for cleaning and sun drying cloth used during menstruation • System for incineration and burial of sanitary pads (if applicable) • Soap and clean cloth is available to the women
Proper use and maintenance of sanitation facilities	• No excreta including child faeces, visible in temporary relief centre or in solid waste. • Proper usage of toilets/ No excreta visible in pans or slabs • Women articulate a safe method of disposal of child excreta

Additional Sources of Information

This guideline has been developed by adapting material from three sources of information, all of which are

Table 4: Sources of Information

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Chlorination

(Based on the Guidelines of the Department for Drinking Water Supply, Govt. of India)

It has been observed that addition of 4 mg of bleaching powder for every litre of dug well water very effectively destroys the micro-organisms in water and the residual chlorine remains in the range of 0.2-0.5 mg/l.

Working process:

The quantity of water can be measured on the basis of the formula given below.

By assessing the depth and diameter of the well and thereafter by following the chart, the quantity of bleaching powder needed can be determined. The diameter and the height of the well has to be measured by meter. If the measurement is done in feet then it has to be converted to meter by multiplying the feet by 0.304.

$$\text{Volume of Water} = \frac{3.14 \times \text{diameter}^2 \times \text{height}}{4} \times 1000 \text{ litre}$$

Example : If the depth of water is 4 m. diameter is 2 meter then the volume of water in the dug well is

$$= \frac{3.14 \times 2 \times 2 \times 4 \times 1000}{4} = 12560 \text{ litre}$$

Therefore 12560 x 4 mg of bleaching powder or 50.28 gm of bleaching powder will be needed.

The chlorine in bleaching powder is unstable. Therefore, it should be kept with care in cool and dry place. The available chlorine in bleaching powder should always be 25% i.e. 4 mg/l bleaching powder should be used for disinfection.

Necessary things required:

a) Bucket

b) Bleaching Powder

c) Glass Rod

Process of adding bleaching powder:

After the required quantity of bleaching powder is determined, it should be taken in a bucket. Then with a little water and with the help of a glassrod it should be made into a paste. After this, water from the dugwell should be poured into the bucket. It should be allowed to settle for some time. After the lime is settled at the bottom the water from above is poured into another bucket. This bucket of water then poured into the dugwell. Then the water of the dugwell is stirred well, so that chlorine mixes well with the dugwell water. After a period of 30 minutes the residual chlorine of the dugwell is assessed and then used for drinking purpose.

Other methods of disinfection :

Pot Chlorination :

Single Pot System

An earthen pot or a plastic container of 7 - 10 litres capacity with 6 - 8 mm dia. holes at the bottom is half filled with gravels of 20 to 40 mm size. Bleaching powder and sand (1:2 proportion) is placed on top of the gravels and the pot is further filled with gravels up to the neck. The pot is then lowered into the well with its mouth open.

For a well from which water is taken at a rate of 1000 - 1200 litres/day, a pot containing about 1.5 kg. of bleaching powder could provide adequate chlorination for about 1 week. (figure I)

Double Pot System :

When a single pot system is used in a small household well, it may be found to give too high a chlorine content to the water (over chlorination - very effective after flood). In such situations, a unit consisting of two cylindrical pots one inside the other has been found to work well. The inner pot is filled with moistened mixture of 1 kg. of bleaching powder with 2 kg. of coarse sand to a little below the level of the hole and is then placed inside the outer pot. This unit is lowered into the well with the help of a rope. It has been found by a study conducted by AIIH&PH that such a unit could work effectively for 2 - 3 weeks in household wells from which water is withdrawn at a rate of 400 - 500 litres/day. (figure II)

Drop Chlorination :

Main requirements of this arrangement are a plastic container of 3 - 4 litre capacity with a 6 - 8 mm brass tap, 1 kg. of bleaching powder and a fine strainer .

Bleaching powder would be mixed with water in a separate container and then the solution would be filtered into the plastic container by the strainer. The container would then be placed in a nylon net and lowered by a rope inside the well at ground level. Drop adjustment from the container in the well would be made by the tap/stopper by

calculating the quantity of average daily water drawn from the well. It has been found that for a well from which water is taken at a rate of 1000 litres/day, this unit could provide adequate chlorination for about 1 week. (figure III)

This system had been field tested in villages of Kerala by AIIH&PH and had been found to give satisfactory results in maintaining residual chlorine in dug wells.

Dose of Bleaching Powder for Disinfection of Different Size of Dug Wells — A Ready Reckoner

Diameter of the Dugwell (ft/metre)	Depth of Water (ft/metre)	Volume of Water (litre)	Amount of Bleaching Powder* (gram)
3 ft. (0.9 m)	1 ft. (0.3 m)	190.7	0.7
	2 ft. (0.6 m)	381.4	1.5

	3 ft. (0.9 m)	572.2	2.2
	4 ft. (1.2 m)	762.9	3.0
	5 ft. (1.5 m)	956.7	3.8
	6 ft. (1.8 m)	1144.4	4.5
	7 ft. (2.1 m)	1335.1	5.3
	8 ft. (2.4 m)	1525.9	6.1
	9 ft. (2.7 m)	1716.6	6.8
	10 ft. (3.0 m)	1907.4	7.6
	15 ft. (4.5 m)	2861.1	11.4
	20 ft. (6.0 m)	3814.8	15.2
	25 ft. (7.6 m)	4832.0	19.3
	30 ft. (9.1 m)	5785.7	23.1
	35 ft. (10.6 m)	6739.4	26.9
	40 ft. (12.1 m)	7693.1	30.7
	45 ft. (13.7 m)	8711.1	34.8
	50 ft. (15.2 m)	9664.1	38.6
3.6 ft. (1 m)	1 ft. (0.3 m)	235.5	0.9
	2 ft. (0.6 m)	471.0	1.8
	3 ft. (0.9 m)	706.5	2.9
	4 ft. (1.2 m)	9442.0	3.7
	5 ft. (1.5 m)	1177.5	4.7
	6 ft. (1.8 m)	1413.0	5.6
	7 ft. (2.1 m)	1648.5	6.5
	8 ft. (2.4 m)	1884.0	7.5
	9 ft. (2.7 m)	2119.6	8.4
	10 ft. (3.0 m)	2355.0	9.4
	15 ft. (4.5 m)	3532.5	14.1
	20 ft. (6.0 m)	4710.0	18.8
	25 ft. (7.6 m)	5966.0	23.8
	30 ft. (9.1 m)	7183.5	28.5
	35 ft. (10.6 m)	8321.0	33.2
	40 ft. (12.1 m)	9498.5	37.9
	45 ft. (13.7 m)	10754.5	43.0
	50 ft. (15.2 m)	11932.0	47.7
4 ft. (1.2 m)	1 ft. (0.3 m)	339.1	1.3
	2 ft. (0.6 m)	678.2	2.7
	3 ft. (0.9 m)	1017.3	4.0
	4 ft. (1.2 m)	1356.4	5.4
	5 ft. (1.5 m)	1695.6	6.7
	6 ft. (1.8 m)	1808.6	7.2
	7 ft. (2.1 m)	2373.8	9.4

	8 ft. (2.4 m)	2712.9	10.8
	9 ft. (2.7 m)	3052.0	12.2
	10 ft. (3.0 m)	3351.2	13.5
	15 ft. (4.5 m)	5086.8	20.3
	20 ft. (6.0 m)	6782.4	27.1
	25 ft. (7.6 m)	8551.0	34.3
	30 ft. (9.1 m)	10286.6	41.1
	35 ft. (10.6 m)	11982.2	47.9
	40 ft. (12.1 m)	13677.8	54.7
	45 ft. (13.7 m)	15486.4	61.9
	50 ft. (15.2 m)	17182.0	68.7

* @4 mg/l of Bleaching Powder (B.P.) or 1 mg/l of Chlorine

4.2.2 Tube Well & Hand Pump

The tube well as well as hand pump may get contaminated due to entry of polluted water through the annular spaces around the tube well, entry of contaminated water during flood, local priming with contaminated water etc. Hence, tube well and hand pump need to be disinfected regularly once or twice a year.

Process of disinfection of tubewell water

Working Process :

Before the installation of the pump, the tubewell should be disinfected. Moreover, during repair also disinfection is necessary. With the help of the formula given below determine the quantity of water and bleaching powder. In case of tubewell 200 mg/l of bleaching powder is added. After 30 minutes water should be pumped and allowed to flow out for some time.

$$\textbf{Volume of Water} = \frac{\textbf{3.14 x diameter}^2 \textbf{ x height}}{\textbf{4}} \textbf{ x 1000 litre}$$

Necessary articles required :

a) Bucket
b) Bleaching powder
c) Glass rod

Process of Adding Bleaching Powder:

After determining the required amount of bleaching powder to be added it is taken in a bucket. Then with the help of the glass rod and a little water a paste is made. Then water is added and the powder is mixed. This mixture of water is poured into another bucket. Now one part of the water is poured into the tubewell and in the remaining part the different parts of the tubewell immersed, after 30 minutes water is pumped and the water allowed to flow away for some time before using it.

Dose of Bleaching Powder for Disinfection of Tubewells — A Ready Reckoner

Depth of Water	India Mark-II		India Mark - III		Tara Pump	
Metre	Volume of Water	Amount of Bleaching Powder	Volume of Water	Amount of Bleaching Powder	Volume of Water	Amount of Bleaching Powder
Metre	*Litre*	*Gram*	*Litre*	*Gram*	*Litre*	*Gram*
1	25	5	51	11	39	8
2	50	10	102	20	78	16
3	75	15	153	31	117	23
4	100	20	204	41	156	31
5	125	25	255	51	195	39
6	150	30	306	61	234	47
7	175	35	357	72	273	55
8	200	40	408	82	312	62
9	225	45	459	92	351	70
10	250	50	510	102	390	78
15	375	75	765	953	585	117
20	500	100	1020	204	780	156
25	625	125	1275	255	975	195
30	750	150	1530	306	1170	234
35	875	175	1785	357	1365	273
40	1000	200	2040	416	1560	312
45	1125	225	2215	459	1755	351
50	1250	250	2550	510	1950	390

Agencies and Suppliers
Providing Products and Services related to WATSAN in Emergencies

S.No	Name and Address of the Agency
1	**Agencies offering Technical Service on Water Supply & Sanitation**
a)	**RedR India** A-14, Nivedita Apartments, 70 Rambagh Colony, Paud Rd., Kothrud, Pune, India-411038, *Phone:* +91 (0) 20 3091 2532, *Fax:* +91 (0) 20 2544 6659, *Email:* info@redrindia.org,
b)	**Action for Food Production (AFPRO)** 25/1A, Pankha Road, D-Block, Janakpuri, New Delhi - 110058 *Phone:* 011-28525412 *Email:* ed@afpro.org
c)	**Training and Development Centre (TDC)** 11-13-242, Road No. 5, Alkapuri Colony, Disukhnagar Hyderabad, *Phone:* 040-24032689 *Mobile:* 9908930123 *Email:* tdchyd@gmail.com
2	**Agencies offering Technical Service on ECOSAN & DEWATS (Sanitation)**
a)	**Ecosan Services Foundation** "Vishwa Chandra", 1002/42 Rajenda nagar, Pune – 411030, Maharashtra,India *Phone* : 0091 (0)20 64 000 736 Fax : 0091 (0)20 24 530 061 *Email:* ecosanindia@gmail.com *website:* http://www.ecosanservices.org/page.php?id=1
b)	**Eco-Solutions** 'Pulari', 49 Asan Nagar , Vallakadavu, Trivandrum 695008, Kerala, India *Tel :* ++91 471 2502622 *Email:* paul@eco-solutions.org
c)	**SCOPE** P/17, 6th Cross, Ahamed Colony, Ramalinganagar, Tiruchirappalli - 620 003, Tamil Nadu *Phone No:* 0431 – 2774144 *Email:* scopeagency86@rediffmail.com
d)	**Consortium for DEWATS Dissemination,** No 220, 4th 'A' Cross, 3rd Block, HRBR Layout, Kalyan Nagar, Bangalore – 560043 *Tel:* +91-080-25431772, *Telfax:* +91-080-25431773, *Email:* cddindia@eth.net *Internet:* http://www.borda-sa.org

Agencies and Suppliers Providing Products and Services related to WATSAN in Emergencies	
S.No	**Name and Address of the Agency**
3	**Manufacturers of Water Testing Kits (approved by Government of India)**
a)	**Techno-ad Sysytems Inc**. Bhaskar Lane, Jayendra Ganj, Gwalior, Madhya Pradesh 474 009, *Telefax:* 2323765 *Email:* watersafe@hotmail.com
b)	**Tamilnadu Water Supply and Drainage Board (TWAD)** 31, Kamarajar Salai, Chepauk, Chennai - 600 005 *Telefax:* 044-285 25501 *Website:* http://www.twadboard.com/
c)	**Development Alternatives** B-32, TARA Crescent, Qutab Institutional Area, New Delhi 110 116 *Phone:* 011-26898264, 26967983 *Email:* tara@sdalt.ernet.in *Website:* http://www.devalt.org/
d)	**LTEK Systems** 2 B Rajkamal Complex, Dhantoli, Nagpur 440 012 *Phone* # 91-712-542230 *Fax* # 91- 712-521746 *Email:* vishva@nagpur.dot.net.in *Website:* http://www.lteksystems.com/bactoh2s/
e)	**Royal Enterprises** 3rd Floor, No.23, Narasingapuram Street, Anna Salai, Chennai-2 *Contact No:* 09444231620
f)	**Prerana Laboratories** Prerana House, near Chatrapati Bank, Vishal Nagar (Jagtap Dairy) Off Aundh-Wakad Road, Pune - 411027
g)	**Water Tech Engineers** Saluja Arcade, 1st Floor, Thokatta,Tank bund, Secunderabad – 500 009
4	**Personal Water Purifier & Moquito Repellent Nets**
a)	**Vestergaard Frandsen India Pvt. Ltd.** Add: 302, Rectangle One, D-4, Saket New Delhi – 110017 *Tel:* +91 11 4055 3666 *Mobile:* +91 99104 44725 *E-mail:* mas@vestergaard-frandsen.com *Web:* www.vestergaard-frandsen.com
5	**Tarpaulin & Tents**

Agencies and Suppliers Providing Products and Services related to WATSAN in Emergencies	
S.No	**Name and Address of the Agency**
a)	**United Canvas Udyog** BG-295, 1st floor Sanjay Gandhi Transport Nagar New Delhi-110042 Contact nos.- 0-9810320501,9313323792, 011-27831226,65900226 *Fax*- 011-27833906 Email: united_canvas@yahoo.com
b)	**Priyanka (India) Pvt. Ltd.** B - 109, Mayapuri Industrial Area Phase – I New Delhi – 110064 *Tel:* 011-28117755, 09899222000 *Fax:* 011-28115192 *Email:* srv@priyankaindia.com
6	**Cholrine/Halozen Tablets and other Water Treatment chemical & Equipments**
a)	**Water Chem Laborartories** H.No.11-6-652/1 1st Floor, Red Hills, Hyderabad – 500 004 *Tel:* 040-23300428, *Fax:* 040-23300428 *Email:* waterchemlabs@yahoo.co.in
b)	**Gripo Laboratories** 1519-A, Bhagirath Palace, Chandni Chowk Delhi-110006 *Ph:* 011-23865913 *Email:* gripolabs@gmail.com
7	**Domestic Water Filters**
a)	**Bio-Sand Filters** Mr.A.Gurunathan / Ms.J.Kanagavalli DHAN Vayalagam (Tank) Foundation No.17, Vellai Pillaiyar Koil Street S.S.Colony, Madurai – 625 010, Tamilnadu, INDIA *Ph:* 91-452-2601673, 2610794, 2610805 *Fax:* 91-452-2602247 *Email:* dhantank@airtelbroadband.in *Website:* http://www.dhan.org/
b)	**Terafil** S. Khuntia, A. K. Sahu & P. C. Beuria Regional Research Laboratory (Council of Scientific & Industrial Research) Bhubaneswar – 751 013, India. *Tel.* No. + 91 – 671, 2581 635, 2581 636. *Email:* khuntias@yahoo.com & skhuntia@rrlbhu.res.in *Website:* http://www.thinkcycle.org/tc-filesystem/download/development_by_design_2002/publication:_terafil_water_filter_for_sustainable_drinking_water_programme/dydo2-Terafil-paper.PDF
c)	**Rice Husk based Water Filter** Prof. Mathai Joseph, Executive Director TATA Research Development and Design Centre 54B, Hadapsar Industrial Estate, Pune 411 013, Maharashtra *Phone:* 020-6871058; fax: 020-6810921 *Email:* mj@pune.tcs.co.in ; *website :* www.tcs.com
d)	**Candle Filters** (Should be used along with chlorination if bacteriological contamination is suspected) Available in Open Market

Agencies and Suppliers
Providing Products and Services related to WATSAN in Emergencies

S.No	Name and Address of the Agency
e)	**Zero-B (On tap purifier & Storage type filters)** Ion-Exchange Tiecicon House, Dr. E. Moses Road, Mahalaxmi, Mumbai-400 011, India *Tel :* (91) 22 3989 0909 *Fax :* (91) 22 2493 8737 *email :* hocro@ionexchange.co.in , ieil@ionexchange.co.in *Website:* http://www.ionindia.com/residentiallink.html#sur
f)	**Nadi Filters** A. Khurshid Bhatti President Association for Humanitarian Development (AHD) 60/A, Block-C, Unit No. 6, Latifabad Hyderabad, Pakistan- 71800 *Ph:* +92-22-2933236 *E-mail:* ahdpak@yahoo.com *Website:* www.ahdpak.org

Note: *WES-Net Invites professionals, agencies and suppliers to send their information for making this list comprehensive.*