Public Water Corporation

MIWR – GONU

MWRI - GOSS

Technical Guidelines For the Construction and Management of Rural Health Institution Latrines

A Manual for Field Staff and Practitioners

April 2009

DEVELOPED IN PARTNERSHIP WITH

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Ministry of Irrigation and Water Resources – Government of National Unity

Foreword

Significant progress has been achieved in the provision of water and sanitation services in Sudan in the last few years. This is attributed to the increased access to many remote villages as a result of the three major peace agreements, the Comprehensive Peace Agreement (CPA) between north and south Sudan, the Darfur Peace Agreement (DPA) and the Eastern Sudan Peace Agreement (ESPA), that were signed in 2005 and 2006 respectively. This access has allowed the Ministries of Irrigation and Water Resource (MIWR) of the Government of National Unity (GoNU), state governments and sector partners (including NGOs and the private sector) to expand water and sanitation services in many areas. This prioritizing of the expansion and sustainability of water and sanitation services in urban and rural areas throughout the county, including to the nomadic population has resulted in a steady annual increase in water and sanitation coverage for the citizens of Sudan.

With this expansion in implementation, the MIWR recognized the need to harmonize the various methodologies utilized by the various actors in the implementation of water and sanitation interventions. It was agreed that this could be best achieved through the development and distribution of Technical Guidelines, outlining best practices for the development of the 14 types of water supply and sanitation facilities in the Sudan. These Technical Guidelines, compiled in a systematic manner will undoubtedly set standards and provide guidance for all water and sanitation sector implementing partners.

The MIWR of the GoNU of the Sudan is grateful to UNICEF, Sudan for financial and technical support in the preparation of the Technical Guidelines.

I believe these Technical Guidelines will go a long way to improving WES sector programmes, allowing for scaling up implementation of activities towards achieving the MDG goal for water supply and sanitation in Sudan.

Minister
Ministry of Irrigation and Water Resources
Government of National Unity, Khartoum

Date ………………………………………

Foreword

The historic signing of the Comprehensive Peace Agreement (CPA) in January 2005, culminated in the establishment of an autonomous Government of Southern Sudan (GOSS) and its various ministries, including the Ministry of Water Resources and Irrigation (MWRI). The CPA has enabled the GOSS to focus on the rehabilitation and development of the basic services. The processing of the Southern Sudan Water Policy within the framework of the 2005 Interim Constitution of Southern Sudan (ICSS) and the Interim National Constitution (INC) was led by the MWRI. This Water Policy is expected to guide the sector in the planning and monitoring of water facilities during implementation. The Water Policy addresses issues like Rural Water Supply and Sanitation (RWSS) and Urban Water Supply and Sanitation (UWSS). The Southern Sudan Legislative Assembly (SSLA) of GOSS approved the Water Policy of Southern Sudan in November 2007.

The importance of developing effective water supply and sanitation services is universally recognized as a basis for improving the overall health and productivity of the population, and is particularly important for the welfare of women and children under five. Considering the current low coverage of safe drinking water supply and basic sanitation facilities as a result of the protracted civil war in the country during the last five decades, there are enormous challenges ahead. With the unrecorded number of IDPs and returnees that have resettled in their traditional homelands and the emergence of new settlements/towns in all ten states of SS, the demand for water and sanitation services is immense. There is need for implicit policies, strategies, guidelines and manuals to ensure provision of sustainable supply of quality and accessible water and sanitation services.

The preparation of these WES Technical Guidelines at this stage is very timely, as it enables us to further develop our strategies and prepare action plans for the implementation of the Water Policy. It will also allow us to strengthen existing best practices as well as to test new experiences that will create room for future development.

During the development and finalization of these Guidelines for water supply and sanitation facilities, we have consulted WASH sector partners at State level and partner non-government agencies through successive consultative meetings, and appreciate their contribution, which has assisted in finalizing these documents.

The MIWR of the GOSS is thankful to UNICEF, Juba for financial and technical support for the preparation of these Technical Guidelines.

We call upon our WASH sector partners to give us their continuous feedback from the field for the improvement of these Guidelines. We believe that successful implementation and future sustainable service provision will depend on effective coordination and close collaboration among all partners including government, non-government and beneficiary communities.

Mr. Joseph Duer Jakok,
Minister of Water Resources and Irrigation
Government of Southern Sudan, Juba

Date ……………………………………….

Acknowledgements

Special thanks go to Mr Mohammed Hassan Mahmud Amar, Mr Eisa Mohammed and Mr Mudawi Ibrahim, for their directions on GONU's sector policy; Engineer Isaac Liabwel, on GOSS's water policy; Mr Sampath Kumar and Dr. Maxwell Stephen Donkor, for their direction on the WASH sector from the UNICEF perspective, and for the provision of relevant documents & information, and facilitating & organizing a number of forums to discuss draft documents.

The author would also like to thank WES and UNICEF staff of North Darfur, North Kordofan, South Kordofan, Sinnar, Gedaref, Kassala, Red Sea and Blue Nile States; the staff of DRWSS, and UWC in Central Equatoria, Western Bahr el Ghazal, Warap and Upper Nile States; and the staff of UNICEF Zonal Offices responsible for the arrangement of meetings with sector partners and successful field trips to the various facilities.

Many thanks to Emmanuel Parmenas from MWRI, and Mr Mohammed Habib and Mr Jemal Al Amin from PWC, for their contribution in collecting documents and information at the national and state levels, facilitating field trips and contacting relevant persons at state level and to the latter two for their support in translating documents and information from Arabic into English.

The completion of this document would not have been possible without the contributions and comments of staff of SWC, PWC, MIWR, MCRD, MWRI, MOH in GONU, MAF, MARF, MOH MHLE, MWLCT and SSMO in GOSS, UNICEF, National and International NGOs like Oxfam GB, Pact Sudan, SNV, SC-UK, and Medair, and review workshop participants at state and national levels and members of technical working groups.

Acronyms

ACU	**- Area Coordination Unit**
AP	**- Aqua Privy**
APO	**- Assistant Project Officer**
CPA	**- Comprehensive Peace Agreement**
DG	**- Director General**
DPA	**- Darfur Peace Agreement**
ESPA	**- Eastern Sudan Peace Agreement**
FMOH	**- Federal Ministry of Health**
GB	**- Great Britain**
GONU	**-Government of National Unity**
GOSS	**-Government of Southern Sudan**
GWWD	**- Ground Water and Wadis Department**
IRC	**- International Rescue Committee**
ITPL	**- Improved Traditional Pit Latrine**
MCRD	**- Ministry of Cooperatives and Rural Development,GOSS**
MIWR	**- Ministry of Irrigation and Water Resources,GONU**
MWRI	**- Ministry of Water Resources and Irrigation, GOSS**
NGO	**- Non-Governmental Organization**
NK	**- North Kordofan**
PFL	**- Pour Flush Latrine**
PO	**- Project Officer**
PVC	**- Polyvinylchloride**
PWC	**- Public Water Corporation**
RHS	**- Rectangular Hollow Steel**
RWC	**- Rural Water Corporation**
Sanplat	**-Sanitation platform**
SC	**- Save the Children**
SMOH	**- State Ministry of Health**
SPO	**- Senior Project Officer**
SWC	**- State Water Corporation**
TPL	**- Traditional Pit Latrines**
UNDP-TAG	**- United Nation Development Program Technical Advisory Group**
UNICEF	**- United Nation Children's Fund**
USA	**- United States of America**
VIP	**- Ventilated Improved Latrine**
Watsan	**- Water and Sanitation**
WES	**- Water and Environmental Sanitation**
WFP	**- World Food Program**

Definition of technical terms

Composting	The process of converting biodegradable contents of human excreta into useful manure or fertilizer.
Human excreta	Waste matter discharged from human body e.g. faeces or urine
Sanitation	Conditions or procedures related to the collection and disposal of sewage and garbage. In these Guidelines, this refers to the safe collection and disposal of human excreta..
Squatting slab	A slab in the latrine for the facilitation of squatting to relieve excreta from the body.
Vault	Burial chamber. In these Guidelines, this refers to the chamber in ecosan latrines, used for retention and decomposition of faeces

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Document **Summary**

This summary provides a brief overview of the document and is only meant as a quick reference to the main norms. Reference to the whole document is advised for accurate implementation.

Norms

Rural health institutions in Sudan refer to clinics, health centers, and health posts in non-urban areas. Latrines constructed in these institutions should comply with the following basic requirements.

- Latrines should be hygienic, free from bad smells, inaccessible to flies and other insects, and should not contaminate ground water.
- The presence of a sanitary latrine should promote good hygiene behaviour .
- Latrines should be simple in design and the construction, operation and maintenance of the facility should be easy enough for semi-skilled personnel.
- Latrines should ensure safe disposal of excreta.
- Latrines should be culturally acceptable to the users and allow regular service without interruption.
- Latrines should be low-cost and should allow as much as possible the use of locally available materials that do not impact the environment negatively
- They should provide the minimum requirement of safety and privacy to the users (patients and health workers).
- Every latrine should have the following basic components:
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    - A platform on which the user can squat to defecate easily and safely. The platform may have a squatting pan, a simple drop hole or a straight pipe. The number of drop holes or pans depends on the number of users. On average, one drop hole is sufficient for some 50 people in a day.
    - Where it is anticipated that emptying of the pit is possible, a manhole should be provided on the slab or the squatting slab is easily removable from the pit.
    - A superstructure to provide privacy. Vent pipes with fly screens should be provided outside of the superstructure.
    - A substructure (pit) for storage and disposal of excreta. In unstable soil condition, the pit must be lined with locally available materials like bricks, stones etc.
    - A hand washing facility to promote good hygienic practices.
    - .

Design and construction

- For each health institution, ensure one sanitary latrine for 50 users, with a minimum of 3 squatting slabs; one for women, one for men and a separate one for the staff.. A minimum space of width of 1.50m and length of 1.50m should be provided for every squatting space.
- Pits can be rectangular or circular, base don the soil type: Circular pits in loose formation and rectangular pits in hard and stable formation.

- Although a minimum distance of 15m is allowed in other countries, in Sudan it is recommended that pits are located at a minimum distance of 30 to 50 meters away from drinking water sources (tube wells and hand dug wells) depending on soil condition. The distance depends on hydro-geological conditions such as texture of the soil and groundwater depth and flow. When groundwater levels are high or when the soil is too hard to dig, the pit may have to be raised above ground level.
- Hand washing facilities must be provided beside each latrine.
- A bin for hygienic disposal of sanitary materials must be provided in every chamber in the latrine.

1. Introduction

1.1 The purpose of this document

The Ministry of Irrigation and Water Resources (MIWR), GONU, and the Ministry of Water Resources and Irrigation, (MWRI), GOSS, are responsible for the policy and strategy development, coordination, planning, management, monitoring and evaluation of water supply and sanitation facilities in the country. In order to reduce disparities, improve standards, accelerate implementation and to standardise design and costs, the two ministries agreed to harmonize the methodologies utilised in the implementation of WATSAN interventions Currently, there is no standardised document providing Technical Guidelines for implementation by WES or other water and sanitation agencies and this is detrimental to the longevity of structures and the sustainability of interventions.

In 2006 MIWR and MWRI decided to develop Technical Guidelines for the construction and management of rural water supply and sanitation facilities. These Guidelines are a collection of global and national good practices in water and sanitation that have been collated. The process of the development of the Technical Guidelines is outlined in Annex 1.

These simple Guidelines are primarily intended as a reference for field staff and practitioners in the water and sanitation sector challenged by situations and conditions in the field.

Updating of the Guidelines is recommended biennially; to ensure newer and better practices are incorporated as they are developed/ introduced. Water and sanitation sector implementing partners should contribute in providing feedback to the MIWR and MWRI as necessary during the updating.

1.2 Available sanitation technology options

Sanitation systems worldwide can be classified into two major categories, namely: off-site and on-site sanitation systems. The conventional sewerage system with proper treatment and disposal, and small-bore sewers are classified as off-site sanitation systems whilst, others such as dry pit latrines, borehole latrines, ventilated improved pit latrines, eco-san latrines, pour-flush latrines (with single or twin pits), aqua privies, composting latrines (like eco-sans), and septic tanks fall under on-site sanitation systems.
The off-site systems are not suitable in peri-urban and rural areas of developing countries like Sudan for the reasons indicated below:
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- A Conventional sewerage system is highly capital intensive and beyond the financial resources of the communities in developing countries and particularly for scattered and small populations. It also involves sophisticated treatment systems and skilled operators for management, operation and maintenance and a large quantity of water is wasted in flushing toilets. In rural areas, where the density of the population is relatively low and houses are scattered and at great distances, the cost of a conventional sewerage system is neither cost effective nor sustainable.

- Small-bore sewers are cheaper than conventional sewerage systems. They have been constructed in few places but have not been very successful and replicated. The main requirement is that the sewage should not contain settle-able solids, which have to be arrested in intercepting tanks that are provided at individual dwellings. The intercepting tanks have to be cleaned at short intervals. In practice, it is very difficult to ensure such regular attention and the system can get choked and fail to function properly. The effluent has to be treated before it can be disposed off on land or into a water source. As the cost of treatment is high, small-bore sewers are also considered unsuitable for rural areas.

Appropriate low cost on-site sanitation technologies which are affordable, hygienic, culturally acceptable, environmentally friendly and sustainable are the best option for rural areas in developing countries like Sudan, especially in rural health institutions.

2 General design considerations for on-site sanitation

"On-site sanitation can be defined as a system where human excreta are retained and treated on the site of defecation in a way that is hygienic and does not adversely affect the environment."[1]

To ensure the establishment of a successful system, the following factors should be considered in the planning and designing of on-site sanitation facilities.

- Affordability: Without compromising the basic and minimum requirement of health and environmental protection, and the engineering aspect, the affordability of the system should be a priority for the health institution. To promote low-cost sanitation, local authorities must have a choice regarding material, construction and type of superstructure depending on their financial capacity.
- Aesthetics: The system should be such that it is free from smell, flies and other insects. The superstructure should provide the minimum amount of privacy required, especially for the female students. The disposal system must be designed so that it does not create any environmental nuisance by way of vector breeding or water logging, nor foul the environment with bad odours.
- Social customs and habits: If water is used for anal cleansing a pan with a water seal should be suitable, otherwise the seat does not need a water seal. Many cultures consider human excreta as a dangerous and unpleasant waste product and will not handle it even when it is fully decomposed. A final disposal system like a pit latrine would be suitable in this case.
- Soil conditions: The soil should act both as a seepage system for the liquid and also as a filtering media for the removal of pathogens. The soil absorption system should also

[1] WHO

allow for minimum liquid residence time before it reaches a water source. In well consolidated and aggregated fine sand and clay, the vertical layer of about 0.7m should trap most pathogenic microorganisms. If however, there is doubt that the ground water may get polluted; the pits must be made water tight. This is achieved by adding an impermeable envelope at the bottom and around the lining of the pit. A minimum 0.7m vertical layer should be secured between the bottom of the pit and ground water level in these types of soils.

- Contamination of ground water: If the soakage or leach pit is constructed close to an underground source of water such as a hand pump or well, a minimum distance of at least 50m must be maintained between the pit and the water source. This is to prevent bacteria contamination of the water source. In porous soil of fine sand and clay, the ground water velocity would depend on hydraulic gradient and pore size. In fine sand (<0.2mm) and hydraulic gradient <0.01, the velocity would be <1m/day. Given that bacterial survival time is 10 days, a separation limit of 10m would be adequate for such hydrogeological conditions. However, situation specific requirements are recommended for adverse hydrogeological situations. If soil strata is rocky but fissured or the soil is too porous (coarse sand, limestone formations, etc) a sand envelope should be provided around the pit. Otherwise faeces need to be composted in water-tight compartments.
- Water logging: Where the area gets water logged the platform and pits should be constructed slightly above the ground to create a mound around them.
- Limited availability of water: Where water is used for anal cleansing, hand flushing of the excreta/urine using a small portable water container may be practiced as it uses less amount of water than proper water flushing. Where the use of paper and other materials is an option for anal cleansing, this should be encouraged with proper disposal arrangements to check undesirable smells and breeding of flies and insects.
- Reference: Further information or clarification can be obtained from to the WES Coordination Office at PWC, GONU or DRWSS, GOSS and WES Project Offices of SWC at state levels.

3 Mobilization of stakeholders

The stakeholders concerned with rural health institution latrines are patients and other users, community leaders, health workers, health authorities, authorities from local and national administration, NGOs and donors.

Identifying and mobilizing potential stakeholders is an important step in the realization and sustainability of a sanitation facility in rural areas and will help in the timely mobilization of resources. Various stakeholders play various roles at different stages of a project cycle. Roles and responsibilities can be assigned using participatory techniques like participatory rural appraisal. Involvement of the primary users of the facilities in decision making at all stages of the project will guarantee proper use and sustainability of the sanitation facilities, for example in proper site selection, technology choice, identification of design preference like hand washing facilities, etc. Particular attention should be, therefore, given to their involvement and decision making role.

Local authorities also play a significant role in the facilitation of the implementation of the sanitation facilities. Problems that may arise during the implementation of the water supply system sanitation facilities such as for example, land ownership, could be easily solved if the local authorities are brought on board and are involved in the decision making process. Problems can only be identified by the active involvement of all stakeholders.

4 Guideline for the selection of the type of latrines to be constructed in a rural health institution

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Rural health institutions in Sudan refer to clinics, health centers, and health posts in non-urban areas. Latrines constructed in these institutions should comply with the following basic requirements.

- Latrines should be hygienic, free from bad smells, inaccessible to flies and other insects, and should not contaminate ground water.
- The presence of a sanitary latrine should promote good hygiene behavior.
- Latrines should be simple in design and the construction, operation and maintenance of the facility should be easy enough for semi-skilled personnel.
- Latrines should ensure safe disposal of excreta.
- Latrines should be culturally acceptable to the users and allow regular service without interruption.
- Latrines should be low-cost and should allow as much as possible the use of locally available materials that do not impact the environment negatively
- They should provide the minimum requirement of safety and privacy to the users (patients and health workers).
- Every latrine should have the following basic components:
-
    - A platform on which the user can squat to defecate easily and safely. The platform may have a squatting pan, a simple drop hole or a straight pipe. The number of drop holes or pans depends on the number of users. On average, one drop hole is sufficient for some 50 people in a day.
    - Where it is anticipated that emptying of the pit is possible, a manhole should be provided on the slab or the squatting slab is easily removable from the pit.
    - A superstructure to provide privacy. Vent pipes with fly screens should be provided outside of the superstructure.
    - A substructure (pit) for storage and disposal of excreta. In unstable soil condition, the pit must be lined with locally available materials like bricks, stones etc.
    - A hand washing facility to promote good hygienic practices.

5 Rural health institution latrines

5.1 Types of rural health institution latrines

The types of latrines that have been considered for comparison include: Pour-flush latrines (water based latrines), ventilated improved pit latrines, improved traditional pit latrines, aqua privies (water based latrines) and composting (Ecosan) latrines.

Pour-Flush (PF) Latrine with Leaching Pit

The PF has a squatting pan with a water seal, in addition to a leaching pit and the superstructure, The squatting pan and the water seal can be fixed independently or on top of the pit. When the pan is fixed independently, a connecting pipe is necessary to convey the excreta with the flushed out water to the leaching pit.

This type of on-site sanitation facility is appropriate for rural and peri-urban areas where there is sufficient water for flushing and the soil is permeable. This design reduces smells and the breeding of flies, and is also appropriate when water is used for anal cleansing. About 2 to 5 litres of water is required for flushing depending mainly on the pan design and the distance to the pit; less water is required for a shorter distance.

Ventilated Improved Pit (VIP) Latrines

The VIP have two major components; an underground pit to accumulate the excreta, and a superstructure for squatting and which provides privacy and shelter from rain, sun etc. The pit is covered either by a concrete or plastic slab. The pit may or may not be lined. There are vent pipes attached to the pit that let the foul air out from the pit. The drop hole is always open and the squatting space is always be dark.

The user can choose the construction material for the superstructure, which can be local bricks or wood for the walls and thatch or corrugated iron for the roof.

These types of latrines are appropriate for rural institutions like schools. They can be constructed from locally available material and need only semi-skilled labour. A VIP can be easily replicated. This design reduces smells and the breeding of insects.

A VIP latrines differs from a traditional latrine only through the attachment of a vent pipe covered with a fly screen. Wind blowing across the top of the vent pipe creates a flow of air which sucks out the foul smelling gases from the pit. As a result fresh air is drawn into the pit through the drop hole and the superstructure is kept free from smells. Flies that enter the pit through the drop hole are attracted to light and if the latrine is suitably dark inside, the flies will fly up the vent pipe to the light. They cannot escape because of the fly screen, so they are trapped at the top of the vent pipe until they dehydrate and die.

The cost for this type of latrine includes: materials (60-80%), transport (5-30%), and local labour (10-25%). %). The cost also depends on the volume of the pit, quality of lining (when lining has been applied), slab and superstructure, the use of locally available materials, and the region of implementation.

Composting (Ecosan) Latrines

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This type of latrine can be constructed with single or double vaults, and consists of watertight chamber(s) to collect faeces. Urine is collected separately as the contents of the vault need to be kept relatively dry. The urine is diverted to a urine container placed outside the latrine and can be diluted with 3 to 6 parts of water for use as a fertilizer for a vegetable or fruit garden. Otherwise, it can be diverted away to a soak-away pit. In areas where water is used for anal cleansing, a separate diversion system should be incorporated so that this water can be diverted to a soak-away pit.

The pedestal or squatting plate should therefore have three sections: one that allows faeces to go down to the pit, one to convey urine to a urine collection container (pot) and one to carry waste water from anal cleansing to a soak-away pit.

A separate location for faeces composting should be allowed for a single vault ecosan latrine. The organic soil fertiliser will be pathogen free and ready for use in a year. This type of latrine is appropriate in areas where people would consider the use of human excreta as a fertilizer.

Ecosan latrine replicates nature by returning the plant nutrients in human urine and faeces to the soil. Instead of polluting the environment, human urine and faeces are used to improve soil structure and supply nutrients[2].

Improved Traditional Pit (ITP) Latrines

This type of latrine is non-water based and appropriate for rural institutions like rural clinics and health centres. It is simple enough to be constructed with local materials by unskilled and semi-skilled labour. It doesn't, however, guarantee reduction of smell and breeding of flies. On the other hand, water is not used for anal cleansing and flushing. A small amount of water that is required for cleaning of the surface of the squatting slab may be allowed to get into the pit

The cost for this type of latrine includes: materials (50-80%), transport (0-25%), and local labour (15-35%). The cost also depends on the volume of the pit, quality of lining (when lining has been applied), slab and superstructure, the use of locally available materials, and the region of implementation.

Aqua Privies (AP)

Aqua privies are more appropriate for rural and semi-urban areas where water is available and the service of emptying the pit is not a problem. This system requires a soak away that will allow the liquid effluent to soak into the ground. Raw sewage is a health hazard.

5.2 Steps in selection of different types of rural health institution latrines

The appropriateness of the latrines discussed above, for any health institution, depends mainly on availability of water in the institution and a proper method of disposal of the

[2] Ecological Sanitation, editors and co-authors; Uno Winbald and Mayling Simpson-Hébert

content (excreta) of the pit. Stakeholder consultation is essential to decide on the type of latrine to be constructed. Health workers, local authorities, health institutions, and community representatives should be made aware of the cost related to each type and the amount of contribution expected from them. The end-users must also be shown how to ensure proper function of the latrine. Roles and responsibilities for operation, maintenance and replacement must be discussed and fully accepted by all stakeholders. Table 1 compares the pros and cons of the various types of latrine suggested above.

Table 1: Comparison of different types of latrines against some criteria set under section 2

Type of latrine	Affordability in terms of cost	Reduces smell and insect breeding	Suitable for Social customs and habits		Water requirement for flushing	Possibility of use of the nutrients of excreta
			Water users	Non water users		
ITP	It is the cheapest of all	No	Not appropriate as it gets filled quickly	Appropriate	No	No
VIP	More expensive than ITP	Yes	Not appropriate as it gets filled quickly	Appropriate	No	No
PF	More expensive than AP and ecosan, if it is twin pit	Yes	Appropriate	Not appropriate	Yes	No
Ecosan	More expensive than ITP and single pit VIP	No	Not appropriate	Appropriate	No	Yes
AP	More expensive than ITP and VIP	Yes if the level of the liquid is properly maintained	Appropriate	Not appropriate	Yes	No

The type of rural health institution latrine constructed must support the hygiene messages disseminated. In this regard a water based type of latrine should be prioritized above all other types.

If a school can afford the cost and water is available for flushing, a PF type would be the best option; either a single pit (where recycling of human waste is unacceptable) or double pit where recycling of human excreta as a fertilizer is acceptable. The permeability of the soil must be right for the leaching pit(s) to function properly.

Where a PF latrine is not feasible an ITP latrine would be the next option. This type of latrine does not however, guarantee reduction of smell and breeding of flies. In most cases, it is difficult to promote hygiene education, where reduction of smell and breeding of flies are not guaranteed. It might, however, be appropriate where water is not being used for anal cleansing and where water for flushing is not needed.

Other types of latrines like VIP, aqua privies, composting latrines are not considered suitable for the following reasons:

- VIP latrines require a dark superstructure for efficient performance, and this is not appropriate for patients like the elderly, children, pregnant mothers, etc. Where stool examinations are provided, a water based system would be essential to allow flushing. Water for flushing is restricted in VIP latrines.
- Aqua privies, although water based, require a soak away pit and regular emptying of the pit. This may be problematic for health institutions as the content of the pit is unhygienic, and needs special handling.
- AP latrines require a large and water tight tank to accommodate both human faeces and liquid before the effluent is directed to the soak pit. This makes the construction cost very expensive.
- Composting latrines require commitment of using the human waste as fertilizer after emptying the vaults. They also restrict the use of water for anal cleansing and this may not be acceptable by the primary users. There is also no guarantee in restricting of harmful disposable materials reaching into the vaults. These harmful disposable materials may not be decomposed in the vaults.

6 Design and construction of latrines for health institutions

6.1 Design and construction

Minimum standards

- For each health institution, ensure one sanitary latrine for 50 users, with a minimum of 3 squatting slabs; one for women, one for men and a separate one for the staff.. A minimum space of width of 1.50m and length of 1.50m should be provided for every squatting space.
- Pits can be rectangular or circular, base don the soil type: Circular pits in loose formation and rectangular pits in hard and stable formation.
- Although a minimum distance of 15m is allowed in other countries, in Sudan it is recommended that pits are located at a minimum distance of 30 to 50 meters away from drinking water sources (tube wells and hand dug wells) depending on soil condition. The distance depends on hydro-geological conditions such as texture of the soil and groundwater depth and flow.
- When groundwater levels are high or when the soil is too hard to dig, the pit may have to be raised above ground level.
- Hand washing facilities must be provided beside each latrine in every rural health institution.
- A bin for hygienic disposal of sanitary materials must be provided in every chamber in the latrine.

6.1.1 Volume of the pit

Pits can be rectangular or circular. The volume of the pit may be calculated from the equation

$$V = A + B$$
$$V = 0.3CPN + 0.75 \times w \times l \times h \ldots\ldots\ldots\ldots \text{for rectangular pit}$$
$$V = 0.3CPN + n \times 0.75 \times h \times \Pi \times d^2 /4 \ldots \text{for series of circular pits}$$

Where:
A is volume of accumulated sludge and is equal to 0.3 CPN in m^3.
B is volume of free space above the sludge and is equal to (0.75 x w x l x h) for rectangular pit or (n x 0.75x hΠxd^2/ 4) for circular pit in m^3
C is sludge accumulation rate or effective capacity per capita per year in m^3/c/y. This figure varies from 0.04 to 0.09[3] and 0.045 to 0.050[4]. For Sudan situation it was arbitrarily taken as 0.06m^3/c/y even though there are no available researched data for this.

P is the number of visitors using the latrine.

N is the number of years the pit is to be used before emptying.

h is the most top depth of the pit which is 1 m in this case

w is the width of the pit in m

l is the length of the pit in m

d is the diameter of a single pit in m

The factor 0.3 has been introduced taking into considerations that such latrines are not going to be used during certain hours of the day, and a factor 0.75 has been introduced as the pit is to be emptied or filled with earth when the level of the waste in the pit has a free space of one quarter of a meter from the squatting level.

6.1.1.1 Pour-Flush Latrine with Leaching Pit (Figures 1 to 3)

This type of latrine is recommended only where there is adequate water in the school for flushing and the soil conditions allow adequate infiltration of the liquid into the surrounding media. A Pour-flush latrine with a leaching pit is installed with a pan with a water seal (a U-shaped conduit partly filled with water) in the defecation hole. This overcomes the problems of flies, mosquitoes and odour. After use, the latrine is flushed by pouring water into the pan. The concrete floor slab with the pan is either on top of the leaching pit (direct system) or a short distance away (offset system). Pits are usually lined for strength, but adequately permeable for infiltration.

[3] Engineering in Emergencies, second edition 2002, Jan Davis and Robert Lambert

[4] Indian research institutes and UNDP TAG- Global projects

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In offset systems a short length of sufficiently sloping PVC tube leads from the U-trap down to the pit

The size of the leaching pit depends on a number of factors such as: soil properties, number of users, water table conditions and the quantity of water being used for flushing and anal cleansing. The volume of the pit can be calculated using the equation given above, but it is recommended from experience that the volume is increased under wet condition by 50% over that in dry conditions. In this regard the required volume will be $8.1m^3$ $((0.3 \times 0.06 \times 100 \times 3 + 2 \times 0.75 \times 1.0 \times \Pi \times (1.5)^2 /4))$

6.1.1.2 Improved traditional pit latrines (Figures 4 to 7)

A traditional pit latrine usually consists of a single rectangular or circular pit covered by a reinforced concrete slab. Each latrine will have 3 drop holes which would suffice a health institute serving about 100 visitors in a day.

The volume of a pit can be calculated using the equation given above. For example for a health institution to serve about 100 visitors a day and sludge accumulation of 0.06 m3/p/y in a pit in three years period , the accumulated sludge volume will be 5.4m3 which requires a rectangular pit size of width of 1.2 m, length of 2.4 m and depth of 2 m. A circular pit that has a diameter of 2m will have equal volume. In order to allow the pit to serve for more than three years, the depth of the pits could be increased from 5 to 7 meters. Therefore, the minimum dimensions of the pits should be as indicated below.

Rectangular pit[5]: 1.2m of width, 2.4m of length and 5-7m of depth,
Circular pit: 2m of diameter and 5-7m of depth.

6.1.2 Depth of a pit

6.1.2.1 PF Latrine

A latrine with two circular leaching pits of diameter 1.5m each and 4.5m depth would be enough to serve about 100 visitors a day, These dimensions, can be adjusted based on the availability of space. An additional depth of 0.5m for freeboard would be sufficient to provide for leaching pits.

6.1.2.2 ITP Latrine

The depth of an ITP pit may vary from 5 to 7 meters depending upon the stability of the soil. As a general rule, in areas where surface water is expected to flood, the lining of the latrine and squatting slab must be raised above the expected line of flooding (at least by 0.15m). Where digging is difficult due to hard formation, the pit can be constructed above the hard formation, and the lining and squatting platform raised above ground level in order to acquire the desired pit volume. The lining must, in this case, be water tight to avoid seepage out of the latrine and to prevent surface water getting into the latrine.

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[5] These dimensions should not be considered as absolute. They will depend on the availability of space, and may be changed by the designer.

6.1.3 Lining of a pit

6.1.3.1 PF Latrine

The pit can be lined with bricks or stones and should allow infiltration of the liquid part into the soil.

6.1.3.2 ITP Latrine

The pit must be lined if the soil condition is loose or unstable, with locally availed red bricks or stones. Where the pit is rectangular, additional reinforcement is required with intermediate beams around the lining at one third and two thirds of the depth of the pit (in addition to the top and bottom tie beams). There is not need to line this pit in stable soil; however, care should be taken to ensure that rainwater does not enter the pit. This is done by raising the floor by at least 0.15m. A proper foundation for the reinforced concrete slab with a minimum depth of 0.5m should also be constructed.

6.1.4 Squatting platform (reference below is to the cover slab??)

6.1.4.1 PF Latrine

The cover slab of the leaching pit is circular slab and is usually from reinforced concrete. The slab has a thickness of 75mm. The squatting platform can be constructed separately from that of the leaching pit. The squatting slab is usually a concrete floor with a pan (made from concrete, ceramic or fiber reinforced plastic) with a U-water seal attached (refer Figure 3.2). A PVC pipe of minimum diameter of 100mm further connects the U-seal with the leaching pit. Manholes are included at appropriate positions. The shorter the connecting pipe, the less water required for flushing. The concrete mix ratio of cement:

sand: aggregate should be 1:2:4, complying to British Standard 5328. According to this standard, $1m^3$ of reinforced concrete (in mild conditions), requires 6 bags of cement (each 50kg), 490 liters of sand and 800 liters of aggregate. are required.

6.1.4.2 ITP Latrine

The squatting platform could be constructed from one monolithic reinforced concrete slab cast in-situ or two removable slabs supported by an additional central beam. The slab has a thickness of 10cm. The concrete mix ratio of cement : sand : aggregate by volume should be 1:2:4, complying to British Standard 5328. According to this standard, $1m^3$ of concrete will require 6 bags of cement (each 50kg), 490 liters of sand and 800 liters of aggregate under mild conditions.

The squat holes can be covered with a lid made of a suitable locally available material e.g a wooden plank. This will prevent the entry of flies and other insects into the pit and reduce odours. A handle should be attached to the lid to facilitate lifting for users.

During emergencies, however, plastic or concrete slabs of size of 600x800mm or 1000x1200mm can be used in the early stages of the emergency. However, supporting beams (100mm in diameter and 1400mm in length) must be provided, two beams per slab. These beams can be made from locally available wooden planks (preferably termite resistant)
.

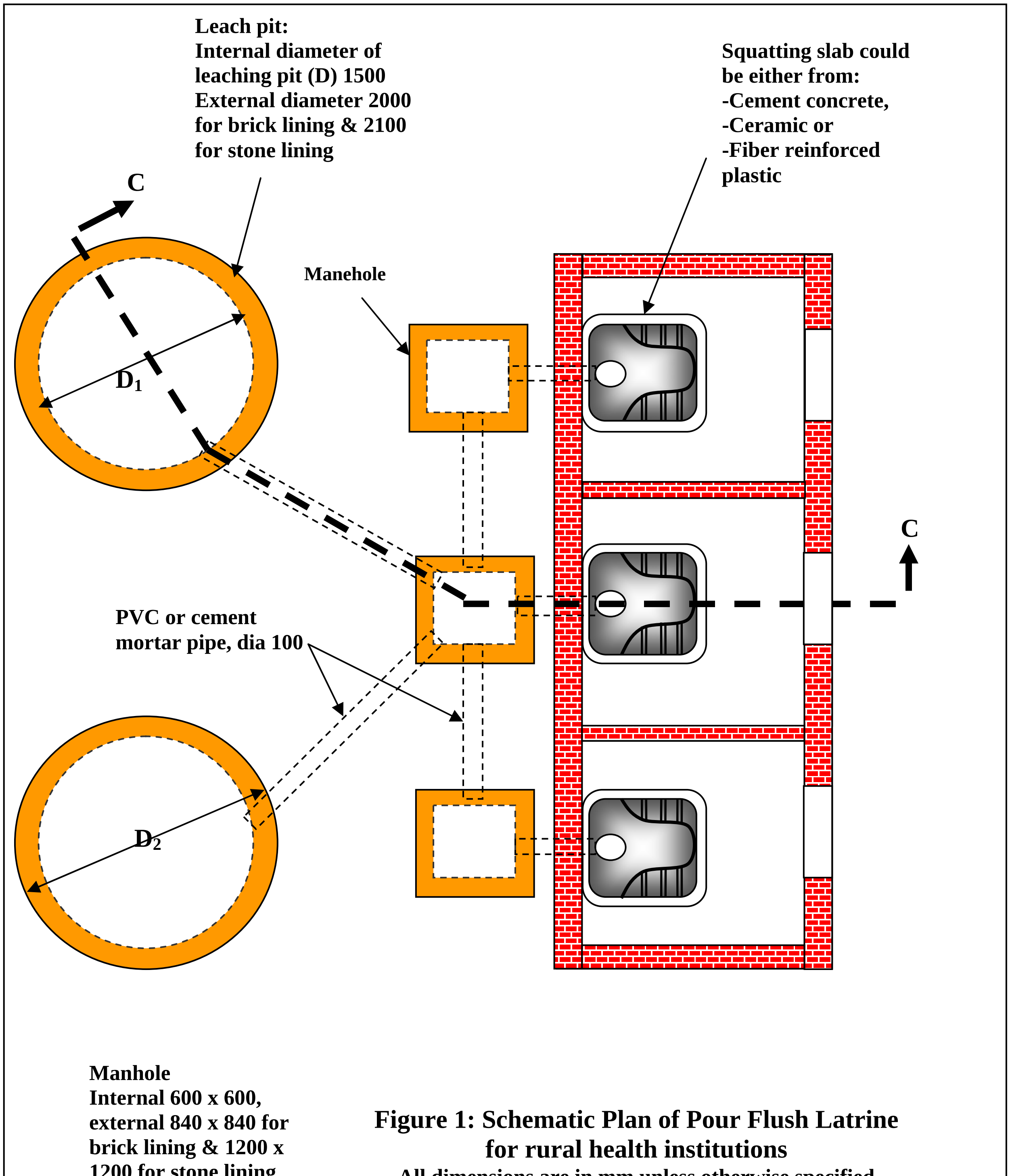
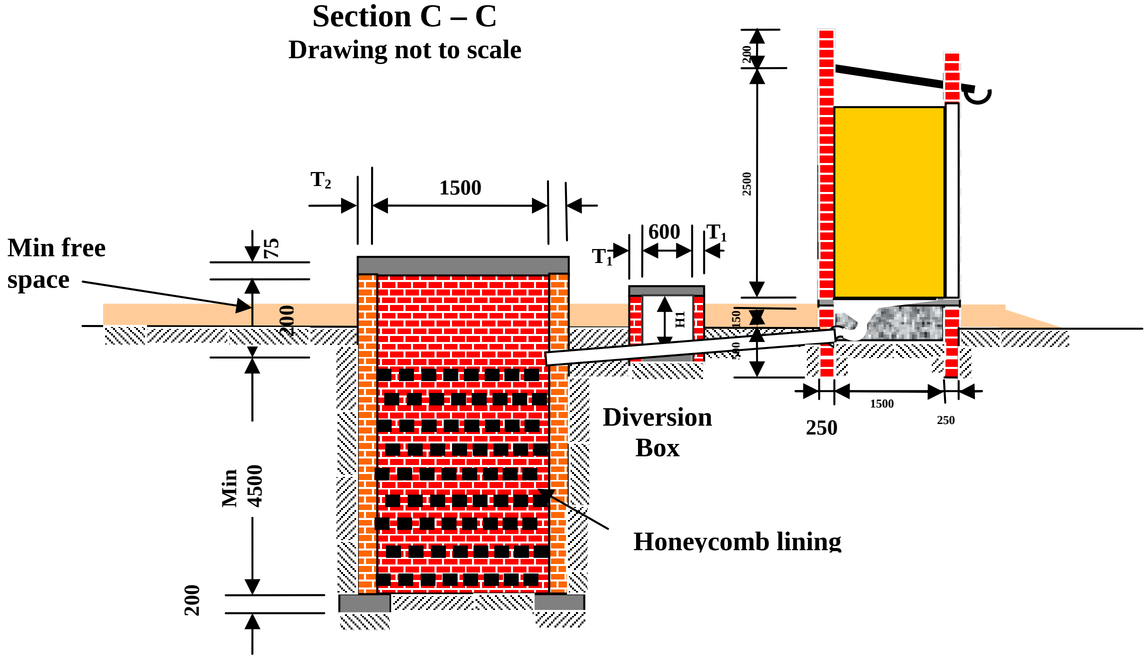


Figure 1: Schematic Plan of Pour Flush Latrine for rural health institutions

All dimensions are in mm unless otherwise specified

Section C – C
Drawing not to scale



	Minimum thickness	
	T_1	T_2
Brick wall	120	250
Masonry wall	300	300

Note:
-The walls of diversion box, manholes and leaching pit should be raised by min 150 from the ground level to protect them from any possible flooding.

-The depth of a diversion box (H_1) depends on the slope of the connecting pipe. However the minimum internal depth should not be less than 200.

Detail of squatting slab

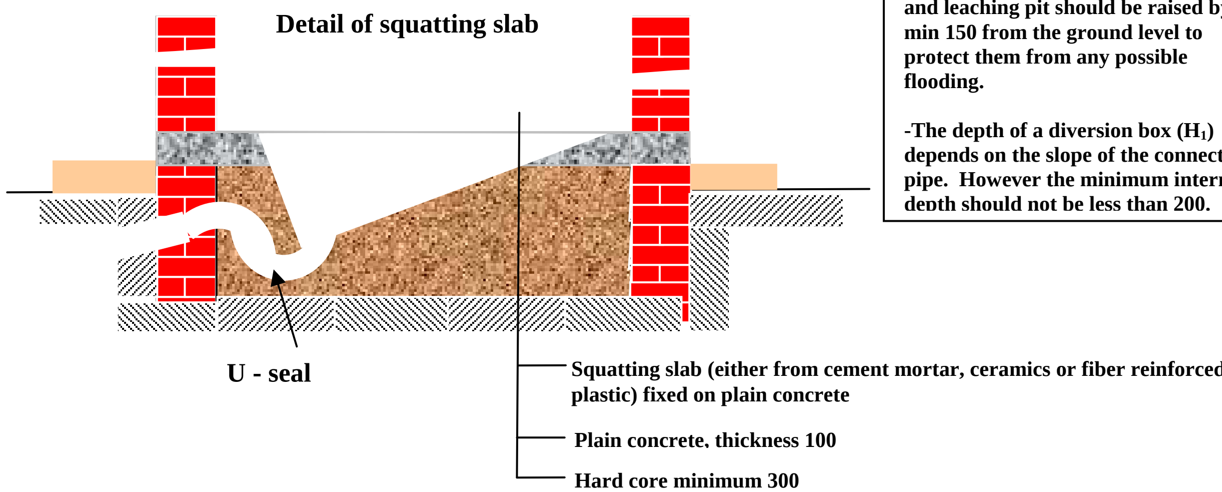


Figure 2: Sectional Drawing of Pour Flush Latrine for rural health institutions
All dimensions are in mm unless otherwise specified

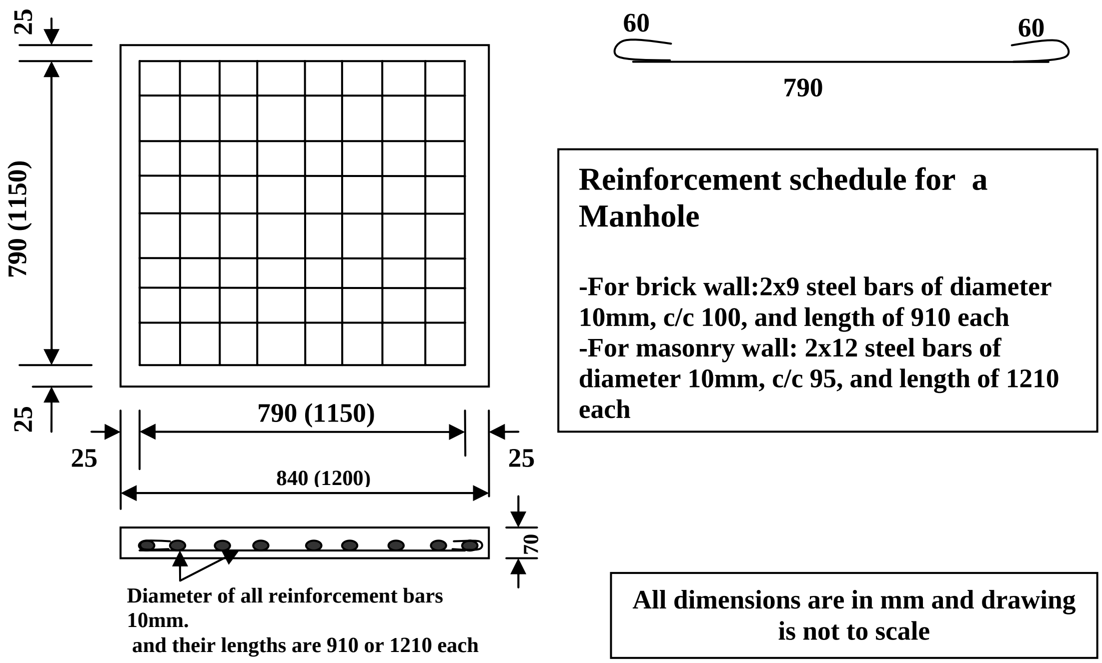
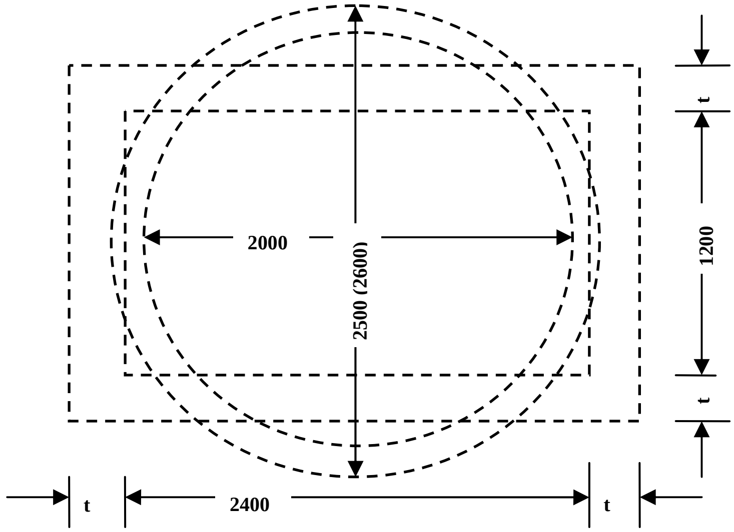


Figure 3: Reinforcement bar schedule for rectangular manhole covers of Pour Flush latrine for rural health institutions



Lining material	Min t
Red brick	25
Stone	30

Note:

- **The thickness t depends on the depth of the pit and the type of lining material. For rectangular pit t should be calculated based on all pressures the exert on the lining material**
- **Rectangular dimensions of pit. Internal 1200 x 2400**
- **Circular, internal diameter 2000**
- **Minimum depth of pits 2000**

Figure 4: Dimensions of rectangular and circular improved traditional pit latrines for rural health institutions

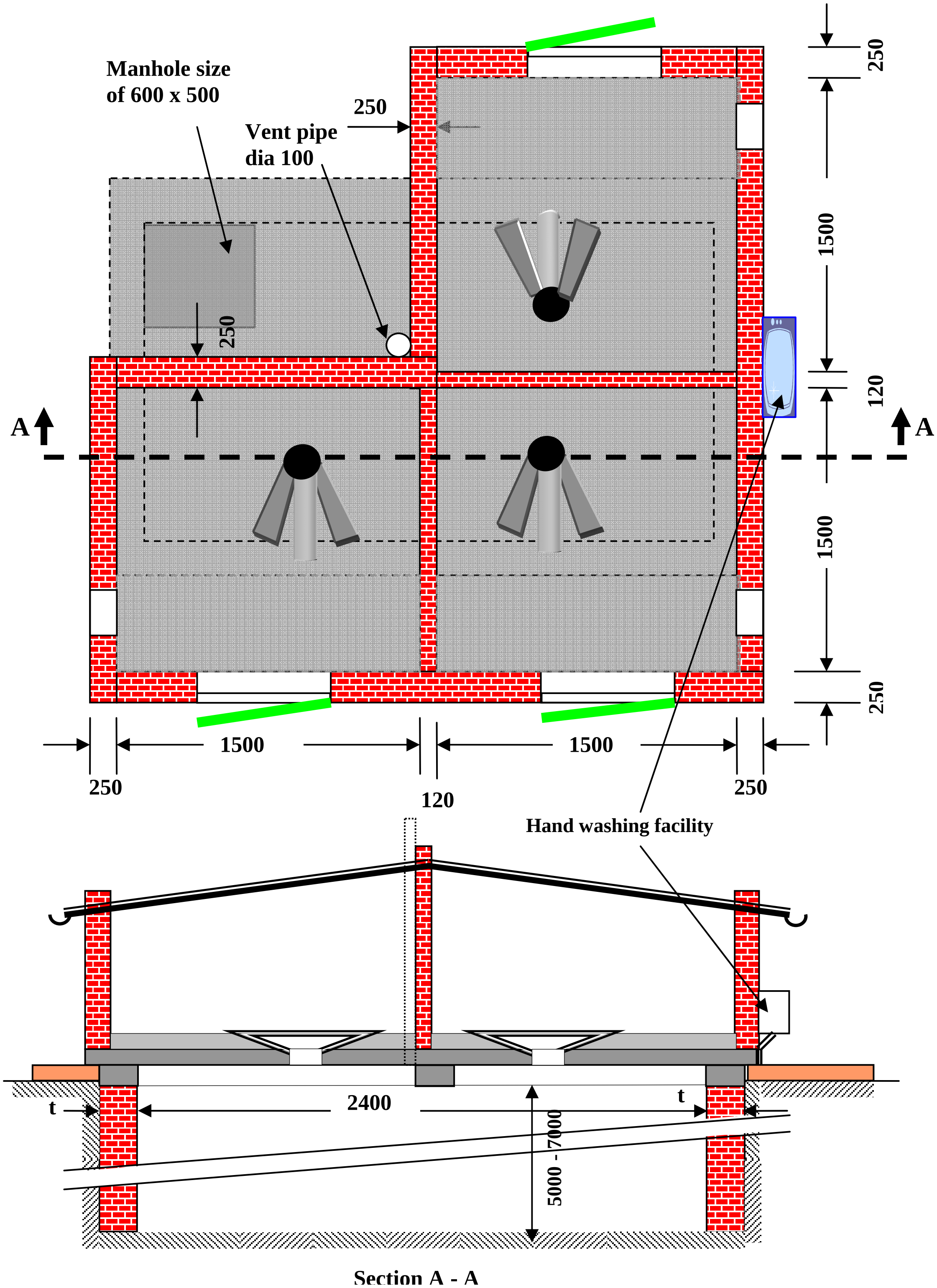


Figure 5: Improved traditional pit latrine with rectangular pit for rural health institutions

All dimensions are in mm and drawing is not to scale

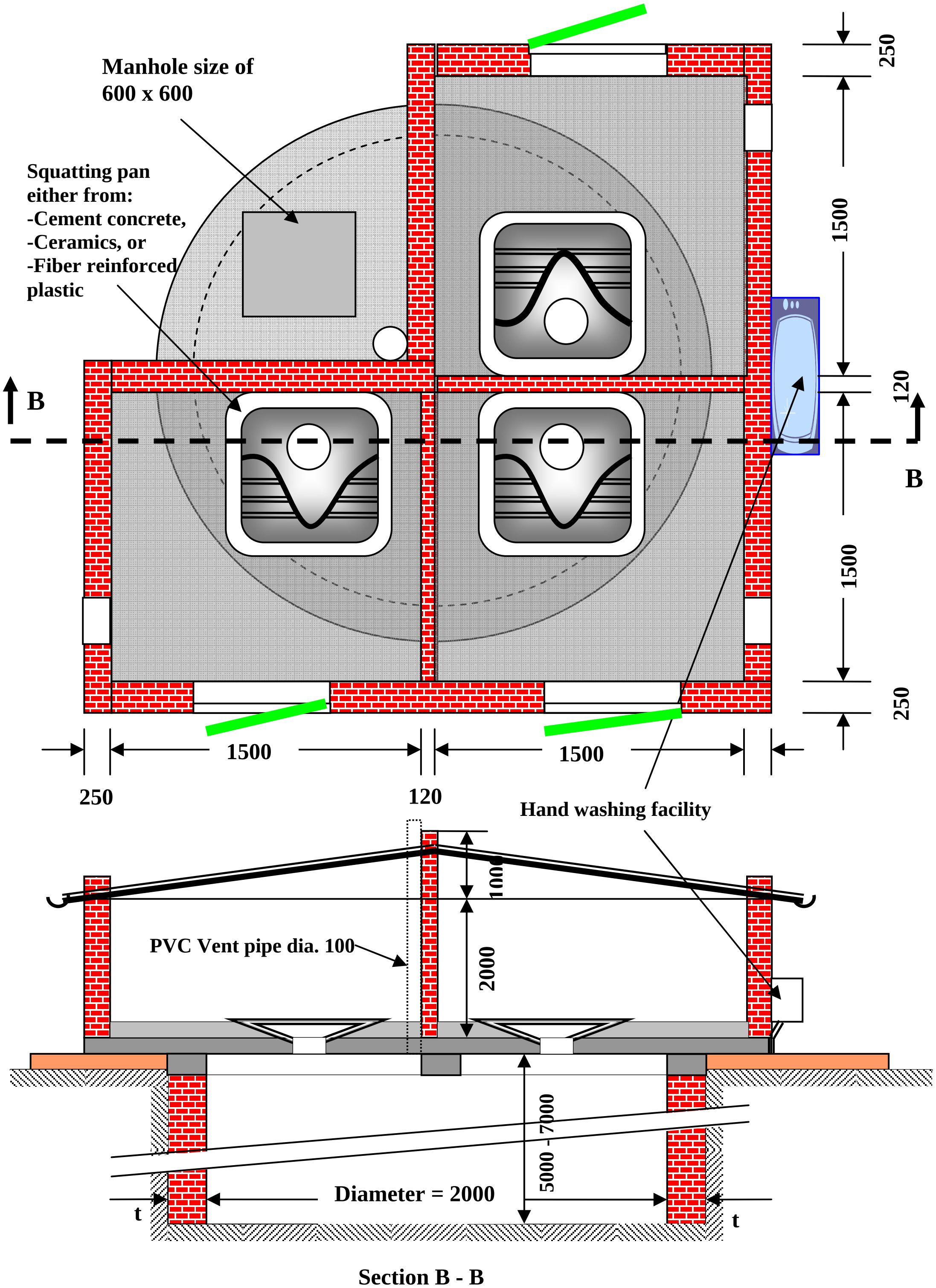
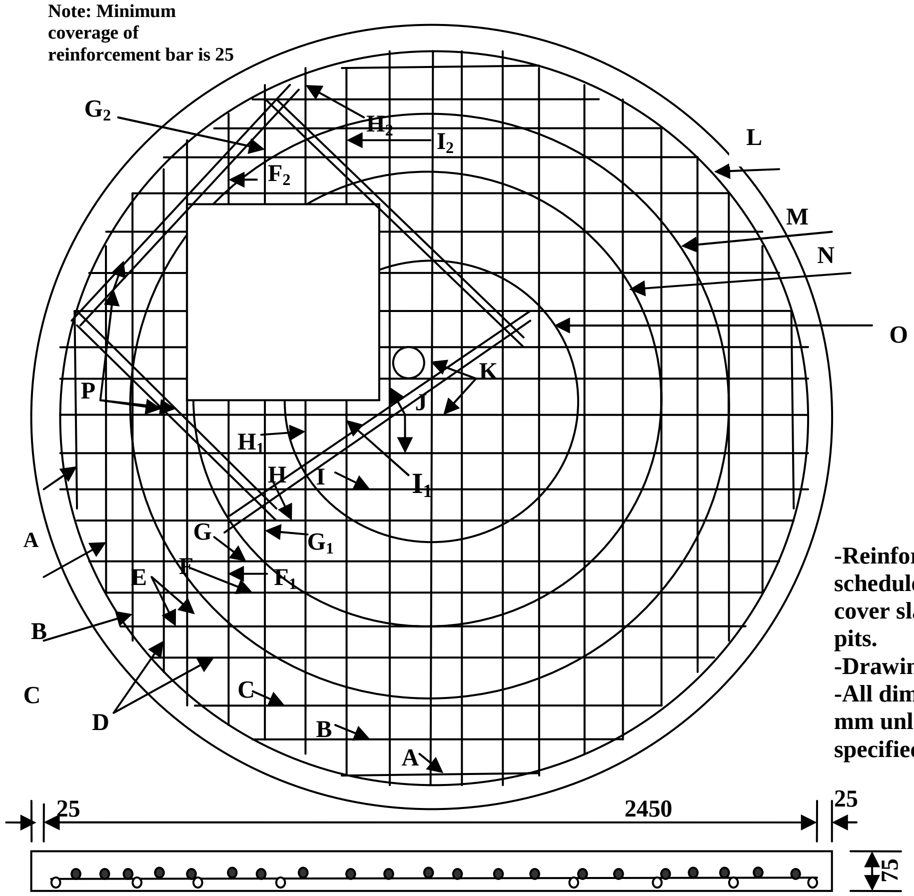


Figure 6: Improved traditional pit latrine with circular pit
All dimensions are in mm and drawing not to scale

Note: Minimum coverage of reinforcement bar is 25



-Reinforcement bar schedule for one cover slab of leaching pits.
-Drawing not to scale.
-All dimensions are in mm unless otherwise specified

Type of bar	Shape	Length of each bar (mm)	Quantity	Total length (mm)
A	____	690	4	2760
B	____	1245	4	4980
C	____	1580	4	6320
D	____	1830	4	7320
E	____	2030	4	8120
F	____	2170	2	4340
F_1	____	1285	2	2570
F_2	____	285	2	570
G	____	2280	2	4560
G_1	____	1340	2	2680
G_2	____	340	2	680
H	____	2360	2	4720
H_1	____	1380	2	2760
H_2	____	380	2	760
I	____	2415	2	9660
I_1	____	1405	2	2810
I_2	____	405	2	810
J	____	2450	4	9800
K	____	2450	2	4900
L	C	7910	1	7910
M	C	5860	1	5860
N	C	4010	1	4010
O	C	2055	1	2055
P	____	860	8	6880

Figure. 7: Reinforcement bar schedule for cover slabs of circular pit of improved traditional pit latrine for rural health institutions.

6.1.5 Superstructure

6.1.5.1 PFL

Locally available materials like mud bricks, red bricks, etc. can be used for the construction of the walls of the superstructure. The roof can be also be constructed from durable local materials. The type of material can be chosen by the users so long as it provides privacy, convenience and comfort. A minimum of three squatting spaces each of dimension 150cm by 150cm should be provided.

The squatting space should be fitted with a pan attached with a U-water seal. The pan could be of either cement concrete, ceramics or fibre reinforced plastic.

6.1.5.2 ITP Latrine

The superstructure can be constructed from locally available and durable material like bricks, and should provide privacy, convenience and comfort to the user. A minimum of 150cm x 150cm area per squatting space should be provided. Plastic sheeting can be considered for construction of the superstructure during emergencies.

6.1.6 Vent pipe

6.1.6.1 PF Latrine

There is no need for a vent pipe as gases will defuse into the soil.

6.1.6.2 ITP Latrine

The installation of a vent pipe outside of the superstructure is recommended to minimize the odour of foul gases from the pit. The vent pipe can be a PVC pipe of minimum diameter 100mm and should be dark in colour. The vent pipe should extend a minimum of 500mm – 1000 mm above the highest part of the roof, and the top should be covered with mesh wire.

6.1.7 Options for accessing of pits

The pits of rural health institution latrines are labelled accessible, or inaccessible depending on the availability of a de-sludging service

In accessible pits provision is made to allow removal of the contents of a pit. Depending on the type of de-sludging service available, the following may be provided:

- A manhole at the top of the cover slab as indicated in Figures 5 & 6
- Removable slabs from the leaching pits as indicated in Figure 2

An inaccessible latrine should be abandoned and replaced with a new one. The abandoned pit must be sealed and properly fenced to prevent access for humans and animals for 12-18 months to ensure the complete decomposition of the pit’s contents in order to avoid any health and environmental hazards while handling the pit’s contents.

6.1.8 Material for the superstructure

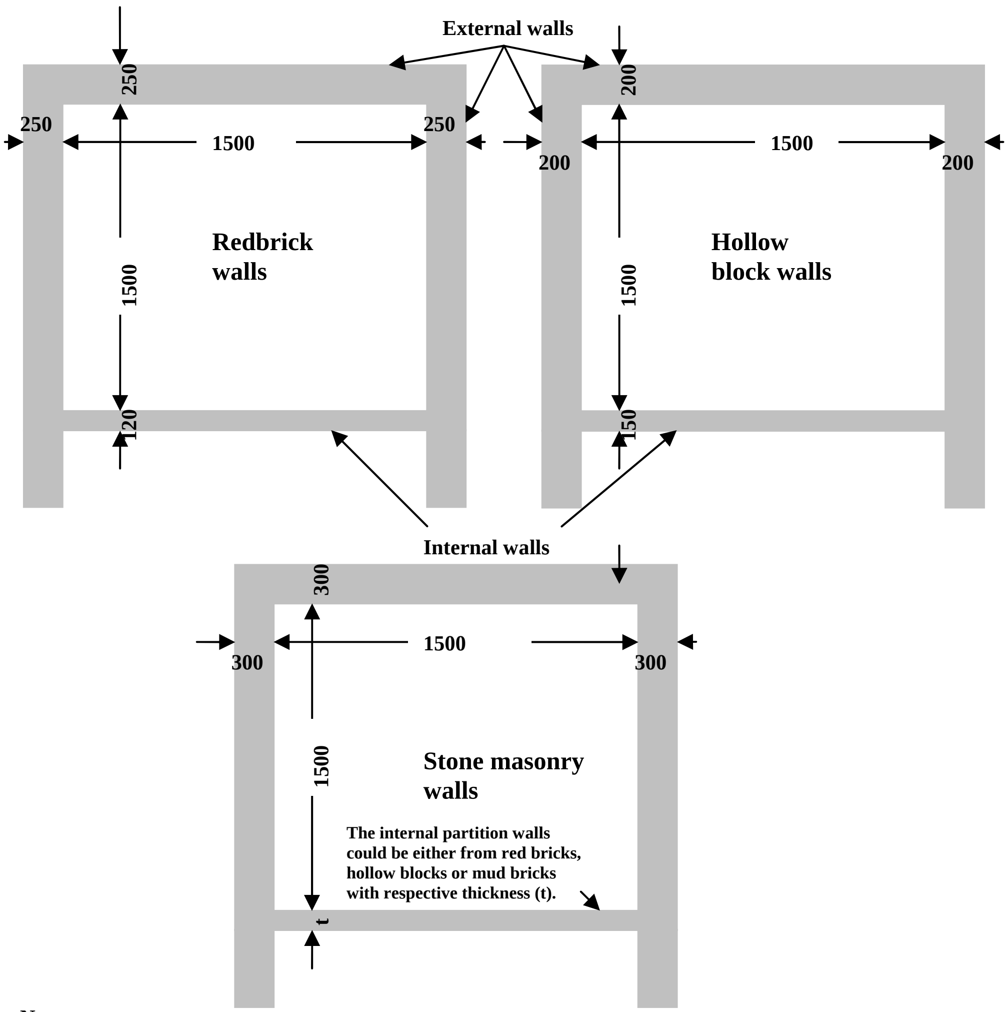
The walls of superstructure of the rural health institution latrines can be made from any of the following:

a) Red bricks
b) Hollow blocks
c) Stone
d) Corrugated iron sheets and RHS, as shown on Figures 8 and 9

Figure 8: Superstructure of a latrine made from corrugated iron sheet and RHS

As the sizes of bricks may vary from state to state and from place to place, the thickness of the walls of the superstructure should be adjusted to the size available..

Figure 9: Wall thicknesses of superstructure from different materials
All dimensions are in mm



Note:
-The internal surfaces of walls up to the height of 2000 of walls from redbrick, hollow blocks and stones masonry should be plastered with two coats (thickness 25mm) of cement mortar and smoothened.
-The external faces of walls from redbrick, hollow blocks and stones could be left rendered
-The internal partition walls of superstructures from stone masonry wall should be either from redbrick or hollow blocks in order to avoid unnecessary load on the slabs as the slabs are not designed to carry such load.
-The dimensions of the bricks vary from place to place and from state to state. Designers should adopt the dimensions of the walls according to the available brick sizes in each particular area.

6.2 Advantages and disadvantages of different types of rural health institution latrines

Pour-flush latrines

Advantages:

- Sanitary and durable
- Provides all the health benefits which a conventional sewerage system provides.

- A pedestal type seat can be used to replace the toilet seat if required
- Odourless due to the water seal.
- Vent pipe is not required as the gases get dispersed in the soil through holes in the pit lining.
- Only a small quantity of water is required (about 2 liters) for flushing.
- Can be constructed with local labour and materials.

Disadvantages:
- Requires between 2-5 litres of water for flushing per usage.
- Not suitable in rocky areas, for impermeable soils, if solid materials are used for anal cleansing and if the site is flooded or water table is too close to the ground surface.
- Cannot be upgraded to a high volume flushing cistern.
- Requires more community education/awareness for use.
- More expensive than an ITP latrine

Improved traditional pit latrines
Advantages
- Construction cost is low as compared to other types
- Can be constructed quickly by unskilled/semi skilled labourers from the community.
- Water requirement is low

Disadvantages
- Odours and flies cannot be completely eliminated.
- Less sanitary compared with pour flush latrines.
- Floor is difficult to clean properly.

7 Management, operation and maintenance of latrines for health institutions

The overall management, operation and maintenance responsibility including replacement of latrines for health institutions lie with the institution.. This has to be made clear at the outset, and information should be provided on the use, operation, and maintenance as suggested below:

Pour-flush latrines:
Flushing water should be always available near the latrine. Before use the pan is wetted with a little water to avoid faeces sticking to the pan. After use, the pan is flushed with 2-5 litres of water. No material that could obstruct the U trap should be thrown into the pan. The floor, squatting pan, or seat, door handles and other parts of the superstructure must be cleaned regularly with brush, soap and water. The institution should assign someone for this task. Rainwater should not be allowed to enter leach pits. Do not provide a water tap in the latrine as this will shorten the lifespan of the leaching pit

The Pan and U-traps must be checked monthly for cracks. If the excreta does not flush away quickly, the PVC pipes may be choked. Immediate unblocking with scoops and long twigs is recommended. Full pits must be abandoned and covered with at least 0.5m soil, or emptied by mechanical means (if such a service is available).

Improved Traditional Pit latrine:
The operation of a pit latrine is quite simple and consists of regularly cleaning the slab with little quantity of water (and a little disinfectant, if available) to remove any excreta and urine. The tight fitting lid must be replaced after use to ensure insect control and reduction of the smell. Appropriate anal cleansing materials should be used. Non biodegradable materials like stones, plastic, rags, needles, bandages etc should not be thrown in the pit as they reduce the effective volume of the pit and hinder mechanical emptying.

Monthly maintenance includes: checking the slab for cracks; the superstructure for structural damage; ensuring that the lid is fixed tight; and ensuring that surface water continues to drain away from the latrine. Anticipation of the latrine becoming full is essential as decisions have to be made in advance on: where to relocate the sludge; timely digging of another pit and transfer the slab and the superstructure to the new pit (where the slab and superstructure materials are reusable). The contents of the old pit must then be covered with at least 0.5m of top soil to provide a hygienic seal. In addition the old pit should be completely isolated or protected and definitely kept out of the reach of children and animals.

Immediate action must be taken if the following problems occur: parasites in cracks in the floor (as a result of unsuitable materials for the floor slab or improper curing of concrete); damaged or broken lids that have fallen into the pit; flooding of the latrine by surface water, etc.
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8 Recommendations

General
Squatting platform indicated above may not be appropriate for use by pregnant women and disabled people. Relevant designs should be applied to meet their needs as required.

Particular
1. Improved traditional latrines
Some of the limitations and problems associated with improved traditional latrines are: In hard soils it may be impossible to dig a proper pit. Pits often fill up too quickly in soils with low infiltration and leaching capacity. Bad quality of the floor slab due to unsuitable materials or improper curing of concrete (parasites may develop in cracks in floor). Lid gets damaged or falls into the pit. Flooding and undermining of improperly sited latrines. Often slabs do not have enough overlap with the ground or there are clear holes between the ground and the slab, clearing the way for insect invasions.

Therefore,

- Proper sites should be selected in consultation with the school community and if that is not possible take the preventive action to make latrine accessible throughout the year.
- Proper supervision should be conducted on the quality of workmanship to avoid the problems mentioned above.

2. Pour-flush latrines

Pour-flush latrines are unsuitable where it is common practice to use bulky materials for anal cleansing such as corncobs or stones which cannot be flushed through the U-trap. Double offset pits are usually much smaller than single pits because they need to last for twelve to eighteen months at least before they can be emptied by hand. In a direct pit system less water is needed for flushing than in an offset system. Pour-flush latrines may be upgraded to a septic tank with drainage field or soak away or be connected to a small-bore sewerage system whenever this is required and feasible.

Frequent problems associated with pour-flush latrines are: Blockage of U-trap because of bad design, construction or improper use. Damage of U-trap caused by improper unblocking (sometimes U-traps are broken on purpose to prevent blockage). There could be blocked diversion boxes or PVC pipes. Contents in pit do not decompose safely because the double pits are too close to each other without an effective seal between them, allowing liquids to percolate from one pit to the other. Where pour-flush pans are not available full-flush pans may be used, but they require more water (7-12 litres) which can be a problem if water is limited.

The limitations of pour-flush latrines include: leaching pits only function in permeable soils; latrines must be at least 30 – 50 meters away from water sources; can only be used in areas where sufficient water is available for flushing.

- Pits can only be emptied manually if their contents have been left to decompose for at least one year. Otherwise, either new pit has to be dug when a pit is full or the pit has to be emptied mechanically.
- If double pits latrines are used, the health institute needs to understand the concept of the system fully in order to be able to operate it properly.
- User education must cover aspects such as reasons for switching pits, using one pit at a time, use of excreta as future manure and the need to leave the full pit untouched for at least one year before it can be emptied.
- Users also need to know how to switch the pit and how to empty it, even when they do not do these tasks themselves.
- Where these tasks are carried out by the private (informal) sector, the labourers also have to be educated in the concept of the system and its operation.

Annexes

1. The development of the technical guidelines
2. People Contacted
3. Technical working group members
4. Some selected bibliography and references

Annex 1: The Development of these Technical Guidelines

The Technical Guidelines development process was completed in two stages: preparation and finalization.

A. The Preparation Stage

The preparation stage began in April 2006 with the agreement to select eight WASH facilities. At the request of the GONU, 3 additional water supply facilities were added, making the total eleven. The preparation stage that included information collection and analysis was completed in December 2006.

Collection of Information:
Technical and managerial information related to the development of the 14 Technical Guidelines was collected from the following sources:

- PWC/WES, SWCs and GWWD
- UNICEF, WHO, World bank and NGOs
- National institutions like SSMO
- International institutions like IRC and WEDC
- Donors like DFID.
- Different countries' standards like BS, IS, DIN, etc.
- Field trips to 14 states in the northern and southern states of Sudan to visit the different existing facilities and to have live discussion with the sector professionals and community members.

Analysis of collected information:
The Steering Committee, which comprised senior staff from PWC, WES and UNICEF together with the consultant, analyzed the collected information, which led to the development of the outlines of the documents in a zero draft. The draft documents were shared with the Steering Committee. The committee met to discuss the drafts, and provided comments, which were incorporated, resulting in the first draft. .

The first draft was widely circulated to PWC, UNICEF, various SWCs, INGOs and GoSS for information and feedback. All relevant feedback from the sector actors were incorporated into the documents and the second draft prepared and presented to the first national review workshop in December 2006. The relevant recommendations and comments of the national review workshop were incorporated into the documents resulting in a third draft.. The first National Review Workshop recommended that this draft of the Technical Guidelines be shared with a wider range of stakeholders, including specific technical working groups.

B. The Finalization Stage

The finalization of the 14 Technical Guidelines involved wider consultation with WASH sector partners through technical working group discussions, 3 regional review workshops, wider consultation and revision by GoSS and a national review workshop at the final stage.

Technical Working Group Discussions:
Professionals from various ministries participated in these technical working group discussions. MIWR, MOH, University of Khartoum, Sudan Academy of Science, private sector, NGOs, PWC/WES, UNICEF and Khartoum Water Corporation were also represented in these groups. This technical consultation process started in July 2007 and continued up to December 2007 resulting in the fourth draft of Technical Guidelines.

Regional Review Workshops:
Three Regional Review Workshops were conducted in Nyala, Wad Medani and Juba in November-December 2007 for GoSS and state level inputs into the documents. The Juba workshop recommended that the need for wider consultation within Southern Sudan to review the documents and to incorporate Southern Sudan specific contexts into the documents such as information relating to the location and different hydrogeological situations. These 3 workshops resulted in the fifth draft.

Wider Consultation by GoSS:
Based on the recommendation of the Juba Review Workshop, a wider consultation process was started in July 2008 and completed in October 2008. The process included state level consultation with sector actors, technical working group discussions and a final consultation workshop in Juba. The process was concluded by the finalization and the approval of the final draft documents which were reviewed at a final National Workshop.

Final National Workshop:
The final National Workshop was conducted in April 2009 in Khartoum under the guidance and the presence of H.E. Eng. Kamal Ali Mohamed, Minister of Irrigation and Water Resources of GONU, Eng. Isaac Liabwel, Undersecretary, Ministry of Water Resources and Irrigation of GoSS, Eng. Mohammed Hassan Mahmud Amar, DG of PWC and Eng. Adam Ibrahim, Minister of Physical Planning and Public Utilities of South Darfur State.

The workshop was attended by ninety two participants representing MIWR, MWRI, MOH, PWC, WES, GWWD, Engineering Council, SWCs, SMoH, University of Khartoum, and UNICEF, WHO, IOM, ICRC, NGOs, USAID and private sector.

The National Workshop reviewed the 14 WASH Technical Guidelines and approved them as the national WASH Technical Guidelines.

The workshop recommendations included:

- Publication and wide distribution of the Guidelines;
- Translation of the Guidelines into Arabic and other major Sudanese languages;
- Organization of training and advocacy courses/workshops related to the Guidelines;
- Adoption of supportive policies, strategies, laws and regulations to ensure best utilization of the Guidelines;

- Development of a system for further feedback from implementing partners for inclusion in future updates of the Guidelines. MIWR/PWC, MWRI and SWCs were selected as focal points for that purpose.

Annex 2: People contacted

At Khartoum level

1. Mr Mohammed Hassan Mahmoud Amar, Director General, PWC
2. Mr Eisa Mohammed, National WES Coordinator, WES/PWC
3. Mr Mohammed Habib, National Project Coordinator, PWC
4. Mr Sampath Kumar, Chief WES Section, UNICEF
5. Mr Vishwas Joshi, PO, UNICEF
6. Mr Zaid Jurji, PO, UNICEF
7. Mr Stanely Hall, SPO, UNICEF
8. Mr Fouad Yassa, PO, UNICEF
9. Mrs Awatif Khalil, APO, UNICEF
10. Mr Samuel Riak, PO, UNICEF
11. Dr Isam M. Abdel Magid, Faculty of Engineering, University of Khartoum
12. Mr. Bedreldeen Ahmed Ali, Engineering Department, FMOH

North Darfur, El Fashier

1. Osman Bukhari Ibrahim	SMOH	DG Envoronmental Health
2. Abdul Azim Ahmed	SWC	Mechanical Engineer
3. Abdella M. Adam	WES	Drilling Engineer
4. Mohammed Mohammedein	WES	Mechanical Engineer
5. Omer Abdurahman Adam	GWWD	Hydrogeologist
6.Nour Eldin Adam	WES	Surveying Engineer
7. Abdella Adam Ibrahim	WES	Geologist
8. Tayalla El Medomi	UNICEF	Water Engineer
9. Mohammed Mohammedein Subi	SWC	Acting DG & Manager of RW
10. Salma Hassan	WES	Social Mobilzer
11. Ahmed Abu Elgasim	WES	Acting GM
12. Hassan Sheik Nur	Oxfam GB	Public Health Engineering Coord.
13. Jaka Magoma	IRC	Environmental Health Manager

North Kordofan, El Obeid

1. Hassan Adam Suleiman	ACU WES	Monitoring Officer
2. Ahmed El Abeid	RWC	Surface Water Section
3.Alehmin Ahmed	WES	Mechanical Engineer
4. Saeed Elmahdi	WES	Programme Manager
5. Asia Mahmoud Mohmed	ACU WES	W Coord. Kordofan Section
6. Yassin Abbas	NWC, NK	RWC Manager
7. Mahgoup Dahia	WES, NK	Mini Water Yard Officer
8. Abeer Ali Elnour	WES, NK	Civil Engineer
9. Mutasim Hamad	WES, NK	Monitoring Officer
10. Makin Mohammed Toto	WES, NK	Drilling Engineer
11. Salah Mohammed	GWWD	Director General

South Kordofan

1. Adil Awad Farog	SWC	Geologist
2. Jakob Jebbrel	SWC	Engineer
3. Haidar Ariah Abdel Bari	SWC	Geologist
4. Mohammed Morgan Yhya	SWC	WES PA
5. Gamaa Aziz	UNICEF	APO
6. Fatima Toto	SWC	Urban Water Management
7. Sunaya Zroog	SWC	Urban Water Management
8. Mymona Taha	SWC	Urban Water Management
9. Adam Mohammed Ibrahim	SWC	Urban Water Management
10. Ali Gabaur Ahmad	SWC	Urban Water Management
11. Elzaki Eisa	WES	Drilling Engineer
12. Kamal Bashir	SC/USA	Watsan
13. Osman Elnour	SWC	DG
14. Dr Abdel Rahim Ahmed	UNICEF	APO
15. Hassaballa Hamad	SWC	Rural Water Management
16. Absaida	SWC	Mechanic
17. Awatif Elhag	WFP	Field Monitor
18. Al Amin Shawish	Sudan Aid	Coordination Officer

People Contacted in Southern Sudan, July 2008

1. Juma Chisto, Operator of Kator Emergency Water Supply, Juba
2. Habib Dolas, Member of Watsan committee, Hai Jebel
3. Andew Wan Stephen, Member of Watsan committee, Hai Jebel
4. Francis Yokwe, Member of Watsan committee, Hai Jebel
5. William Ali Jakob, Member of Watsan committee, Hai Jebel
6. William Nadow Simon, Member of Watsan committee, Hai Jebel
7. Ali Sama, Director General, Rural Water Department, Central Equatoria State (CES)
8. Engineer Samuel Toban Longa, Deputy Area Manager, UWC, CES
9. Sabil Sabrino, Director General UWC, WBeG
10. James Morter, Technician, UWC, Wau
11. Carmen Garrigos, RPO, Unicef Wau
12. Sevit Veterino, Director General, RWC, WBeG
13. Stephen Alek, Director General, Ministry of Physical Infrastructure (MPI), Warap
14. John Marie, Director of Finance, MPI, Warap State
15. Angelo Okol, Deputy Director of O&M, Warap State
16. Santino Ohak Yomon, Director, RWSS, Upper Nile State
17. Abdulkadir Musse, RPO, Unicef Malakal
18. Dok Jok Dok, Governor, Upper Nile State
19. Yoanes Agawis, Acting Minister, MPI, Upper Nile State
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21. Garang William Woul, SRCS, Malakal

22. Peter Onak, WVI, Malakal
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2) For Borehole Hand pumps, Hand dug well Hand pumps, Hand dug well Water yards, Mini Water yards and Water yards

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Mr. Mohy Al Deen Mohamed Kabeer, GWW
Mr. Abd el Raziq Mukhtar, Private Consultant
Mr. Mohamed Salih Mahmoud, PWC
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3) For Improved Small Dams

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6) For Household Latrines, School Latrines and Rural Health Institution Latrines

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Dr. Isam Mohamed Abd Al Magid, Sudan Academy of Science
Mr. Badr Al Deen Ahmed Ali, MOH
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B) At Juba level:

For all facilities:

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