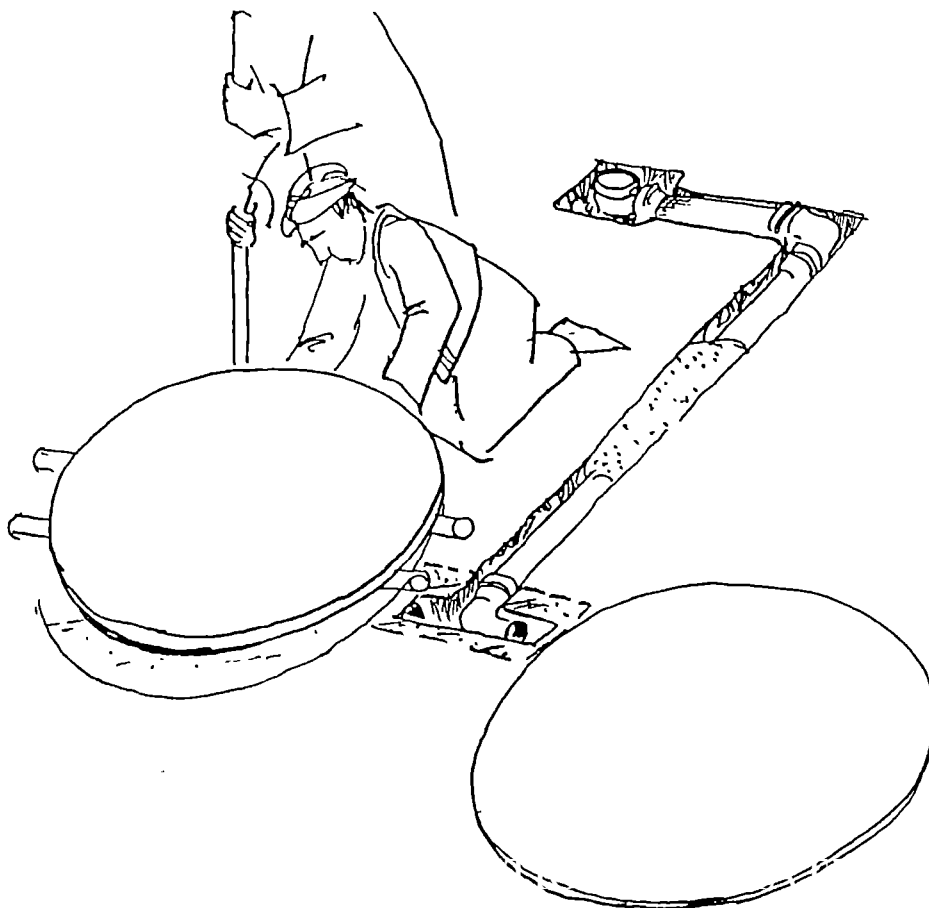


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# REGIONAL WATER SUPPLY AND SANITATION PROJECT IN BENI SUEF



## MANUAL FOR CONSTRUCTION, OPERATION AND MAINTENANCE OF DOUBLE PIT LATRINE

---

April 1997



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## INTRODUCTION

This manual for construction, operation and maintenance of double pit latrine has been prepared by the Regional Water Supply and Sanitation Project in Beni Suef Governorate in April 1997. The manual is intended to be a tool for village sanitation promoters and consists of 4 parts:

- Part 1: Location and design of toilet
- Part 2: Construction of toilet
- Part 3: Operation and maintenance of toilet
- Part 4: Technical specification.

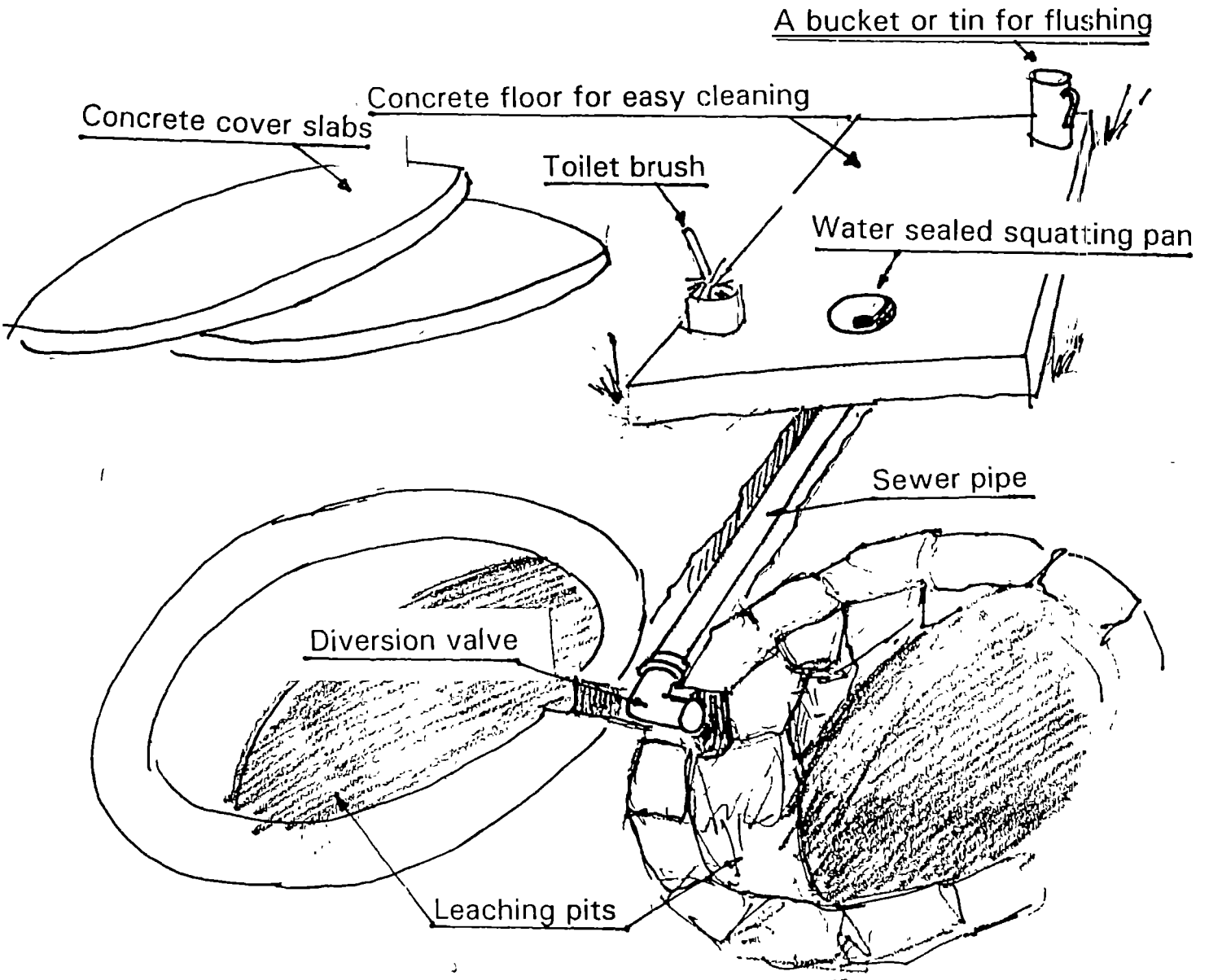
The created latrine model consists of a water sealed (goose neck) squatting pan, sewer pipe to the pits equipped with diversion valve and two separate covered pits with masoned walls located under the ground. Excrements are flushed from the squatting pan to the pits with small amount of water (about 1-3 l). The water seal in the pan prevents odor problems. The waste water is lead to one of the pits and the liquid from the pit is infiltrated to the ground via the soil bottom and the walls of the pit. The first pit is in use 1 - 2 years and then the diversion valve is turned over to the other pit. After about 1 year the sludge in the first pit is digested/composted and is ready to be used as fertilizer.

The total costs for the latrine is about 450 - 500 LE excluding possibly needed walls.

The principle of the latrine is shown on the following drawing.

# POUR FLUSH OFFSET DOUBLE PIT TOILET

## THE ESSENTIALS OF A GOOD TOILET



## **BENEFITS OF THE CREATED LATRINE MODEL**

The benefits of the created latrine is as follows:

- small investments and easy maintenance compared to septic tank solution
- can be manufactured locally
- no smell
- produces fertilizer

## **YOUR OPINION ABOUT THE DEVELOPED TOILET MODEL ?**

On the question 'What is your opinion about the latrine some villagers gave us following replies':

- We get now very good fertilizer and free of charge.
- It was not too expensive, we dug pits and collected stones and sand ourselves.
- It doesn't need so much space; we are going to cover the slabs with soil and use the space as before.
- It's so nice and easy to keep clean. No flies or smell.
- It's very convenient to use, we don't have to wait dark or seek for hideaway places.
- I have a feeling that this helps my family to stay in good health.
- We can not expect that the Government do it for us. We have to do it ourselves.

## **WHY TO HAVE A PROPER TOILET ?**

Human faeces are a health risk if not disposed safely.

Germs in faeces can be passed to people's hands, food, or water, then swallowed, spreading disease. This passing can take place directly when children play on the ground where faeces are left uncovered or indirectly when flies or other insects or animals spread germs.

Safe disposal of faeces is a priority for preventing diarrhoea, which is especially dangerous to small children. Sanitation has a greater impact on improving child health than provision of safe water.





**PART 1**

**LOCATION AND DESIGN OF TOILET**



# 1 LOCATION AND DESIGN OF TOILET

## 1.1

### Is the place suitable for construction of double pit latrine ?

The design of the latrine starts with deciding the place of the pits and the toilet. Before the place for the pits is chosen the following matters should be checked:

- what is the level of groundwater
- at what depth is the rock.

High groundwater table or hard rock may define the depth of the pits underground. This level may in turn define the lowest possible level of the toilet floor. The depth of the pit is 1,5 - 1,8 m and the bottom is recommended to be about 1 m above the maximum ground water level. It is not possible to fulfill this requirement in all cases but the bottom of the pits should anyhow always be at least 0.5 m above the maximum ground water level. It is possible to check the groundwater level by digging a hole in the ground. This means that if the latrine is constructed without embankments the required minimum depth of the ground water level (during flood season) is about 2,2 m (see section drawing in part 4). It is recommended that the pits are constructed above the rock to make sure that the infiltration from the pit is proper and to avoid additional costs for digging in rock. To solve problems with high ground water table or rock close to the ground please see point '1.4 How to tackle some common problems'.

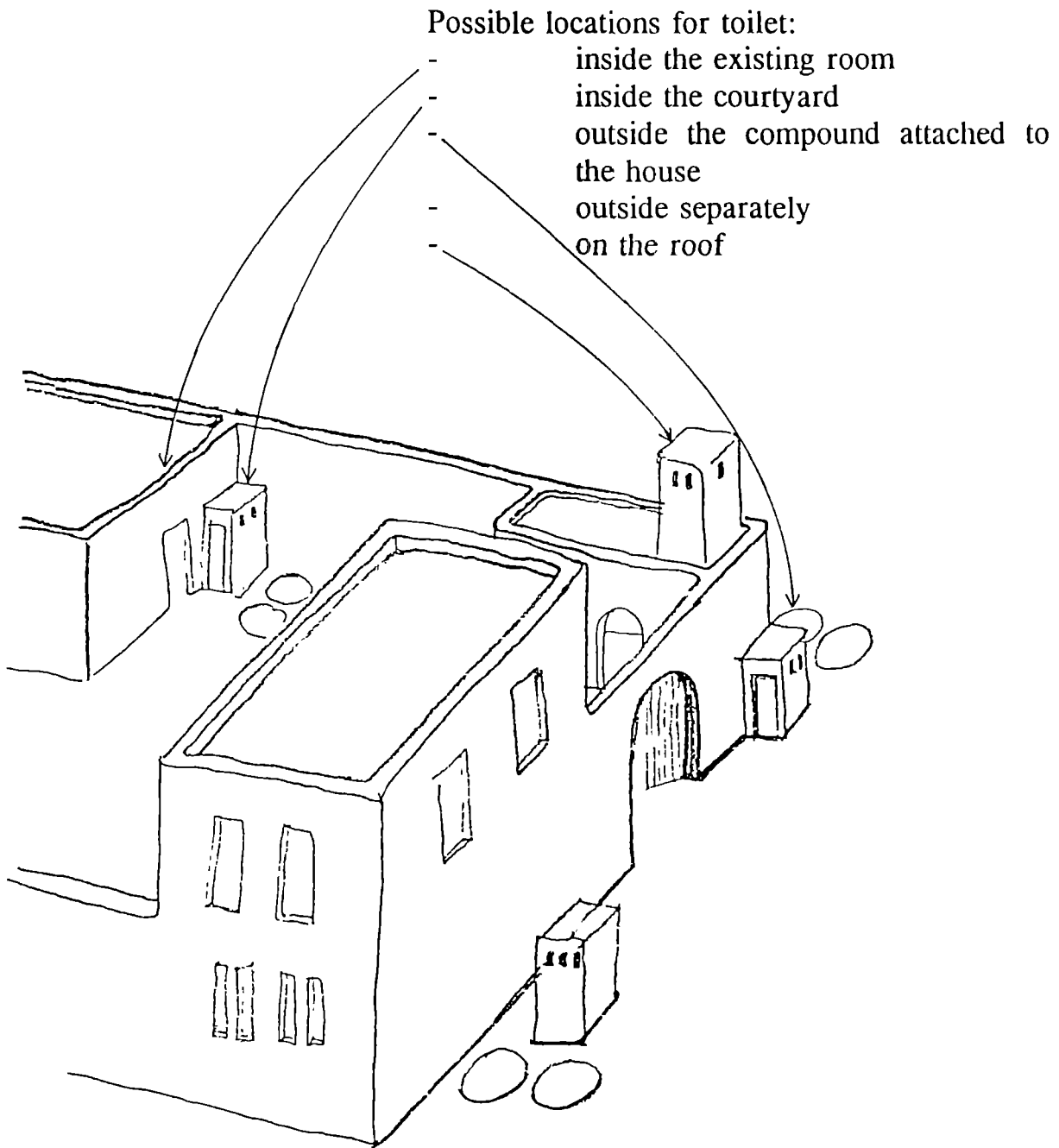
After ensuring that there is no problem with high groundwater or rock the method of covering the pits and the shape of pits should be decided. Assess the best way of covering the pits which could be:

- concave concrete cover slab
- locally manufactured concrete slab
- stone slab (not in area with heavy traffic)

When selecting the shape of pits, remember that round pit is the strongest against collapse. If you decrease one measure you should increase the other one. The normal measures of the pits are inside diameter 1,2 m, outside diameter 1,6 m and effective depth about 1,2 m. The total effective volume 1,3 m<sup>3</sup> of one pit should be constant.

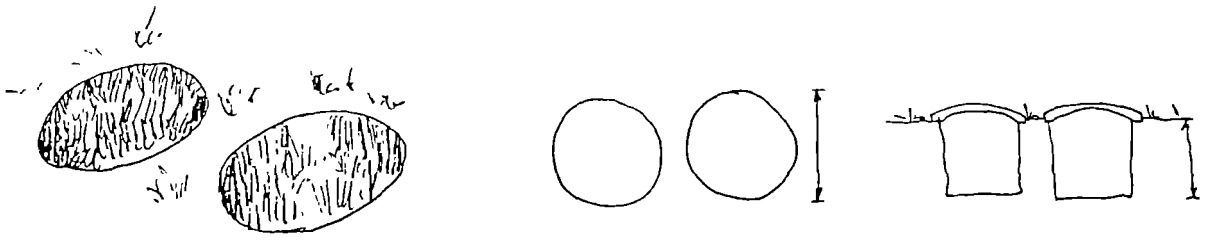
## PLACE FOR PITS AND TOILETS

High groundwater table or hard rock may define the depth of the bottom of the pits underground. This level may in turn define the lowest possible level of the toilet floor.

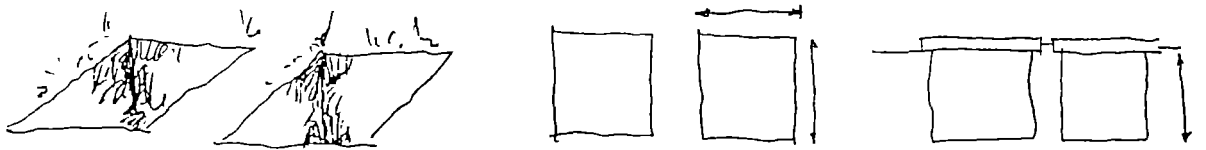


# COVERING OF THE PITS

## Covering with concave concrete cover slab



## Covering with locally manufactured concrete slab



## Covering with stone slab



## 1.2

### Place for pits

Following questions should be checked before the final design for the latrine can be done:

- is there space enough for the pits. Use stick for measuring
- check that the ownership of land is clear
- enough space for work; place to store excess soil from pits
- digging does not destroy the foundations of the house
- place is not too far from intended toilet site
- pits are away from heavy traffic
- remember that pits do not reserve the site permanently; the slabs can be covered with soil and place can be used as before.

Normally it's better to place the pits inside the compound. The cover slabs can be buried and normal functions can continue in the compound. The pits are uncovered and emptied once in about two years. The process takes one day and after that pits are buried again. However the pits can also be outside the compound if there is space. It's not good, however, to locate pits in areas with motor vehicle traffic.

## 1.3

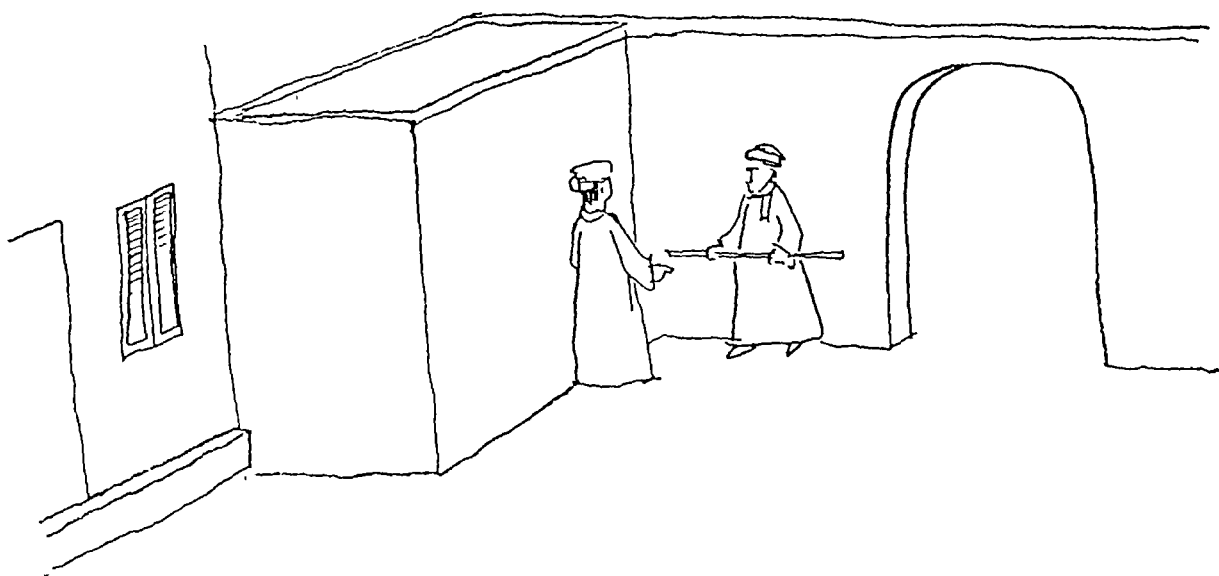
### Place for toilet

Possible locations:

- inside an existing room
- inside the courtyard
- outside the compound attached to the house
- outside separately
- on the roof.

The toilet does not create any smell or other nuisance. Thus it can be placed in any convenient place. If there is no space inside or outside the compound it can be on the roof.

**CHECK THAT THERE IS SPACE ENOUGH FOR THE PITS**



## 1.4

### How to tackle some common problems

#### High ground water table

- Building an embankment around the pits
- Elevated toilet floor
- Pits dug above ground water table

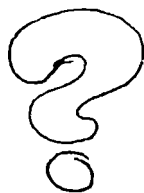
#### Hard rock

- Building an embankment around the pits
- Elevated toilet floor
- Pits dug as deep as feasible

#### No space in the house

- Toilet superstructure on the roof of the house
- Pits in or outside the house



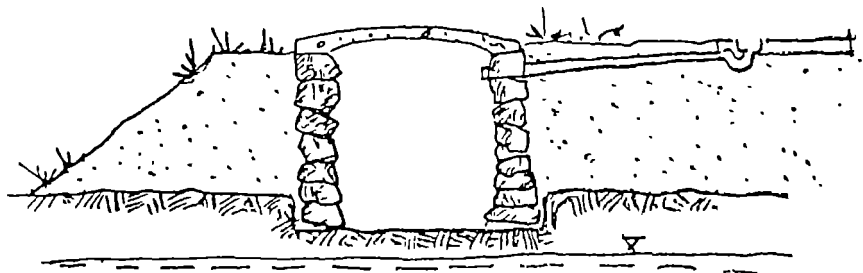


High ground water table



Embankment

Elevated toilet floor



Pits dug above ground water table

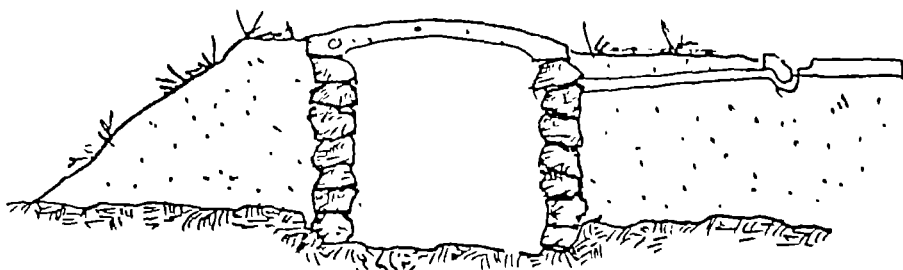


Hard rock



Embankment

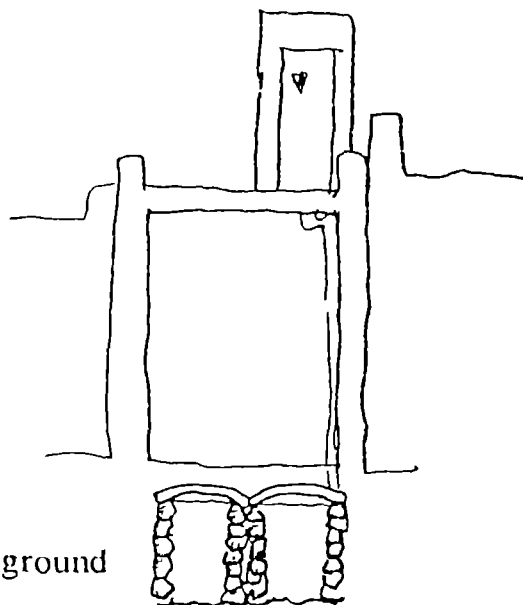
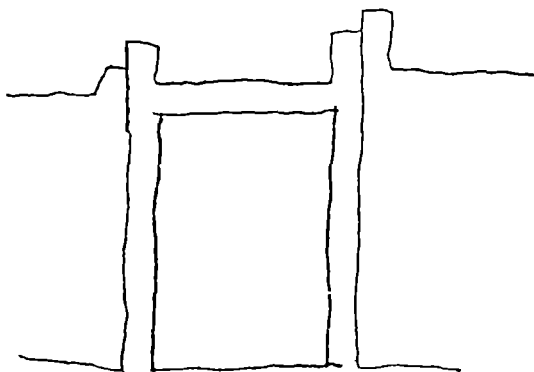
Elevated toilet floor



Pits dug as deep as feasible

Toilet superstructure on the roof

No space in the house



Pits underground

**1.5****Plan the construction work****Assess your own skills**

What can you do yourself and in which tasks you need assistance from professional builder. Following kind of work is needed:

**Unskilled work:**

- digging the pits and ditches for sewer pipes
- mixing of concrete
- transporting material to site
- breaking the stones
- lifting of heavy parts like the slab for pits

**Skilled work:**

- measuring the pit sites
- mason work in lining the pits
- masonry work for making the entrance channels to pits
- installation of the sewer pipes
- installation of the toilet pan with goose neck together with terrazzo slab
- extension of the toilet floor
- superstructure; walls, roof, door, window, etc. depending of the preferred design and material
- manufacture of cover slab

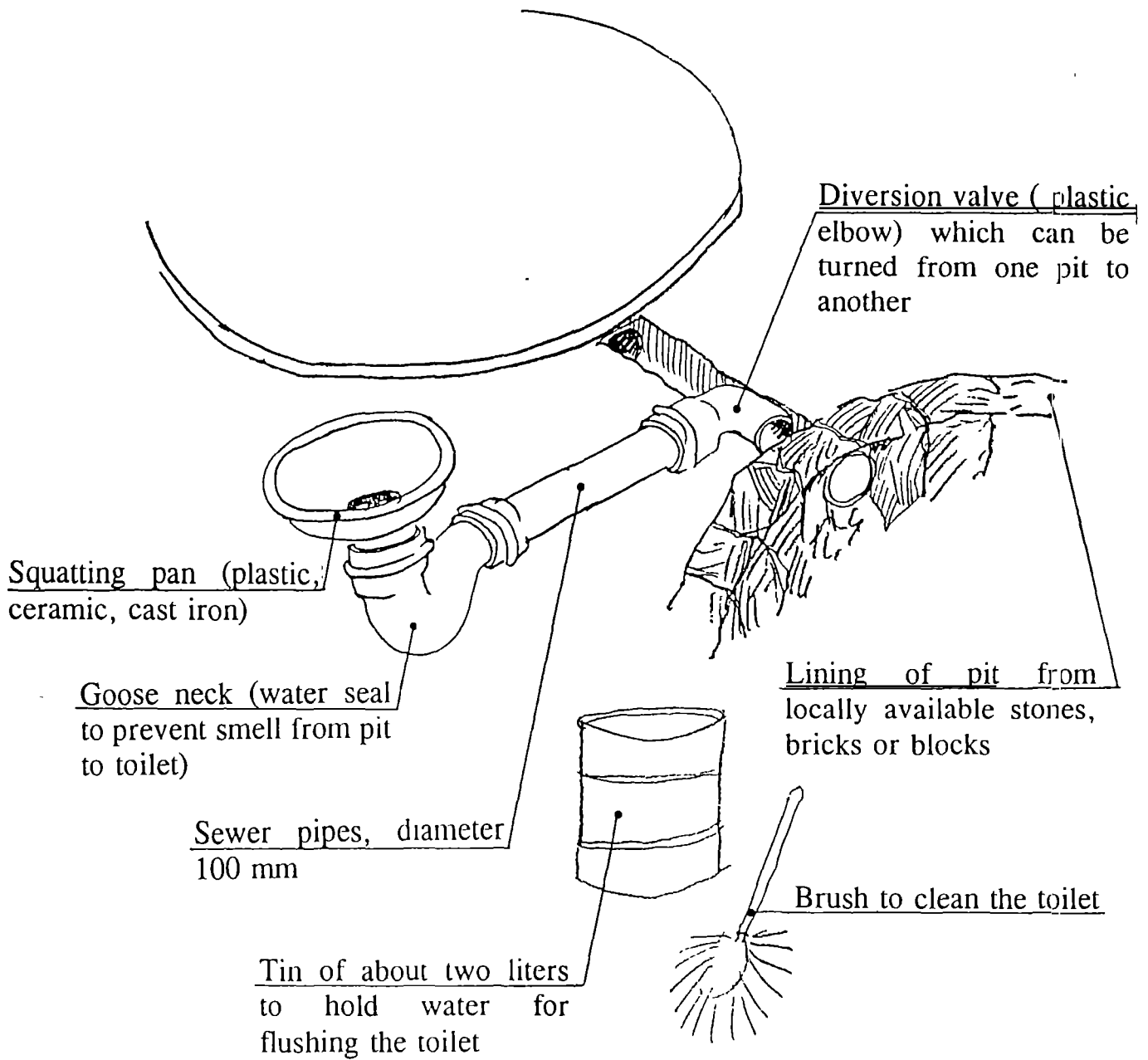
## Assess availability of needed material

Assess locally available free construction material and see what construction material is sold in the village.

Following material is needed (The Bills of Quantities are shown in Part 4, Technical Description):

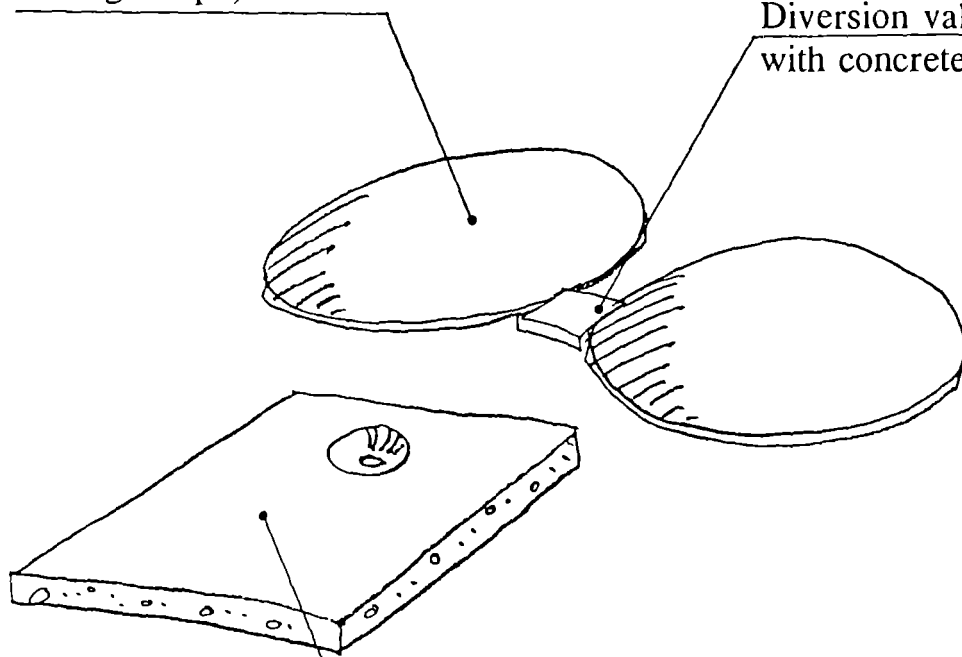
- stones, bricks or blocks for lining the pits
- stone slabs or concrete slabs for covering the pits
- cement
- sand
- gravel
- terrazzo slab for fixing the toilet pan (optional)
- toilet pan with goose neck
- sewer pipes, diameter 100 mm (measure the length and count the elbows)
- 'diversion valve', plastic elbow which can be turned into two alternative positions
- water
- brush to clean the toilet
- tin of about two liters to clean the toilet
- material for walls, roof, door and window
- glue for connection of plastic pipes.

## NEEDED MATERIAL



Cover slab (round  
concrete slab for round  
pit, stone slab for  
rectangular pit)

Diversion valve covered  
with concrete slab



Concrete floor for easy  
cleaning



**PART 2**

**CONSTRUCTION OF TOILET**





## 2

**CONSTRUCTION OF LATRINE**

## 2.1

**Preparation for construction work**

Construction of the toilet can be implemented in one day if the work is properly planned.

Get all the required material on the site; cement, sand, bricks, gravel, steel bars or mesh, good quality water, pipes, elbows and sanitation fittings. See the Bills of Quantities shown in Part 4, Technical Description for detailed specification.

Get all the required tools on the site; spades (shovels), rope and plumb, buckets, bails, sticks for compacting, wooden float, masons trowel, straight wooden timber, spirit level etc.

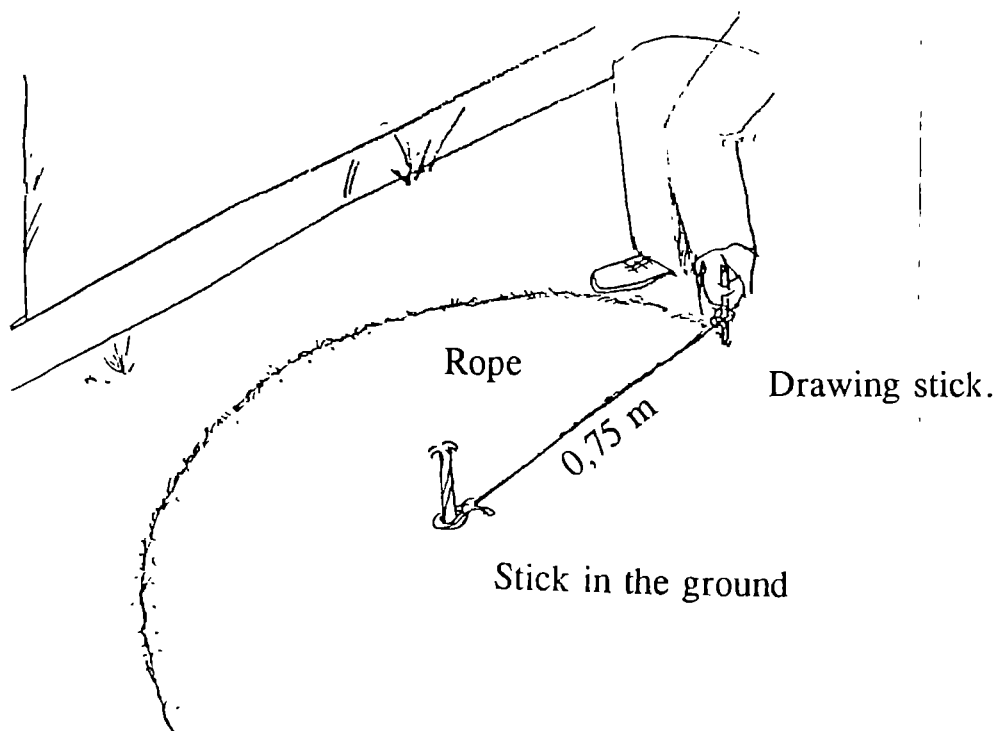
The construction work starts with digging of the pit. To measure the pit you need:

- one stick to be put in the center point of the pit
- rope 80 cm + the thickness of the lining
- drawing stick.

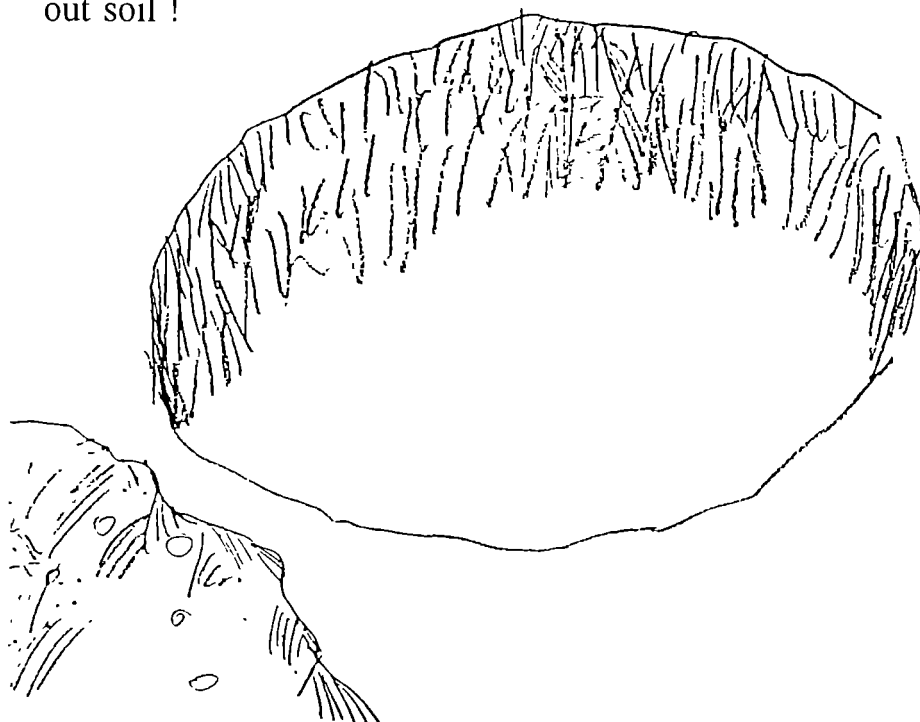
Stop digging if you reach groundwater level because the bottom of the pit should always be about 0,5 m above ground water level.

Remember to reserve place for dug out soil !

# MEASURING THE PIT



Place for dug  
out soil !



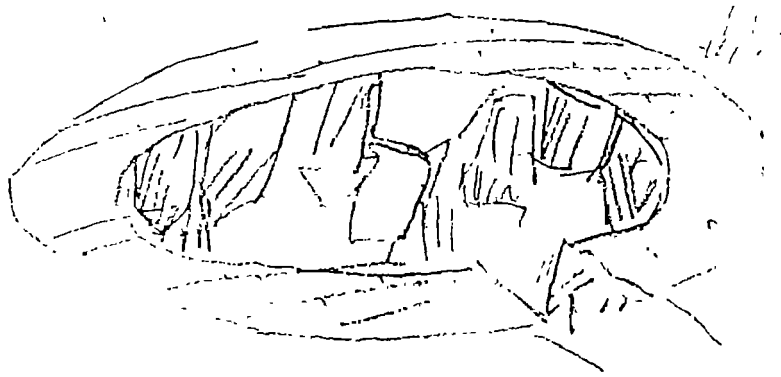
## 2.2 Lining of pits

After the pits have been dug they are lined with stones, stone blocks, bricks, or concrete blocks depending on what material is locally available. Lining of a round pit needs a good mason. If you are not sure of your skills, leave this work to a professional builder.

Measure the roundness of the lining with stick and rope like when measuring the pit for digging. Inside radius should be about 60 cm. Check with plumb that the walls are vertical. A stone in the rope is good plumb.

The top of the lining must be plastered to make smooth bed for the cover slab. Leave the void for entrance channel.

# LINING OF PIT



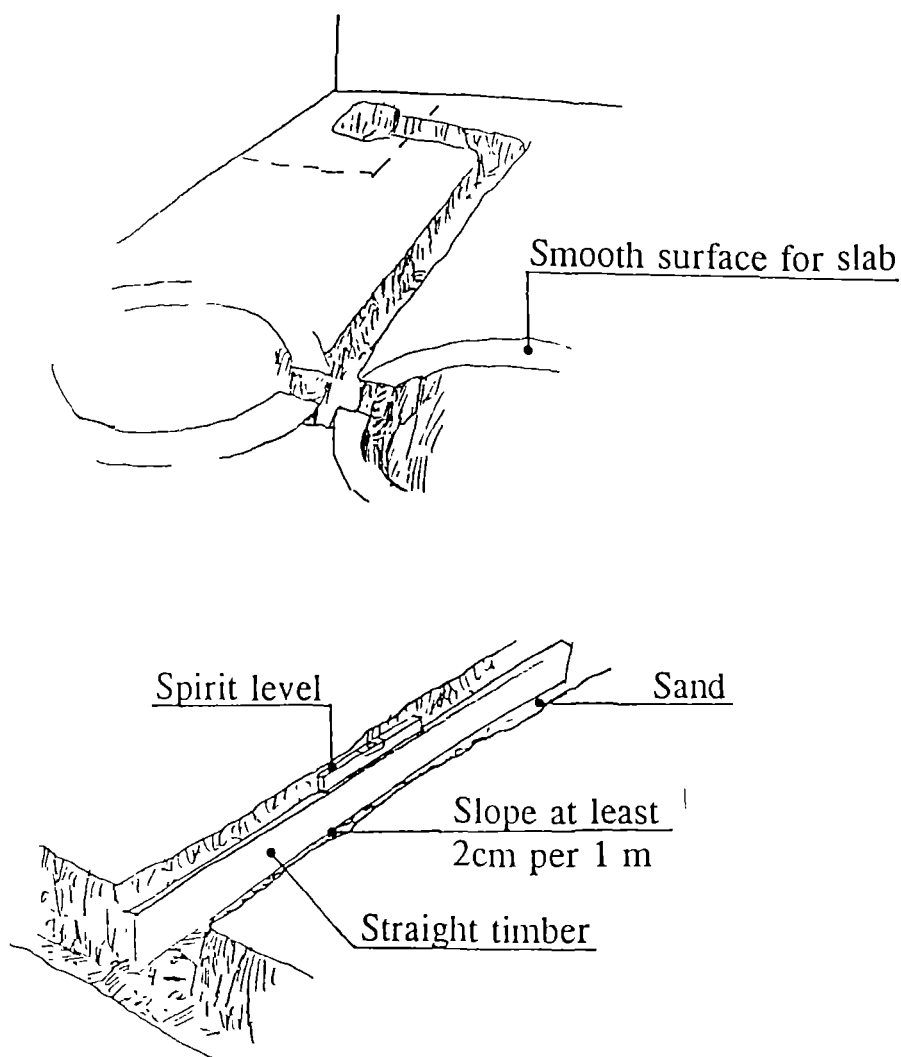
## 2.3

**Digging of channel for pipes**

Measure and dig the channel for the sewer pipe from the toilet site to the pits. Check with a string that the channel is straight so that there is no need to force the pipe to bend.

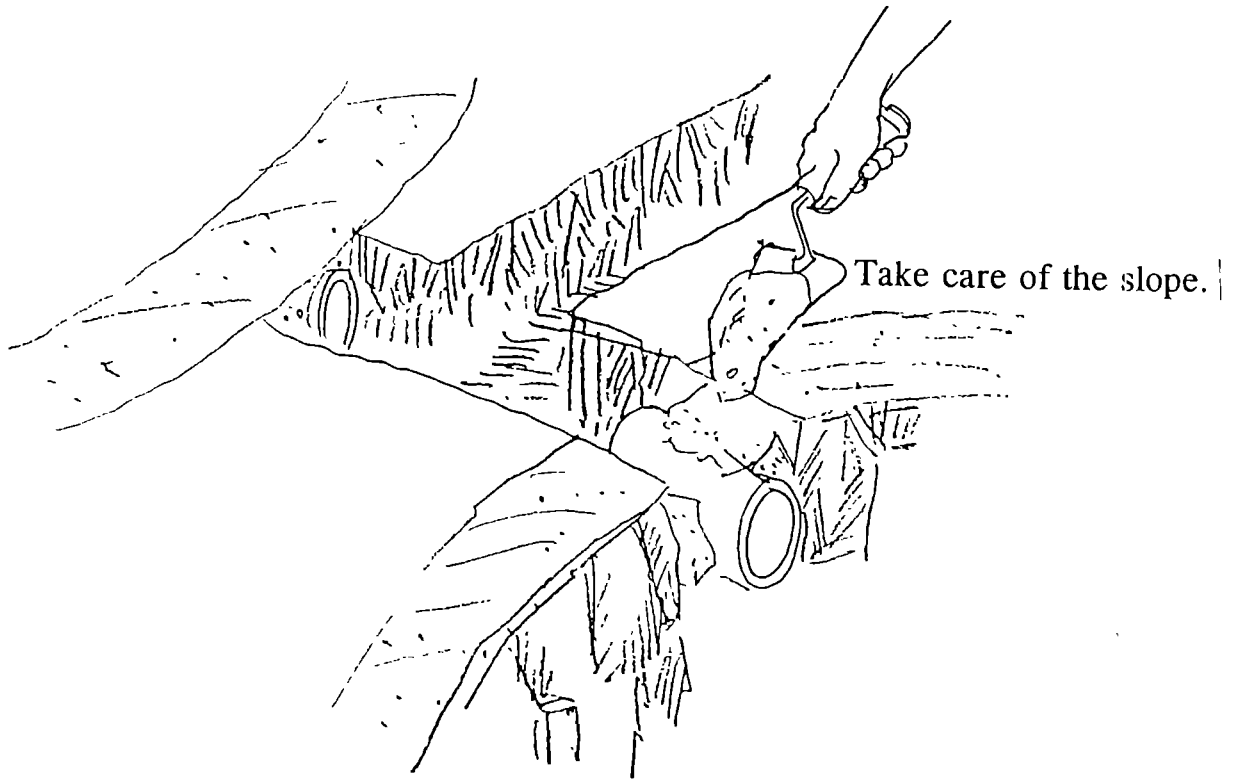
Make a bed of clean sand, clay or silt for the pipe. Check that there is no sharp stones next to the pipe.

Check the slope of the channel. You need a piece of straight timber and spirit level. The slope should be at least 2 cm per 1 m.



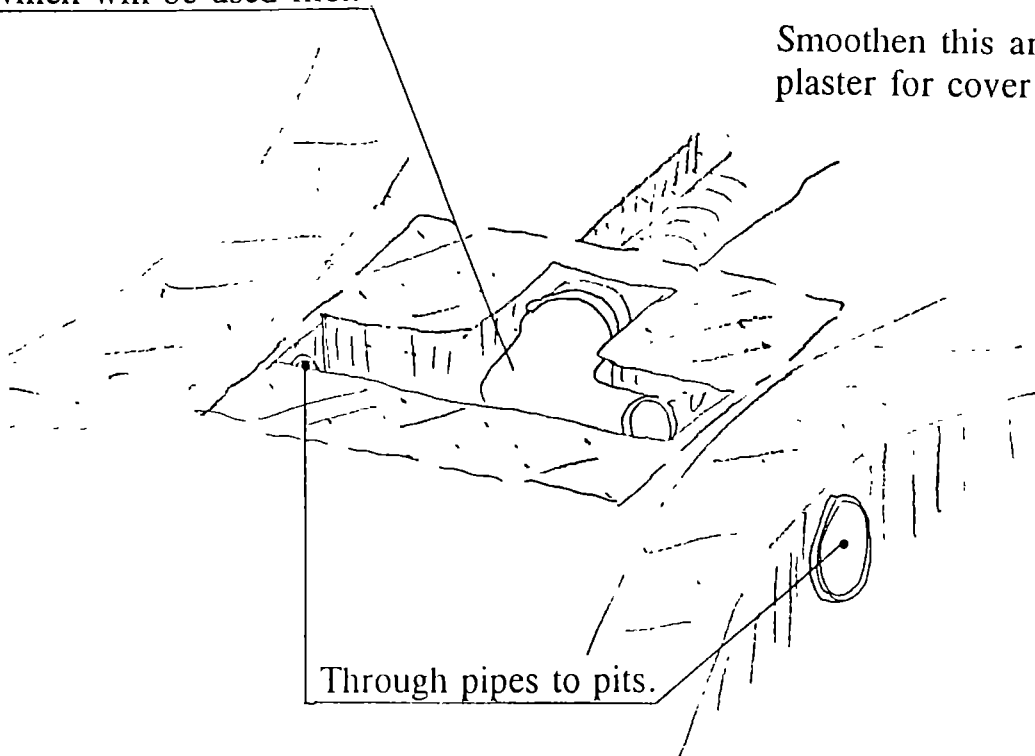
## 2.4

### Finish the entrance channels and diversion valves



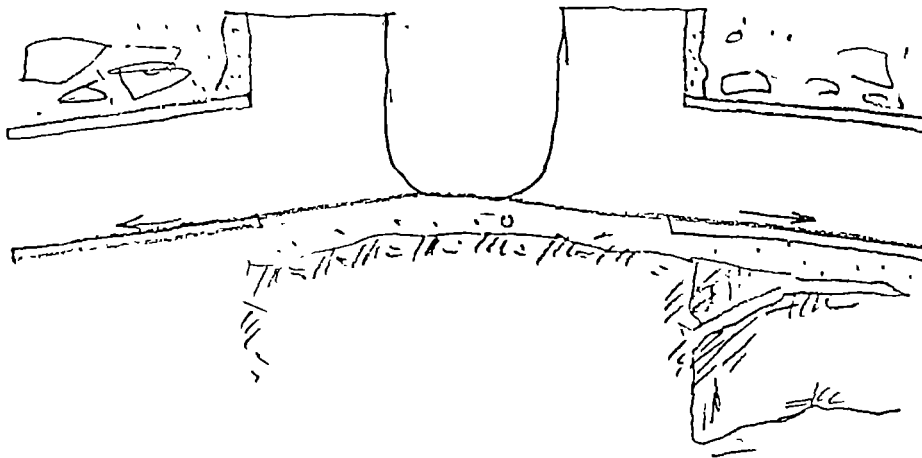
Elbow turned to the pit which will be used first.

Smoothen this area with plaster for cover slab.



Smoothen surfaces well.

Form a place for elbow  
(diversion valve) from  
mortar



Slope at least 2cm per 1  
m

**2.5****Covering the pits and installing the pipes**

Move the cover slabs carefully on the top of the pits.

Lay the required lengths of pipe carefully on the sand bed. Take care of the slope.

Check that the diversion valve can be turned without removing the cover slab.

Backfill the pipes carefully; first with clean sand then with dug out soil. No sharp stones next to the pipe !

Install the toilet pan with goose neck. Backfill carefully. Compact soil.

After installation, check that water is flowing freely from the toilet pan to the pit.

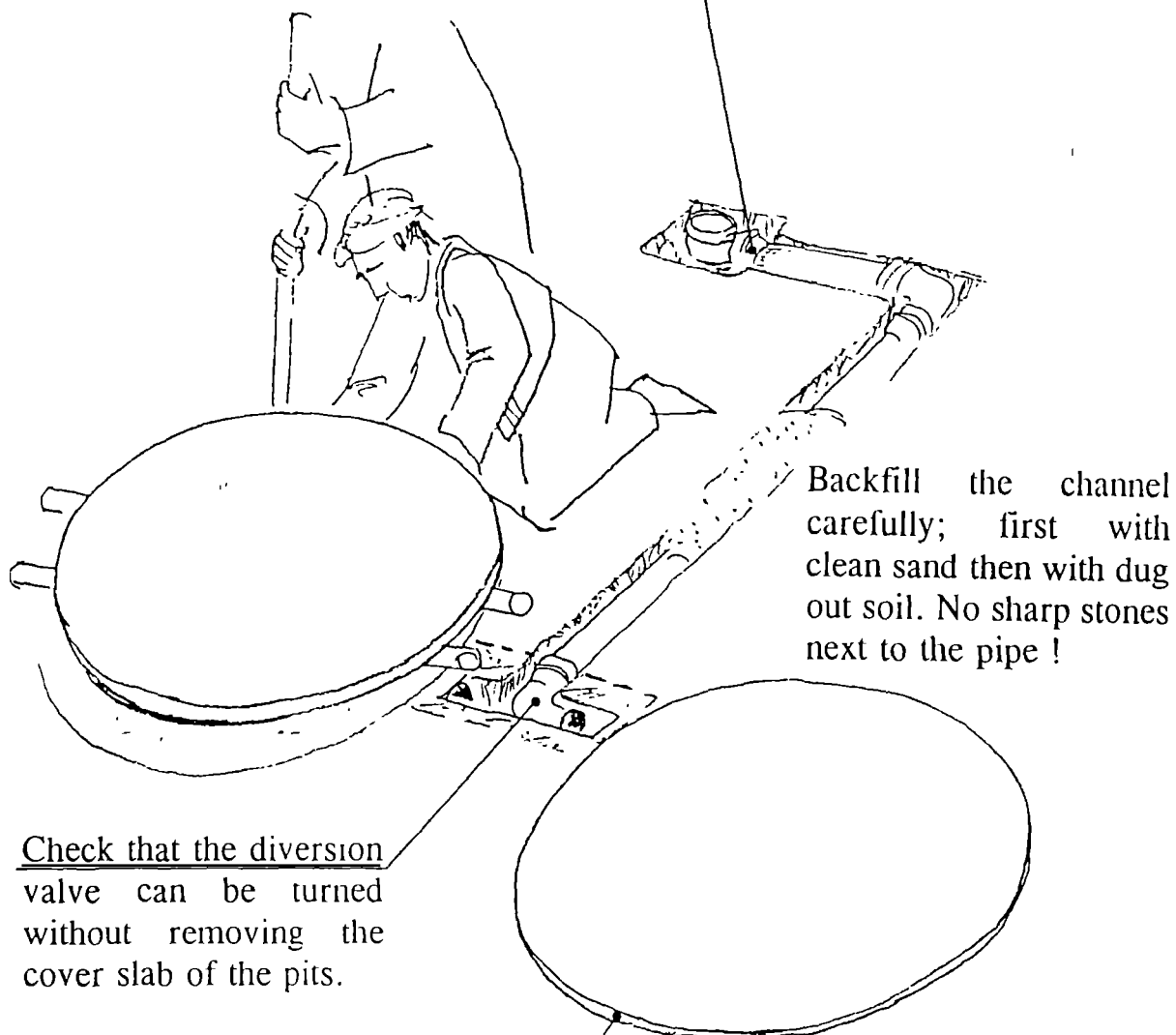
Check the voids under the cover slabs and the lid of diversion valve. Backfill them carefully with cement mortar.

Backfill the sides of the lid and cover slabs. The sides of these must be covered with soil. Otherwise there will be smell.



Move the cover slabs carefully on top of the pits.

Install the gooseneck, fix with mortar or glue



Backfill the channel carefully; first with clean sand then with dug out soil. No sharp stones next to the pipe !

Check that the diversion valve can be turned without removing the cover slab of the pits.

Backfill the sides of the lid and cover slabs. The sides of these must be covered with soil. Otherwise there will be smell.

After installation check that water is flowing well from toilet pan to pit and that there are no places where water stands inside the pipe.

**2.6****Preparing the site for the toilet**

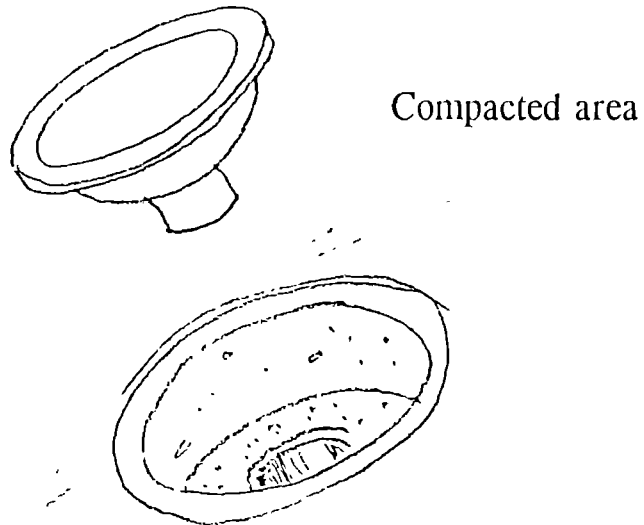
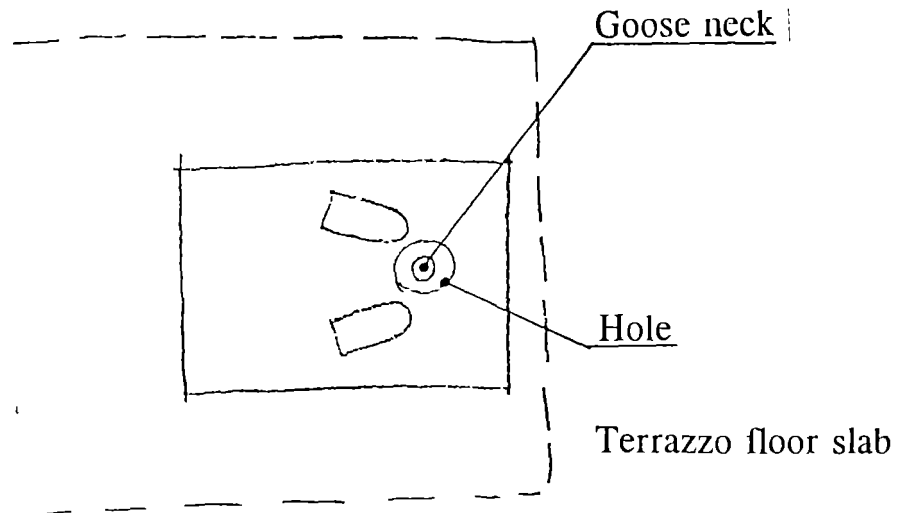
Backfill the area for intended toilet with sand or gravel to the level of the 'goose neck' and compact it well.



Plug the 'goose neck' well with plastic or paper to prevent sand from entering.

If you use ready made terrazzo slab, remove the toilet pan and place the slab carefully onto the correct place. Then install the toilet pan in the hole of the terrazzo slab. Be very careful for not to block the goose neck during the work.

Compact the area for the floor. Protect the toilet pan and gooseneck during the work.



Now remove the plug from the goose neck and carefully install the toilet pan.

## 2.7

### **Make the toilet floor**

Toilet floor must be smooth for easy cleaning.

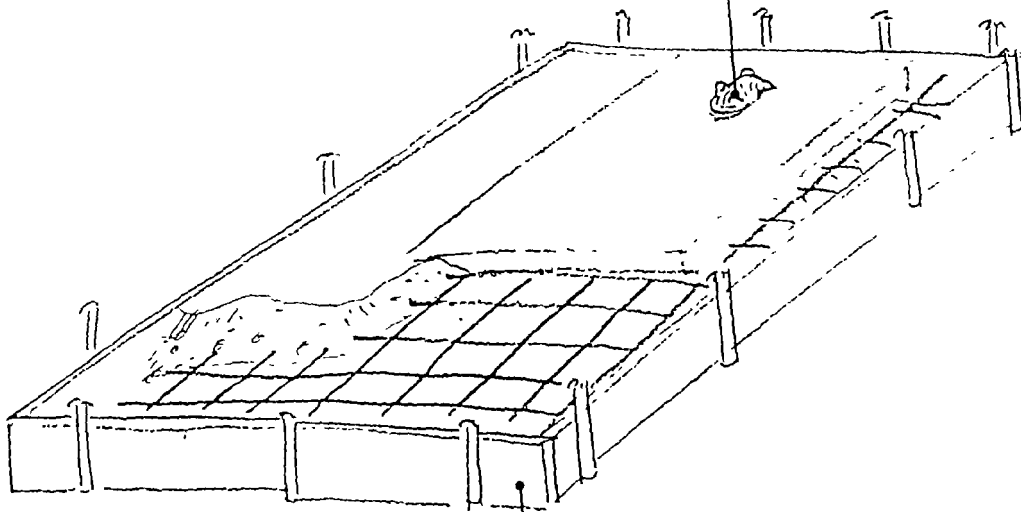
Keep the toilet pan protected all the time until all the works have been completed to avoid damages or filling with sand.

Fix the wooden frame for the concrete floor.

Install the reinforcement, add and compact the concrete.

Extend the floor to cover the intended toilet.

Keep the toilet pan plugged until all the works are completed



Frame of timber supported by pegs

## 2.8

### Visual obstruction to give some privacy

Now all the essential parts of a well functioning and environmentally sound toilet are completed. Toilet can be taken into use.

Is there something missing?

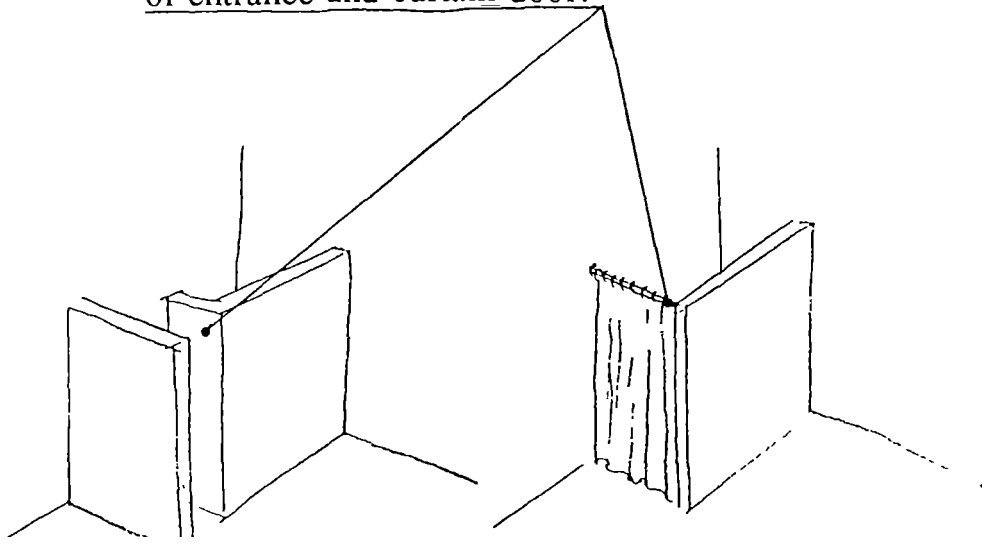
Walls, roof, door, and window.

They are not essential for the functioning of the toilet, but it may be more convenient to use the toilet when it has at least walls.

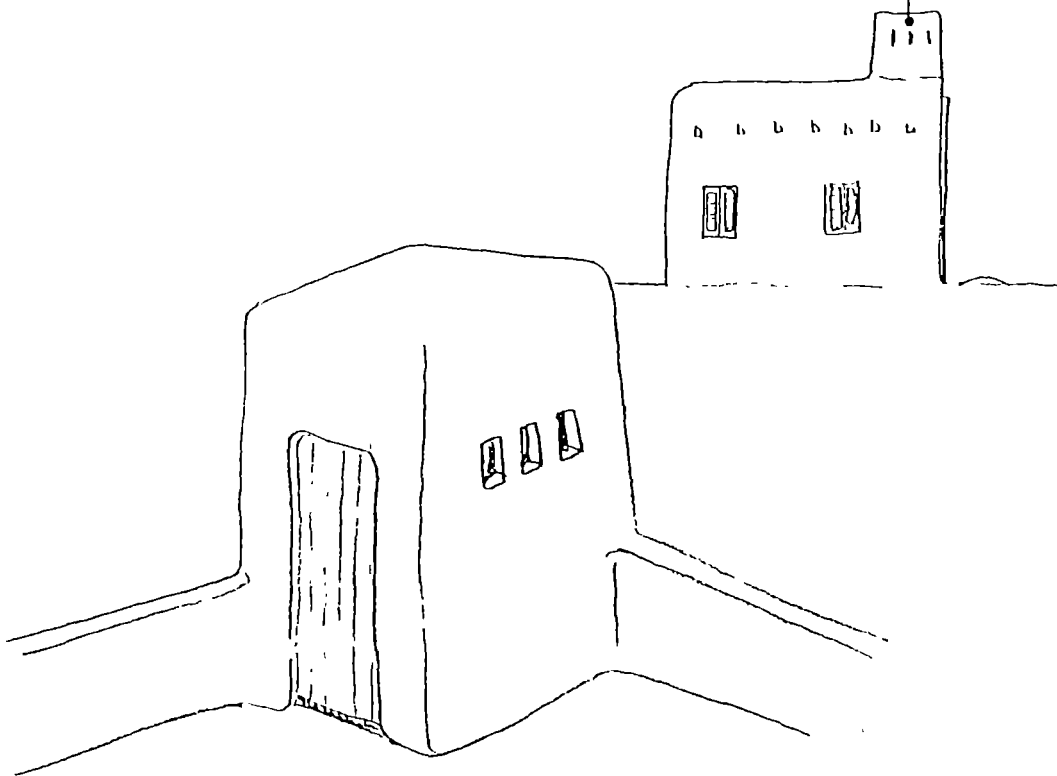
The superstructure can be made of any available material, palm leaves, straw, air dried bricks, stones, etc.

The model the superstructure can be selected according the model of the house. Below some examples are shown.

Solutions without door, wall in front  
of entrance and curtain door.



Mud brick model on the roof.







**PART 3**

**OPERATION AND MAINTENANCE OF THE  
TOILET**



### 3 USE AND MAINTENANCE OF THE TOILET

#### 3.1 Normal use of toilet

Keep toilet floor clean.

Keep a tin of about 2 liter always in the toilet. Also a pail for water from where the tin can be filled is recommendable.

Flush the toilet pan after every use with 2 liters of water. Do not use extra water for flushing to prevent flooding of toilet.

Do not bathe in the toilet. Excess water going into the pits dilutes the valuable nutrients from the content of the pit. Those nutrients should go into the field and not into the ground water. Excess water may also destroy the structures of your house.

Do not put other washing waters into the toilet.

## 3.2

### Changing and emptying of the pit

The first pit will be full after about two years of use. When it is full, uncover the elbow (diversion valve). Turn the elbow into the other pit and cover again.

Now you can use the toilet again as before.

After about a year, at suitable season when fertilizer is needed, you can empty the first pit. Call some help to empty the pit because the cover slab is heavy. Then follow the next steps:

1. Dig out the soil covering the slab.
2. Lift the slab carefully from the top of the pit.
3. The content of the pit is now harmless; it has no bad smell and it is very valuable fertilizer. Dig it out and use as fertilizer.
4. Be very carefull not to use too much for plants. It is very strong.
5. Check that the structures are good. Repair if necessary. Smoothen and clean the top of the lining so as to provide good base for the cover slab.
6. Move cover slab back on the top of the pit.
7. Cover the slab with soil as before.

**PART 4**

**TECHNICAL SPECIFICATION**



## BILLS OF QUANTITIES

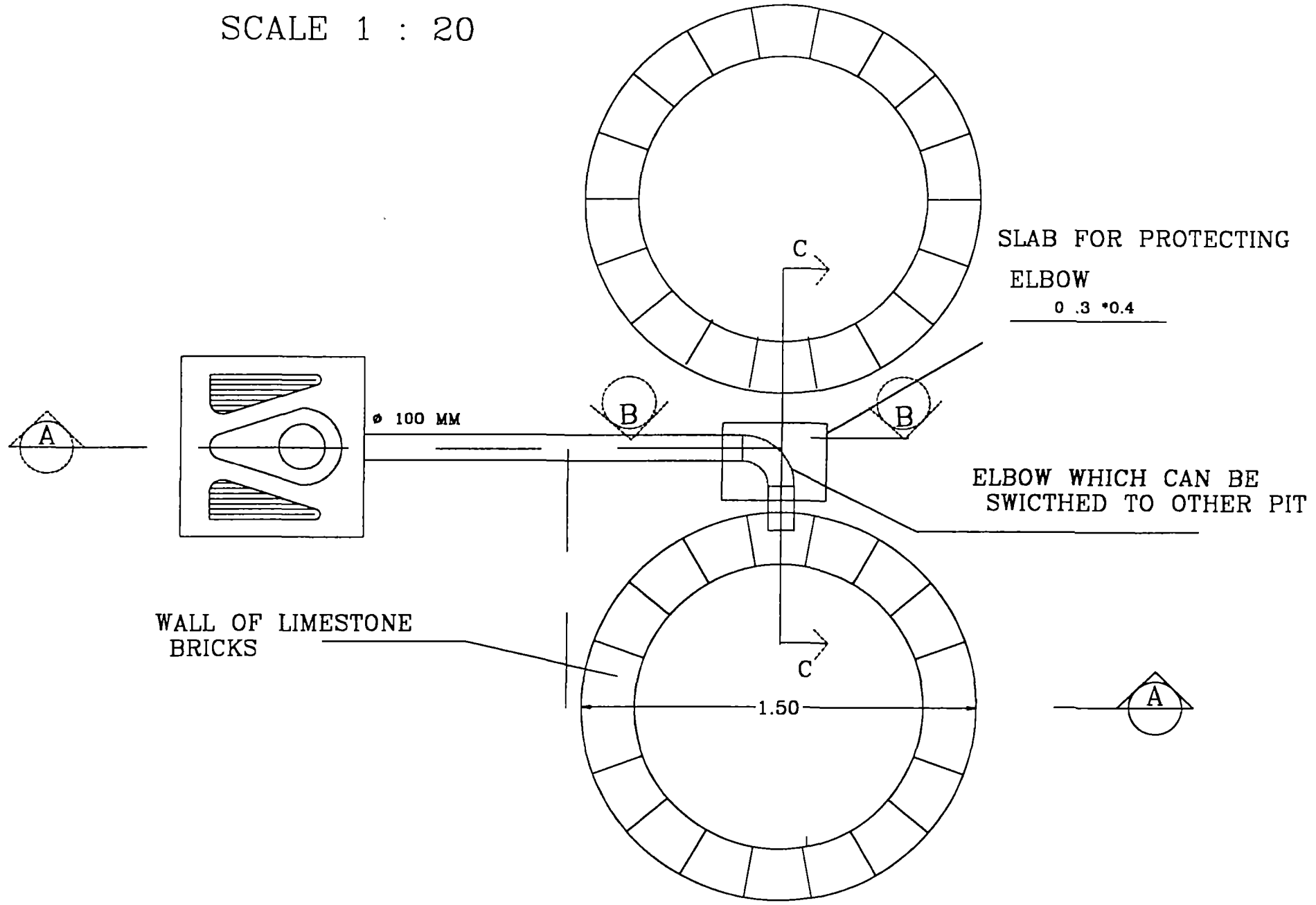
Items	Unit	Qty	Unit price	Total price
1 Pits				
- Digging	m <sup>3</sup>	8	5	40
- Limestone bricks	no	200	0.5	100
- Sand	m <sup>3</sup>	1	20	20
- Gravel	m	0.5	20	10
- Cement	packet	3	12	36
- Concrete slab, pit	no	2	75	150
- Slab, diversion valve	no	1	15	15
Transportation				
Fittings				
- Floor slab	no	1	8	8
- Trap pan	no	1	2	2
- Goose neck	no	1	2	2
- Plastic pipes, 100 mm	m	8	2	16
- Plastic elbow	no	2	2	4
- Adhesive plastic	no	1	2	2
Wages				
- Mason	-	lot	50	50
- Plumber	-	lot	25	25
Total				489





# LAY OUT OF DOUBLE PIT LATRINE

SCALE 1 : 20



SLAB FOR PROTECTING  
ELBOW  
0.3 \* 0.4

ELBOW WHICH CAN BE  
SWICTHED TO OTHER PIT

WALL OF LIMESTONE  
BRICKS

∅ 100 MM

1.50

PLAN

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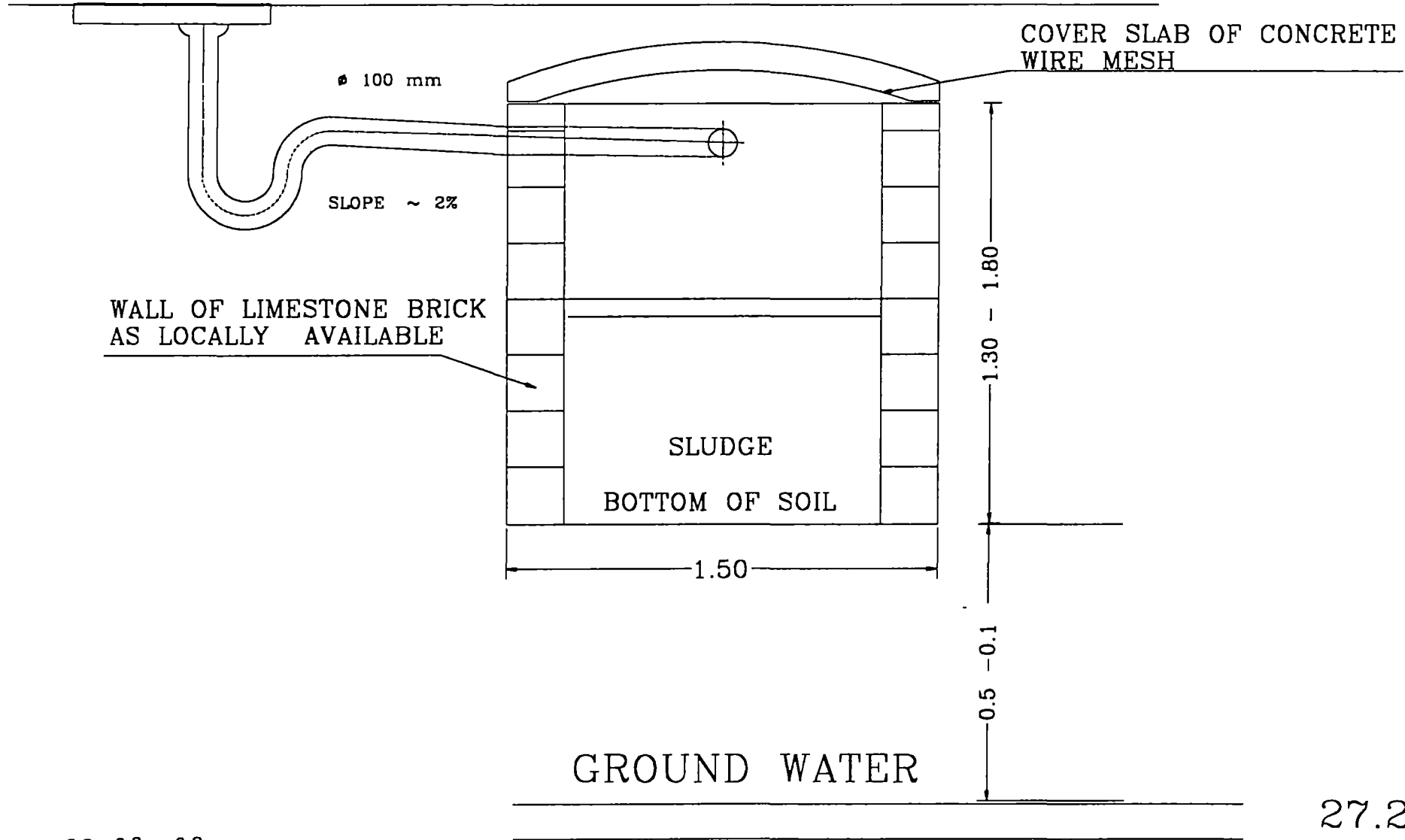
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LAY OUT OF DOUBLE PIT LATRINE  
SCAL 1 : 20

SECTION A-A

GROUND LEVEL



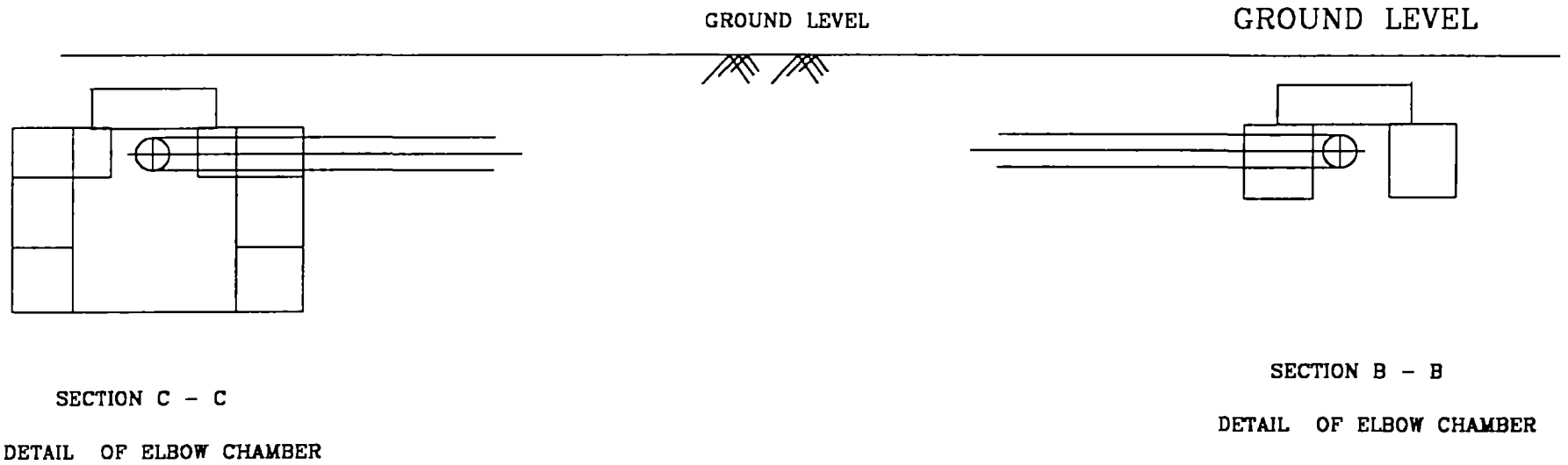
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# LAY OUT OF DOUBLE PIT LATRINE

SCAL 1 : 20



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