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.

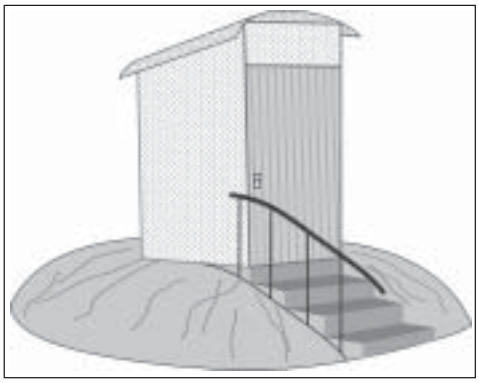
After clearing up scattered excreta, the first 'act of sanitation' involves the provision of basic sanitation facilities for men and women. To be effective, these must be linked to a hygiene campaign which makes open defecation in the relief centre unacceptable and shows people how to use and maintain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

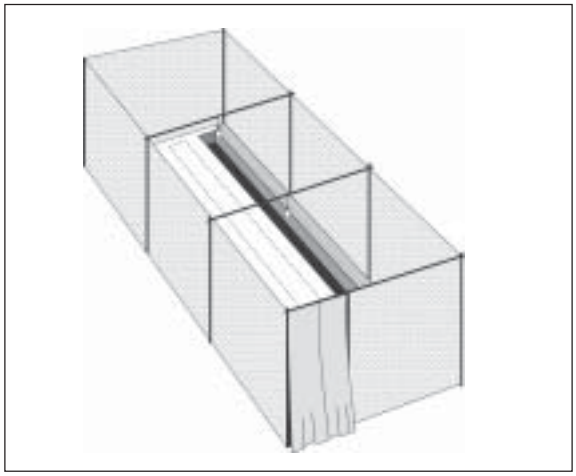
Note:
1. Water requirement increases from step 1 to step 3.
2. Hygiene education critical - messages must be consistent: New messages reinforce old ones.
3. Adequate bathing facilities should also be provided. This ladder only addresses sanitation.

Step – 3 Medium to Long Term Option



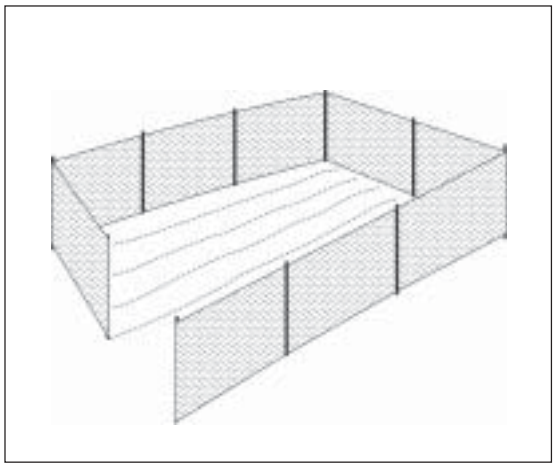
Raised Pit Toilet (Shared)

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)

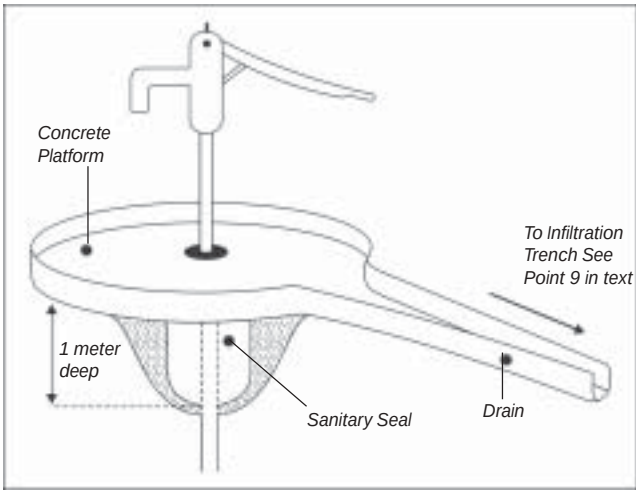


Figure 2: Protected Shallow Hand Pump

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.

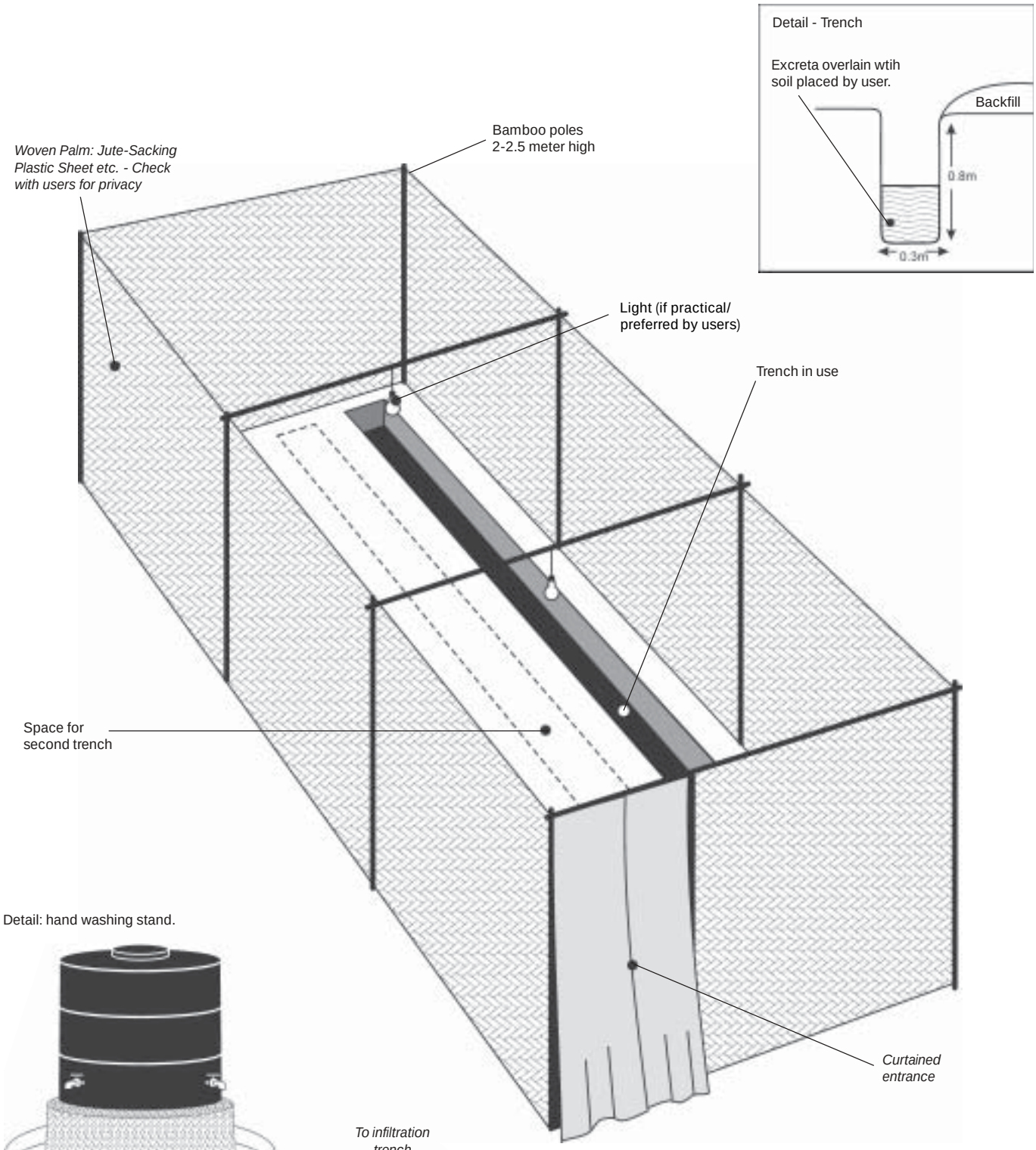
Users must be shown how to use a trench toilet – with male and female facilitators demonstrating to men and women separately. Users should be shown how to cover their excreta with a thin layer of earth to prevent fly-breeding.

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)

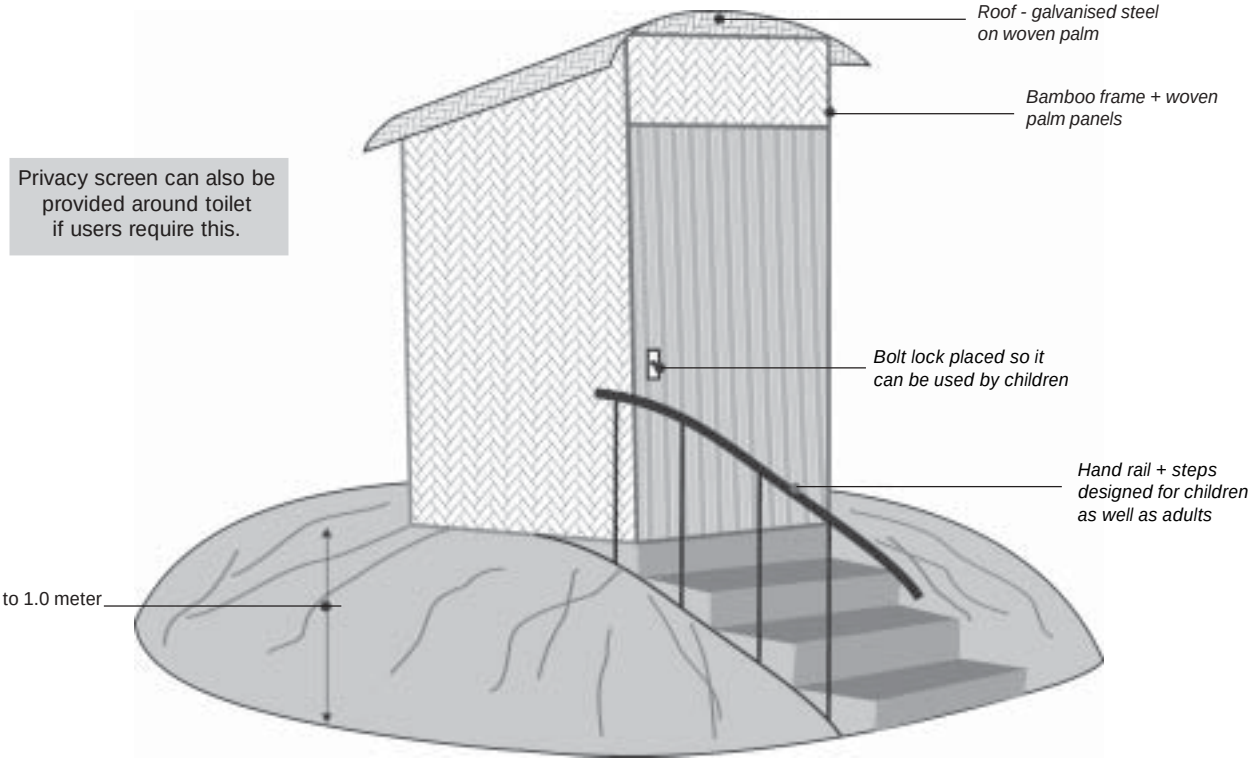
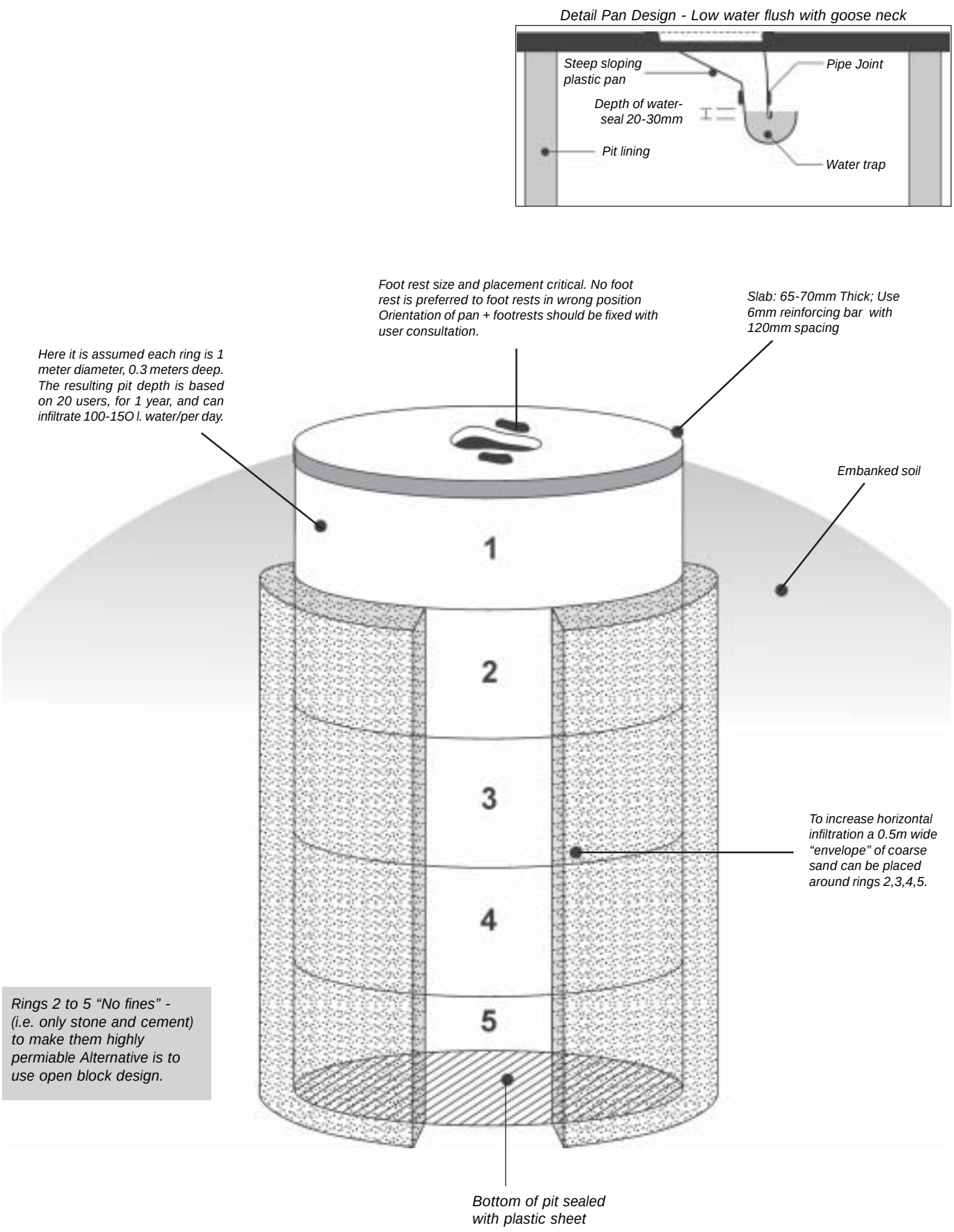


Figure 5: Detail of Raised Pit Toilet



7. Septic Tanks

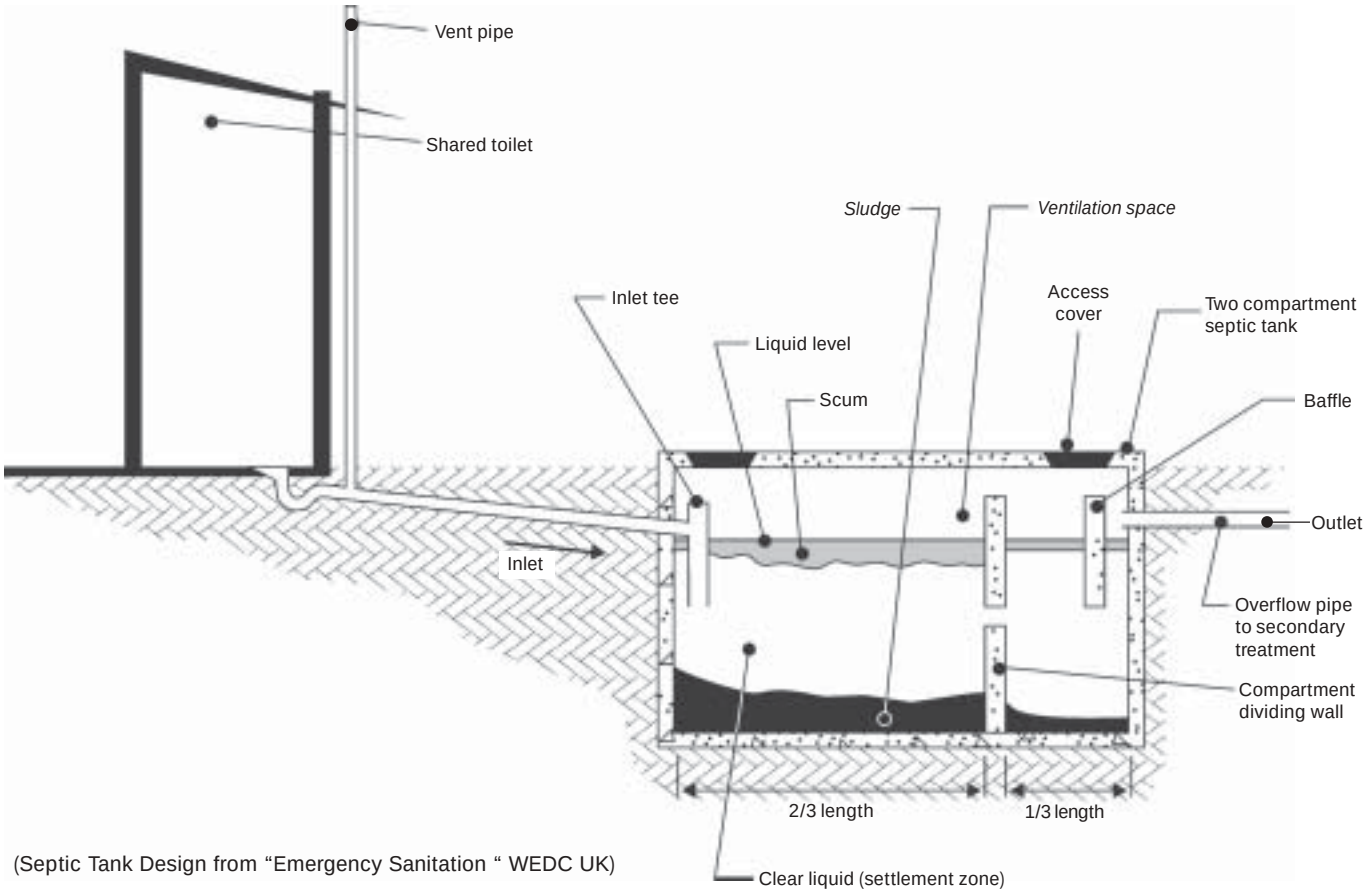
Septic tanks collect and treat excreta and wastewater. If properly designed and constructed, this can minimise the risk to groundwater pollution, albeit at considerably higher cost compared to a basic leach pit design. The design must be checked by a competent engineer. Construction and commissioning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

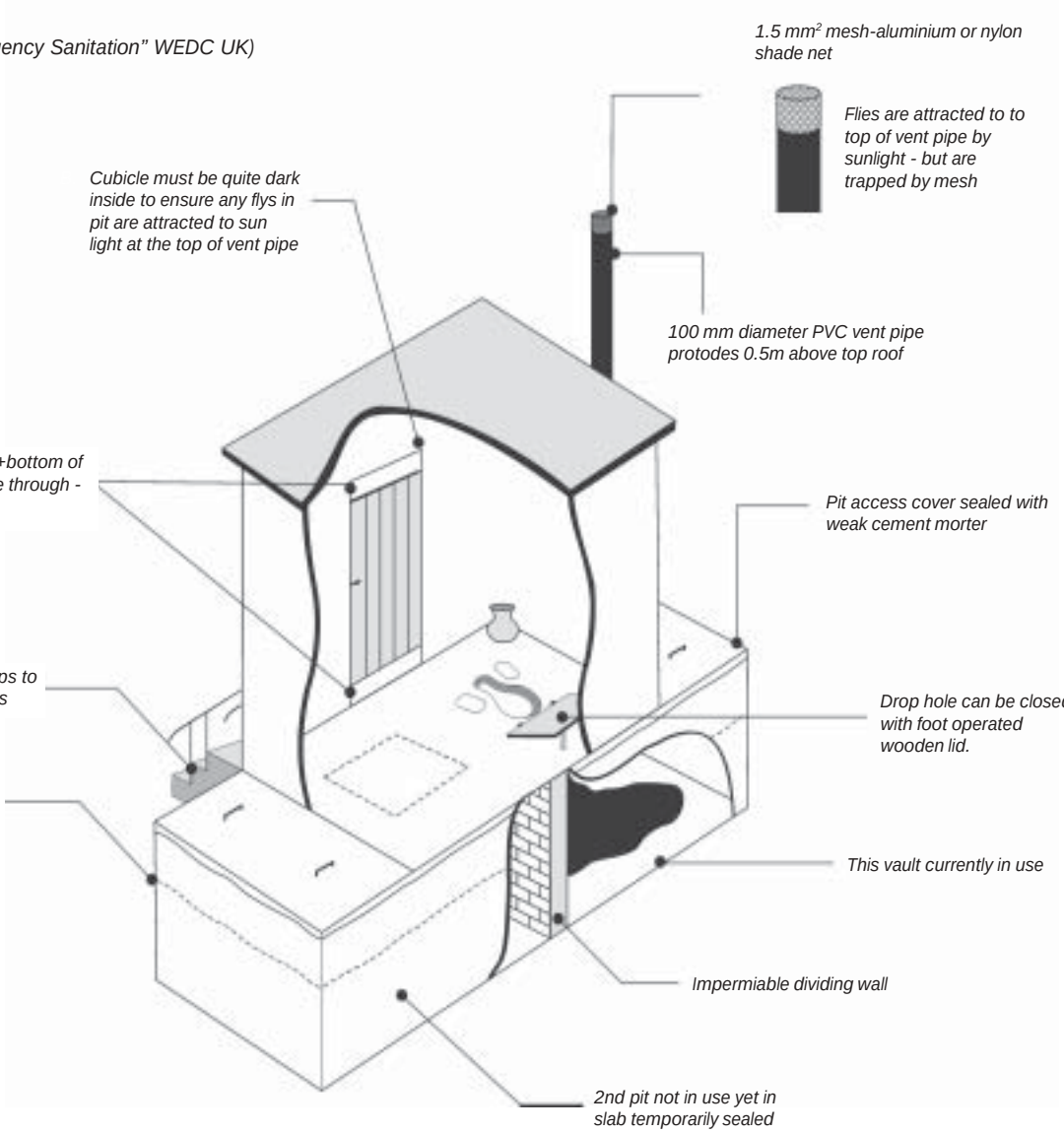
By comparison, an aerobic *composting toilet*, which manages urine, faeces and limited quantities of water together, may be a viable option, although it needs to be piloted first. In this case, bacteria, worms and other organisms break down faeces. Water input has to be regulated, to the extent that 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.

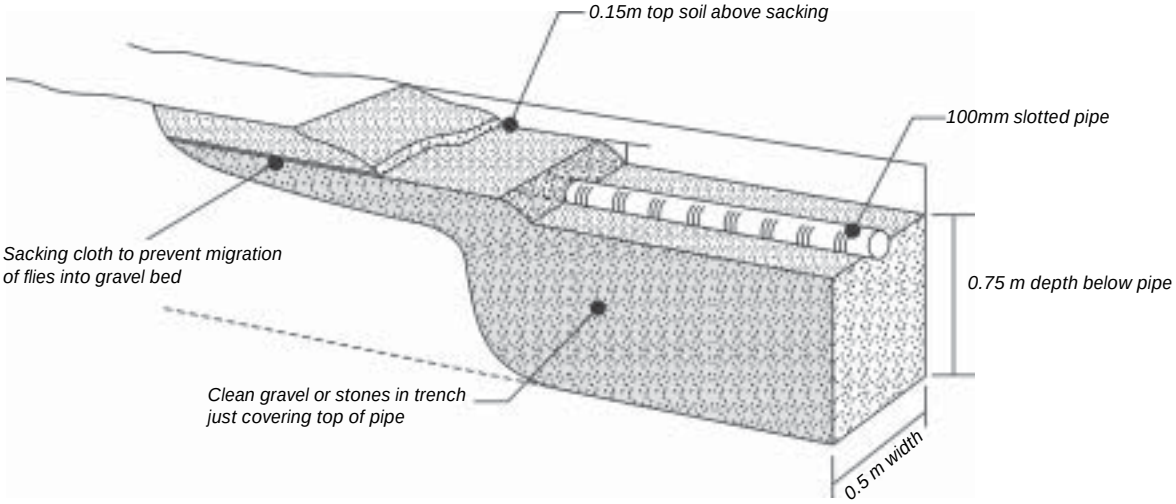
The top of the pipe is covered in sacking, itself covered with a 150 mm layer of topsoil. This allows air to enter and gases to escape, but prevents the topsoil mixing with the gravel and blocking the trench. The trench can be covered with a temporary roof structure during the monsoon to prevent the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

Source	Website	Remarks
SPHERE guidelines – Chapter 2	http://www.sphereproject.org/handbook/index.htm	Details of standards, indicators and guidance notes for water supply, sanitation and hygiene
WHO SEARO Emergency Fact Sheets on water supply and sanitation	http://wedc.lboro.ac.uk/WHO_Technical_Notes_for_Emergencies/	Series of 13 generic fact sheets summarising most aspects of water supply, sanitation and hygiene in emergencies
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

This field note has been prepared for WES-Net India with support from UNICEF. It is based on an assessment of Tsunami affected areas undertaken by REDR India. Additional information and designs have been adapted from various sources.

WES-Net India
WATER AND ENVIRONMENTAL SANITATION

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WES-Net is a recently created and expanding coalition of organisations involved in water supply sanitation and hygiene in India – NGOs, agencies, private sector and Government.

unicef
United Nations Children's Fund
UNICEF House, 73, Lodi Estate, New Delhi - 110 003, India