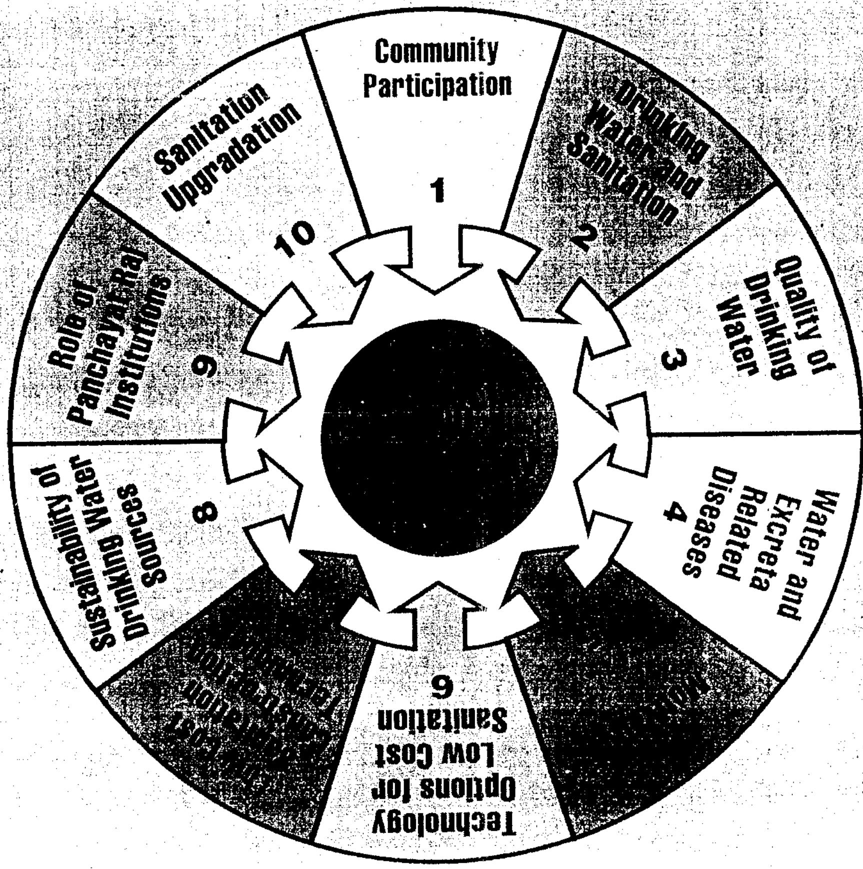
IEC 08

RURAL WATER SUPPLY AND SANITATION PROGRAMME

GUIDE ON SUSTAINABILITY OF DRINKING WATER SOURCES

FOR IMPLEMENTERS AND USERS



RAJIV GANDHI NATIONAL DRINKING WATER MISSION

NATIONAL INSTITUTE OF RURAL DEVELOPMENT

MINISTRY OF RURAL AREAS AND EMPLOYMENT

GOVERNMENT OF INDIA

ABOUT RAJIV GANDHI DRINKING WATER MISSION

Accelerated Rural Water Supply Programme is being implemented rigorously to supplement the efforts of the States/Union Territories. The Rajiv Gandhi National Drinking Water Mission was launched in August 1986 to accelerate the progress of drinking water supply in rural areas and to provide cost effective science and technology inputs to improve the programme implementation in active collaboration and cooperation with the states, local people and institutions.

The Missions' objective is to provide safe drinking water free from chemical and biological contamination as also ensure provision of 40 litres of safe drinking water per person per day (LPCD) in all areas for all human beings and additional 30 LPCD in Desert Development Programme areas for drinking water requirement of cattle. Habitations which are not getting full supply of 40 LPCD are treated as partially covered requiring augmentation facilities to bring them to the level of 40 LPCD.

The Mission's major activities include improvements in the quality of drinking water through the Sub Missions on Eradication of Guineaworm, control of Fluorosis, Removal of Excess Iron and Brackishness, Removal of Arsenic, Water Conservation and Recharge of Aquifers. In addition, other programmes on water quality surveillance, training of villagers and officers/staff involved in the programme, research and development, and information, education and communication for health awareness are being implemented in cooperation with the State/UT Governments. Panchayats and non-Governmental Organisations, with special provisions for SCs and STs.

The Mission has a specialist role to play and has been created by the Ministry of Rural Areas and Employment, Government of India.

ABOUT NIRD

Integrated Rural Development through holistic approach is a national commitment. The goal is to enrich the quality of life of poor by meeting the basic needs and generating employment opportunities on a wider scale through decentralized planning. The Mission of NIRD is to facilitate rural development efforts by improving the knowledge, skills and attitudes of rural development officials and non officials through training courses, workshops and seminars. Further, improvement of economic and social well-being of people in rural areas with focus on disadvantaged groups through research, action research and consultancy efforts is sought. NIRD is the country's apex body for undertaking training, research, action research and consultancy functions in the rural development sector. It is an autonomous body registered under Societies Act, funded by the Ministry of Rural Areas and Employment, Government of India.

NIRD is given the mandate to (i) conduct and assist in the organisation of training programmes, conferences, seminars and workshops for senior level development managers; (ii) undertake, aid, promote and coordinate research on its own or through other agencies; (iii) analyse and propose solutions to problems encountered in planning and implementation of the programmes for rural development, panchayati raj and similar institutions, and (iv) disseminate information through periodicals, papers and books in furtherance of the basic objectives of the Institute.

The Institute serves as a forum for discussions and debate about issues of common concern, and through its training and research activities, attracts academics and development practitioners from all over the country and abroad.

The Institute disseminates the results of its research studies and recommendations of its various seminars and workshops through a number of publications like the Journal of Rural Development, Panchayat Unnati and NIRD Newsletter.

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IEC 08 - English

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INTRODUCTION

The ancient civilisation flourished along the banks of rivers where water was freely available. As the population grew and human needs increased, they had to move away from rivers and for fulfilling their needs of water had to search for solutions like creating water sources, storage and transport for distribution to the people residing in various places. Thus, emerged the practice of water harvesting, a new word for an ancient system. Once the drinking water system was created, upkeep of the source (s), storage and distribution became very important. This is defined as sustainability of the system.

The objective of this booklet is to guide the block and village level community as well as panchayat functionaries the importance of -

i) Water harvesting structure

ii) Watershed management and water conservation

iii) Sustainability of the assets created

2

WATER HARVESTING STRUCTURES

2.1 Traditional Water Harvesting Structures

The water harvesting structures varied from State to State and even from region to region in various States, because of wide variations in rainfall pattern : (e.g. rainfall as low as 10 cm. annually in Western Rajasthan and as high as 1700 cm in Cherapunji, Meghalaya)

The various systems used in different regions of India are described below:-

i) In the hilly and high rainfall areas, domestic roof top rain water collection and storage by constructing dug-cum-embankment type of water storage structures along the foothills to arrest spring and run off flow.

ii) In the western part of India (desert areas) with scanty rainfall and inadequate ground water resources, rainwater harvesting/collection is the only solution.

The traditional water harvesting systems are :

a) Tanks (covered underground tanks)

b) Khadins (eastern embankment in plain area)

c) Nadis (excavated or embarked village ponds)

iii) Ahars in Bihar are water harvesting systems similar to Khadin, except that these are earthen bunds on gently sloping clayey soils basically used for irrigation purpose.

iv) the southern peninsula has highly undulating land form with an elaborate drainage system. It has an uneven rainfall distribution.

The traditional rain harvesting systems are

a) Bhandaras (wiers)

b) Kohapur type (open wiers)

c) Village ponds

d) Stone lined tanks

e) Ooranies

- It is needless to say that traditional water harvesting systems are based on sound principles. However, their improvement incorporating modern technology and scientific inputs would make them even more efficient systems towards solving the problem of drinking water in rural areas.

2.2 Important Water Harvesting Structures and Suggested Improvements

2.2.1 TANKA

Tanka is a local name given to a covered undergound tank, generally constructed, masonry or concrete type for collection and storage of surface run off. Adoption of such a structure can be a solution to the problem of perennia drinking water scarcity in the village of Western Rajasthan. The provision of a tanka near religious centre, school on private household, has been an age old practice.

As the regards the constructional aspects, existing tankas are circular in shape, having almost similar depth/diameter, varying from 3.00 to 4.22m. Since stones or bricks are not available at all places and as these are relatively costly, in sandy areas lime mortar is used to plaster the bare horizontal and vertical soil surfaces to a thickness of about 6 mm. A second layer of plaster, of cement mortar, is applied to a thickness of about 3 mm. The top is covered with zizyphus Numularia thorns.

With simple lime plaster on the bare soil surface, the life of tankas is limited to 3 years. A catchment of tankas are made in variety of ways using locally available sealing materials. The commonly used materials are pond silt, murrum, wood, coal ash, gravel etc. After clearing the soil surface of vegetation, a gentle slope of 3 to 4 percent towards the tanks, is provided in the good pond silt in the form of 3-4 cm thick layer is spread in the entire catchment. During the rainy season, after the first shower, this layer becomes compacted and semi-impervious by local compaction technique. In places where tanks silt is not available, layer of murrum of 5-7 cm. is spread over the catchment. At the onset of monsoon, sheep and goats are made to move over the murrum again and again till the surface becomes compacted and impermeable. During this process, water is also sprinkled, if needed. Wood ash is used to repair the catchments made up of pond silt and murrum. The ash settles, fills the pores and makes the surface, water proof.

Tankas constructed by traditional methods are temporary structure. There are leakages from the bottom as well as from vertical slides. Moreover, the prepared catchment areas are not in accordance with the amount of rainfall received and run off generated. The water collected in these traditional tankas is never free from pollution. There are evaporation losses as it is coverd with thorns only *and there are no provision of proper surface run off!* Is it meant that no provision for run off around the structure or no provision for overflow from the Tankas!

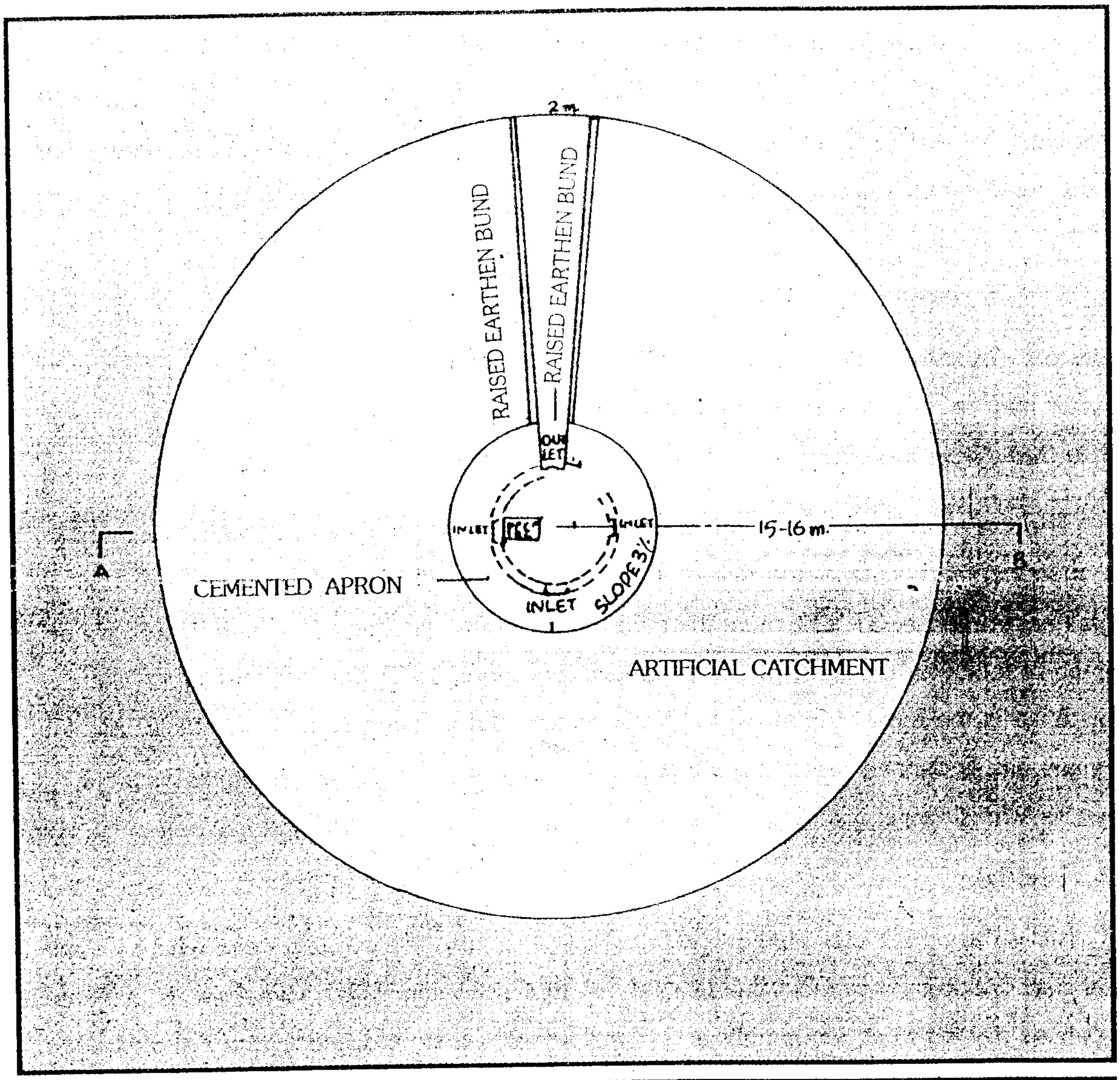
A family of 6 members relying solely on tanka water, require nearly 19.70 cum. of minimum storage of water. However, in case of higher consumption of water, say 12-14 litres per capita per day during the summer period of 4 months, an additional provision of 2.88 cum of water may be made i.e. tanks of 22 cum capacity for single family (figure 1) will ensure water supply throughout the year.

The experiment on use of efficiency of different sealing materials, indicated that spraying of sodium carbonate at the rate of 1 Kg/10 sq.m. is sufficient. It generated 66.32% of rainfall as run off i.e. 37.32% more than the run off from untreated soil. These figures are an average of four year experiment. The treatment cost during 1972 was Rs. 0.60 sq.m. The circular tanka is the most economical form of structure and is found to be more stable. Almost 25 years old. Is thus no recent experiment?

2.2.2 NADIS

NADIS are small excavated or embarked village ponds for harvesting water where rainfall is deficient/inadequate to meet the demand for drinking water. Water from these is available for periods starting from two months to a year after rainy season, depending on the catchment characteristics, the amount of rainfall received and its intensity. This is an ancient practice and the Nadis are the most important water sources of the region. Since Nadis are the vital water sources in the Indian arid (desert) zone, each village has one or more of these, depending on the water demand and availability of sites.

Location and size of a Nadi depends on the catchment area it commands. It should be located in areas with lowest elevation to have the benefit of natural drainage and need for minimum excavation of earth. Surface of catchment area should preferably be impermeable. If necessary, the catchment area may be prepared artificially by soil conditioning wherever possible. Silt trap should be provided at the inlet point to prevent sediment load from entering



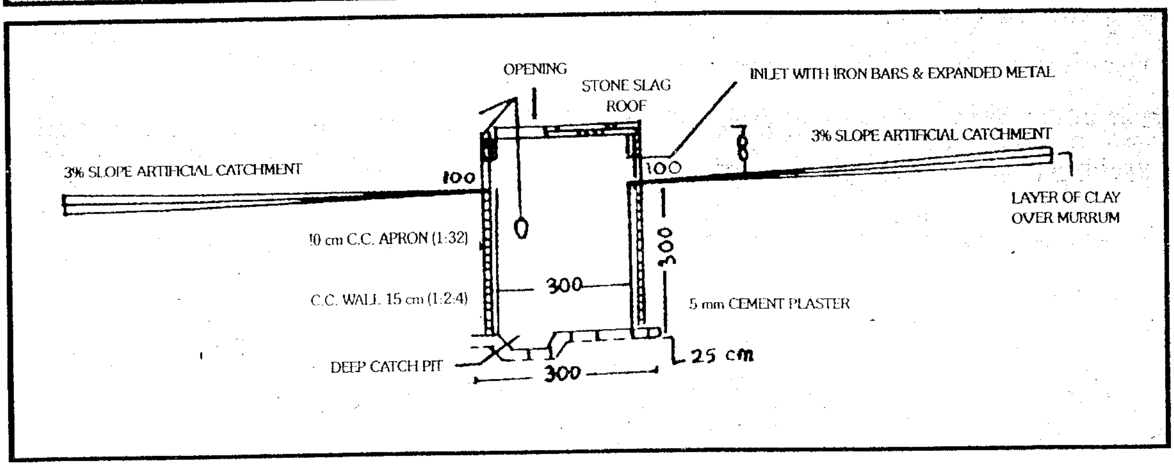


Figure 1 : **Constructional Details of a Water Tanka for a Single family**
(CAPACITY 21 CU.M.)

the Nadi. The size of the silt trap should be designed keeping in view the site conditions, duration and intensity of rainfall. Silt trap should be cleaned regularly. The inlet should be stone pitched to prevent soil erosion. A mesh should be provided at the inlet to prevent floating material from entering the Nadi. The slope of the sides shall depend on the soil condition. In order to prevent seepage losses through sides and bottoms, these are lined with LDPE sheeting. This should be embedded properly. The outlet should be stone-pitched to prevent soil erosion. An exploitation well be constructed at a suitable point of Nadi to facilitate withdrawal of water. The well has to be constructed by raising two masonry wing and one from wall. A suitable platform fitted with iron fixtures for pulley and hand pumps, is necessary. LDPE lining improved design of NADI is shown in figure 2.

2.2.3 KHADIN

KHADIN is a system basically innovated for runoff farming and to increase agriculture productive even where the rainfall is as low as 40 mm.

Rocky-hill-terrain around a valley slopes, constitute the catchment area of a Khadin. Stony gravels, wasteland with gentle slope in the form of a valley can also form the catchment area of such structure.

At the lower point of the valley, earthen bund is constructed to arrest the run-off (figure 3). The stored water helps the crops as well as recharging of ground aquifer. Spillway of stone masonry is provided in the bund to let out the excess run off. A sluice is provided at bed level to drain out standing water, if any, at the time of bed cultivation.

The system is site specific needing a large natural high runoff potential catchment in proximity of plain valley land. The ratio of Khadin area to catchment area, depending on type of catchment, is minimum i.e. 1 : 12 or 15. Since a decade, irrigation department of State has started making many new Khadins at various locations. Under Desert Development Programme also new Khadins are being constructed. Figure 3 shows plan and section of a typical Khadin. However, these need proper management.

Before starting the construction of Khadin, bund position is aligned and then about 15 cm. layer of natural ground surface is scrapped out. The earth work is done in layers of 30 cm. thickness and then compacted by ramming with hand hammer, sheep foot roller or road

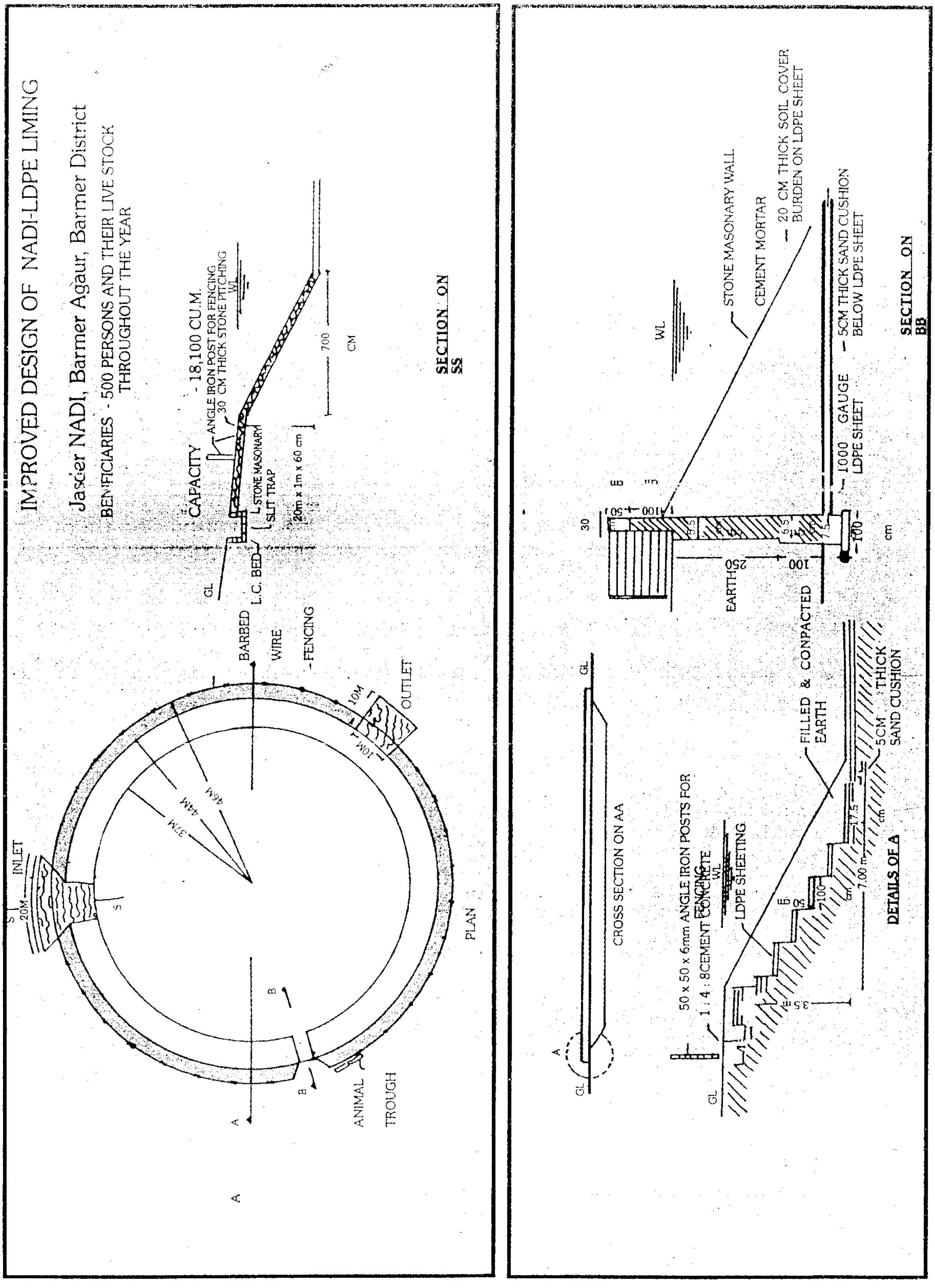
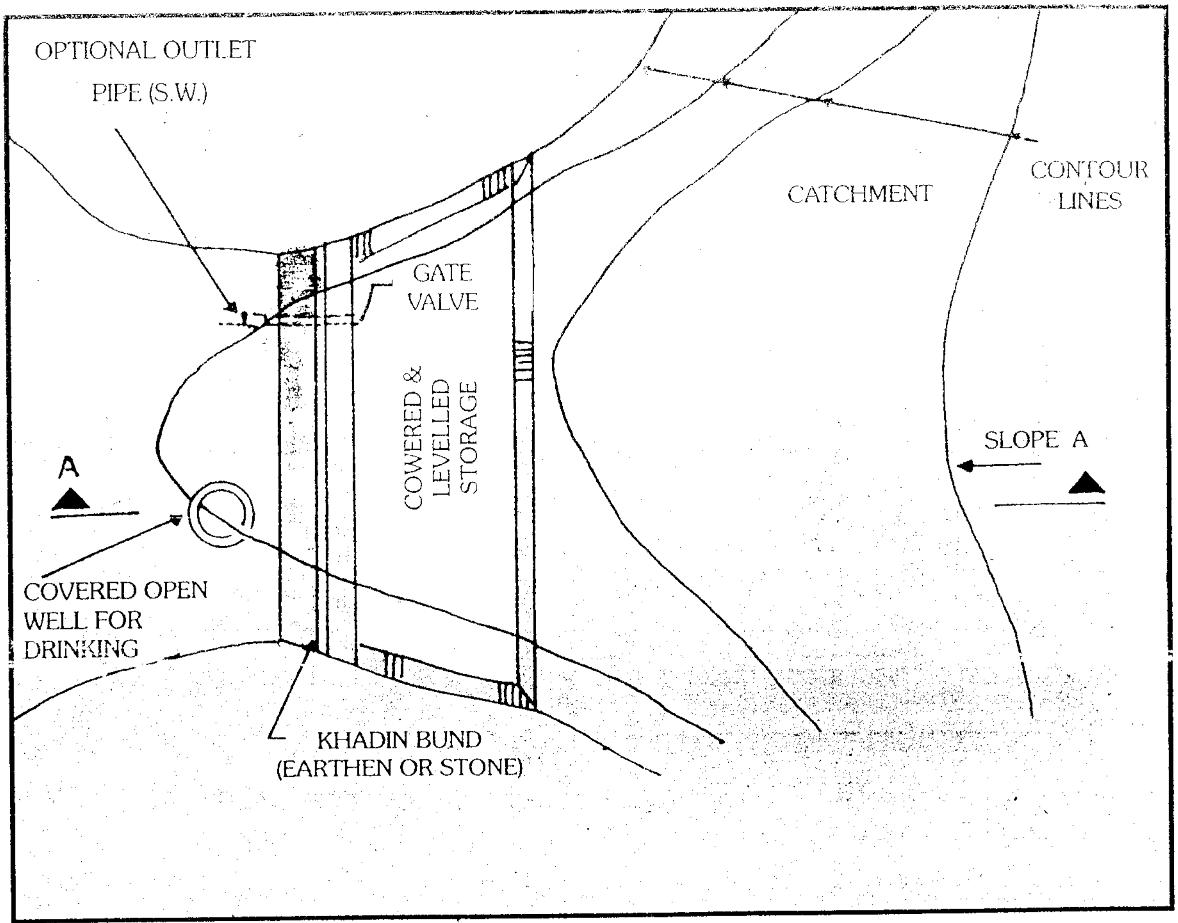


Figure 2 **: Improved Design of Nadi-LDPE Lining**

JASDER NADI, BARMER AGAUR, BAMER DISTRICT.



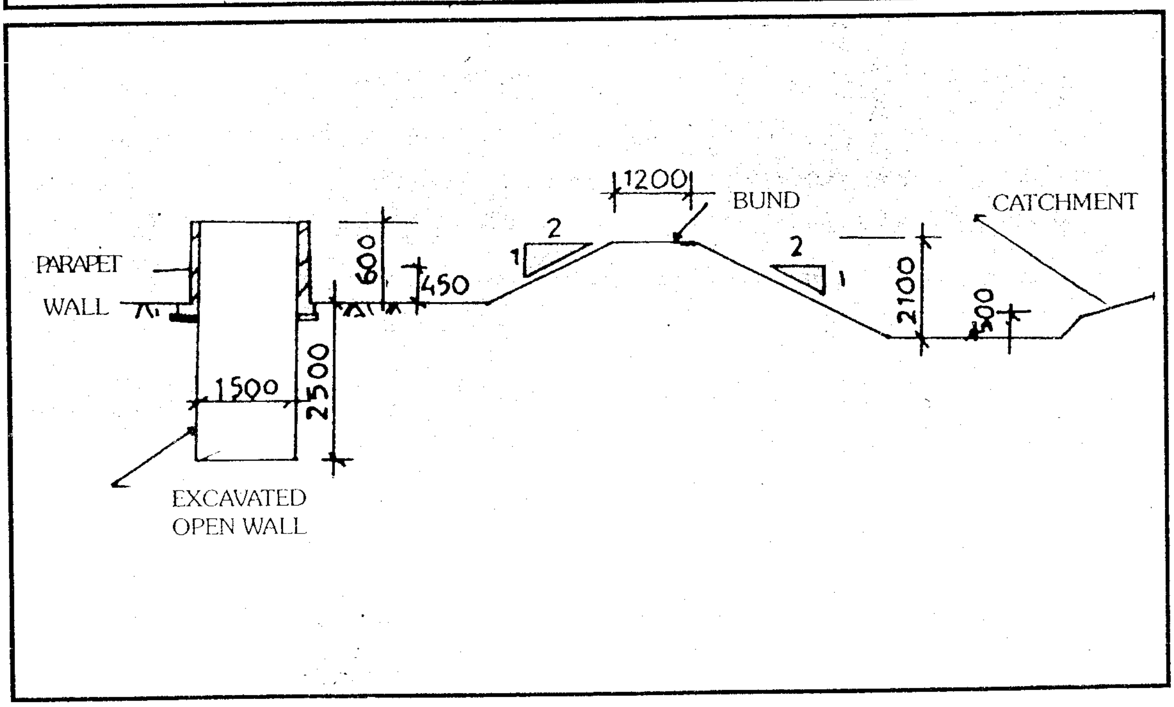


Figure 3 : SEC – A – A ((KHADIN SYSTEM)

roller. For providing shape to the bund, a profile at every 20m. length of bund is erected. Provision is made for over flow by providing cement-concrete spill-over structure with stone pitching, down stream to check erosion. Pipe outlet is also provided at centre of bund to drain out standing water. After completion of Khadin, levelling of land near bund is done for uniform spreading of water. Seeding of grass on bund during rainy season is done for its stabilization.

In big Khadins making small dug well outside Khadins bund is an innovative method developed by ancient people to have conjunctive use of water as also to encourage seeping out of saline water to prevent salinity development in Khadin in course of time. Figure 3 shows a typical Khadin system.

2.3 Roof Water Harvesting

Rain-water may be harvested in areas having rainfall of moderate intensity, uniformly spread over the larger part of the year.

In this system, only roof top is the catchment (figure 4). The roofing may be of Galvanised Iron sheets (GI), aluminium, clay tiles, asbestos sheets or concrete. In case of thatch-roof, it may be covered with water proof polythene sheets. For collection of water, a drain is provided (Gutter) along the edge of the roof. It is fixed with a gentle slope towards the down pipe which is meant for free flow of water to the storage tank. This may be made up of GI sheet, wood, bamboo or any other locally available material. The down pipe may be at least 100 mm. diameter and be provided with a 20 mesh wire screen at the inlet to prevent dry leaves and other debris from entering it.

During the dry period, dust, bird droppings etc. accumulate on the roof. These are washed off with the first rains and enter the storage tank to contaminate the water. This can be prevented by two methods :

a) Simple diversion of dirty water

b) Installation of foul flush system

Under method (a), the down pipe is moved away from inlet of the storage tank initially during the rains, until clean water flows. Under method (b) storage provision for initial rain is kept in a pipe. These are cleaned off after each heavy rain. These are provided between down pipe and the storage tank. Filter materials such as coarse sand, gravel or coconut/palm/betalnut fibre, etc. are used as filter media for preventing entry of any dirty material.

Storage tank can be constructed either underground or above ground. The underground tank may be masonry or R.C.C. structure suitably lined with water proofing materials. The surface tank may be of G.I. Sheet, R.C.C. , Plastic/high density polythene or Ferrocement Tank placed at a little higher elevation on a raised platform. To facilitate cleaning of the tank, an outlet pipe may be fitted and fixed in the tank at bottom level. The size of the tank will depend upon the factors such as daily demand, duration of dry spell, catchment area and railfall. The tank is provided with :

- a manhole of 0.50 m x 0.50 size with cover

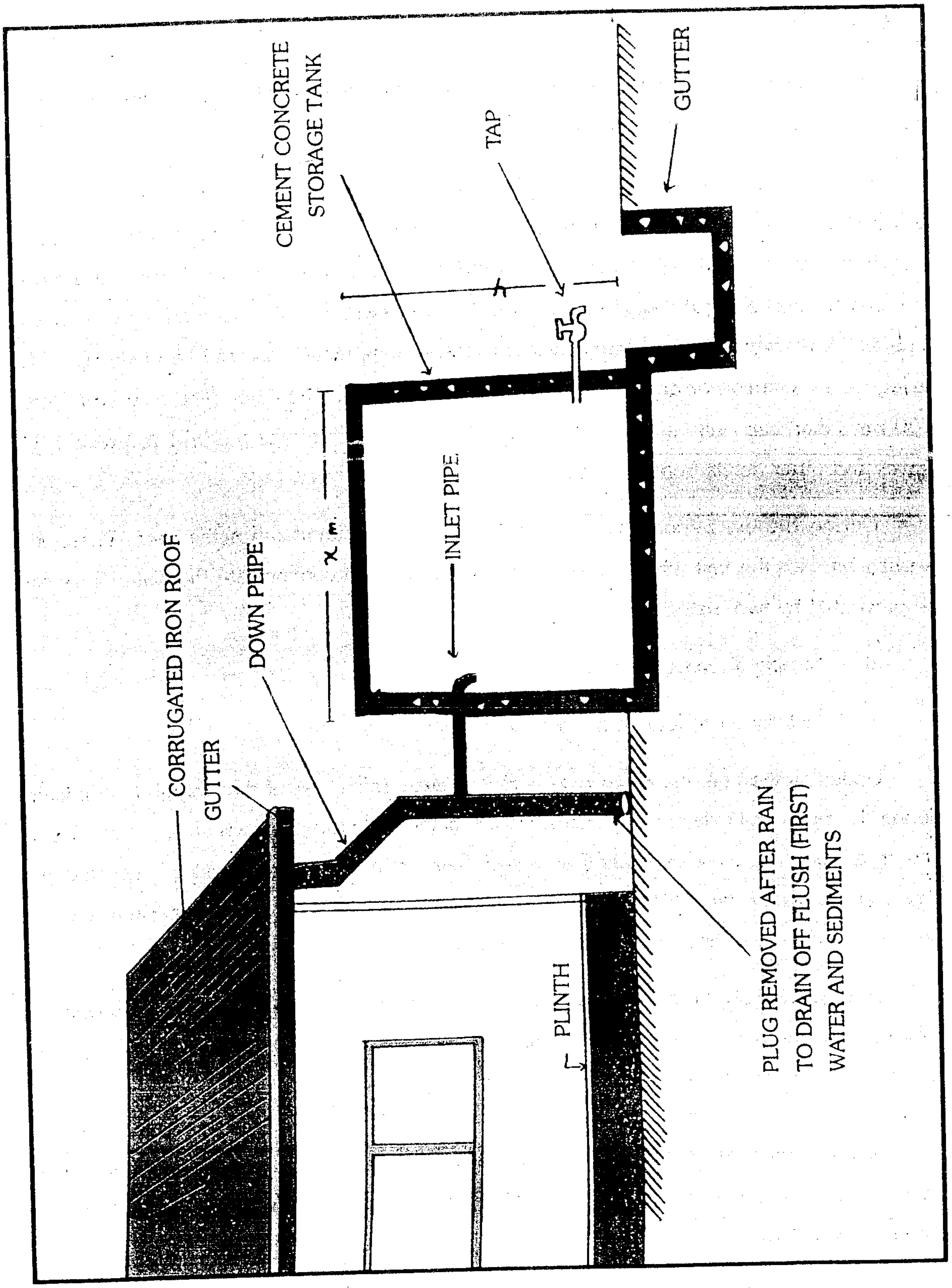


Figure 4 : ROOF HARVESTING STRUCTURE

- vent pipe/over flow pipe (with screen) of 100 mm dia
- drain pipe (100 mm dia) at bottom

Choice of tank depends on locally available materials and space available. When the tank is constructed underground, at least 30 cm of the tank should remain above ground. The withdrawal of water from the underground can be made by installing hand pump in the UG tank. In case of surface tank, tap can be provided.

Before the tank is put into use it should be thoroughly cleaned and disinfected with higher dosage of chlorine. Since the water shall remain stored for quite a long time, periodical disinfection of stored water is essential to prevent growth of pathogenic bacteria.

2.4 Conventional Water Harvesting Structures

The other traditional and conventional water harvesting structures are sanitary dug well (figure 5), Infiltration gallery (figure 6), check dam and dyke (figure 7), Infiltration well (figure 8) and rain water harvesting with built up catchment area. (figure 9).

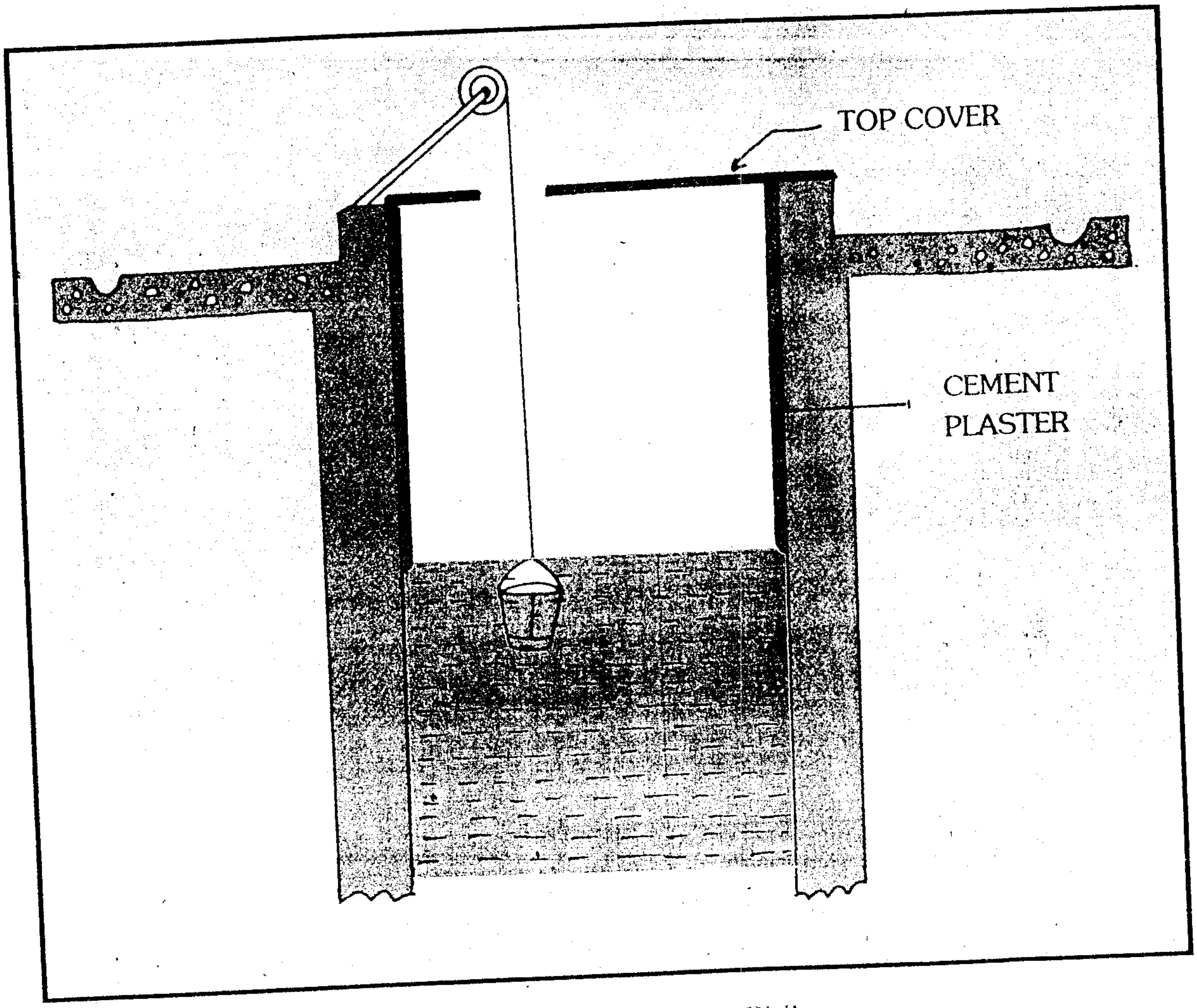


Figure 5 : **Sanitary Dug Well**

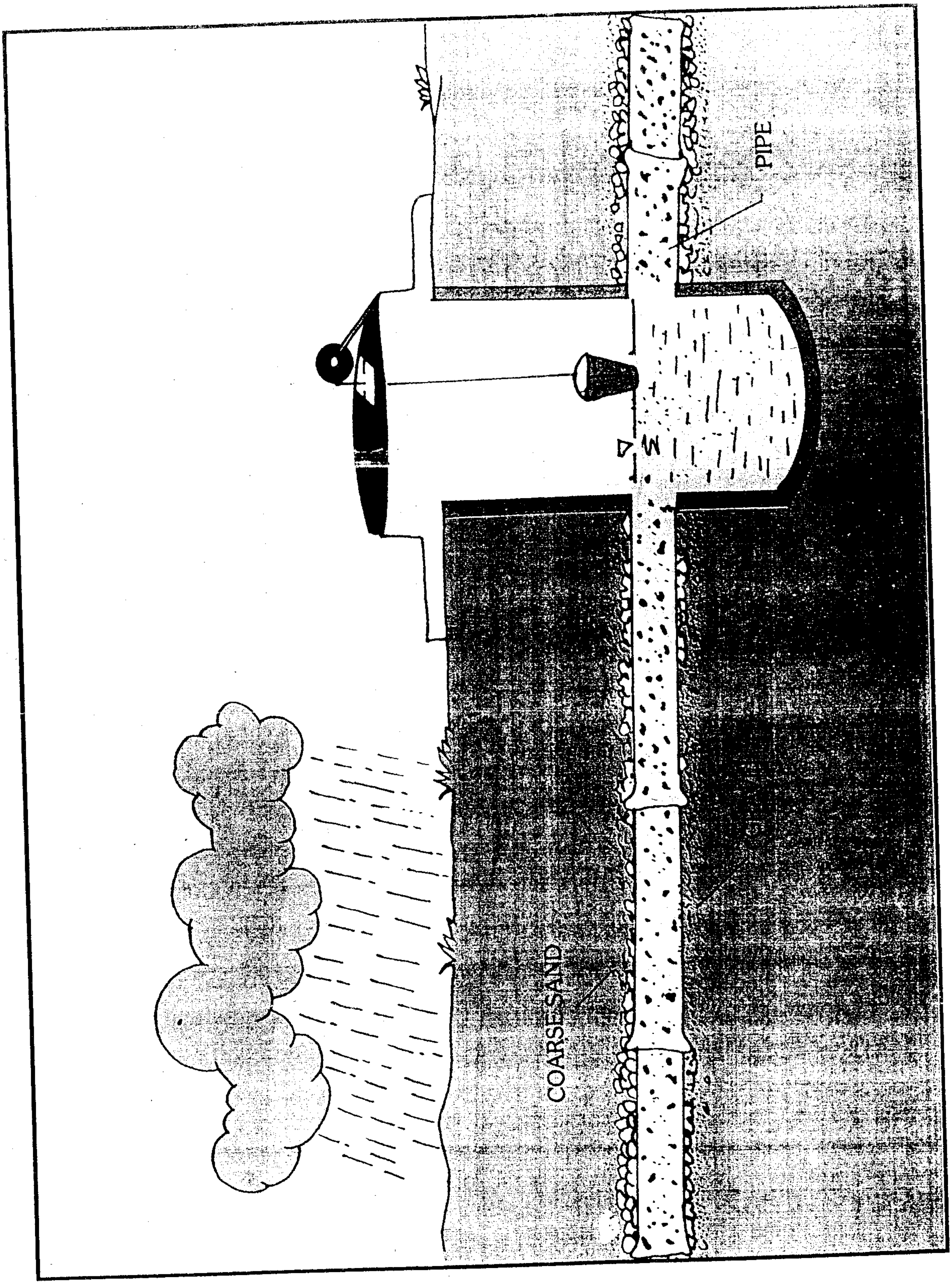


Figure 6: INFILTRATION GALLERY

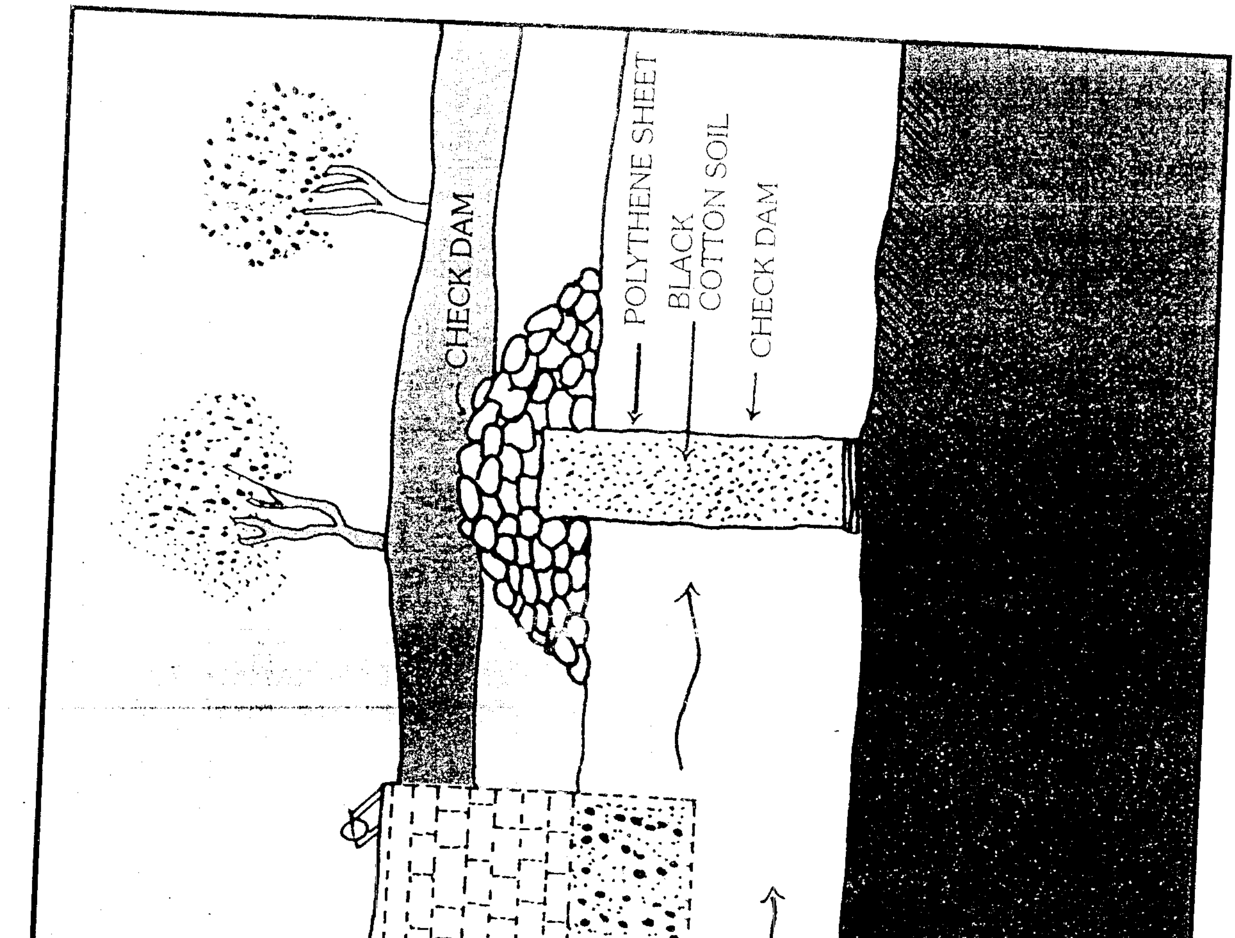


Figure 7 : CHECK DAM & DYKE

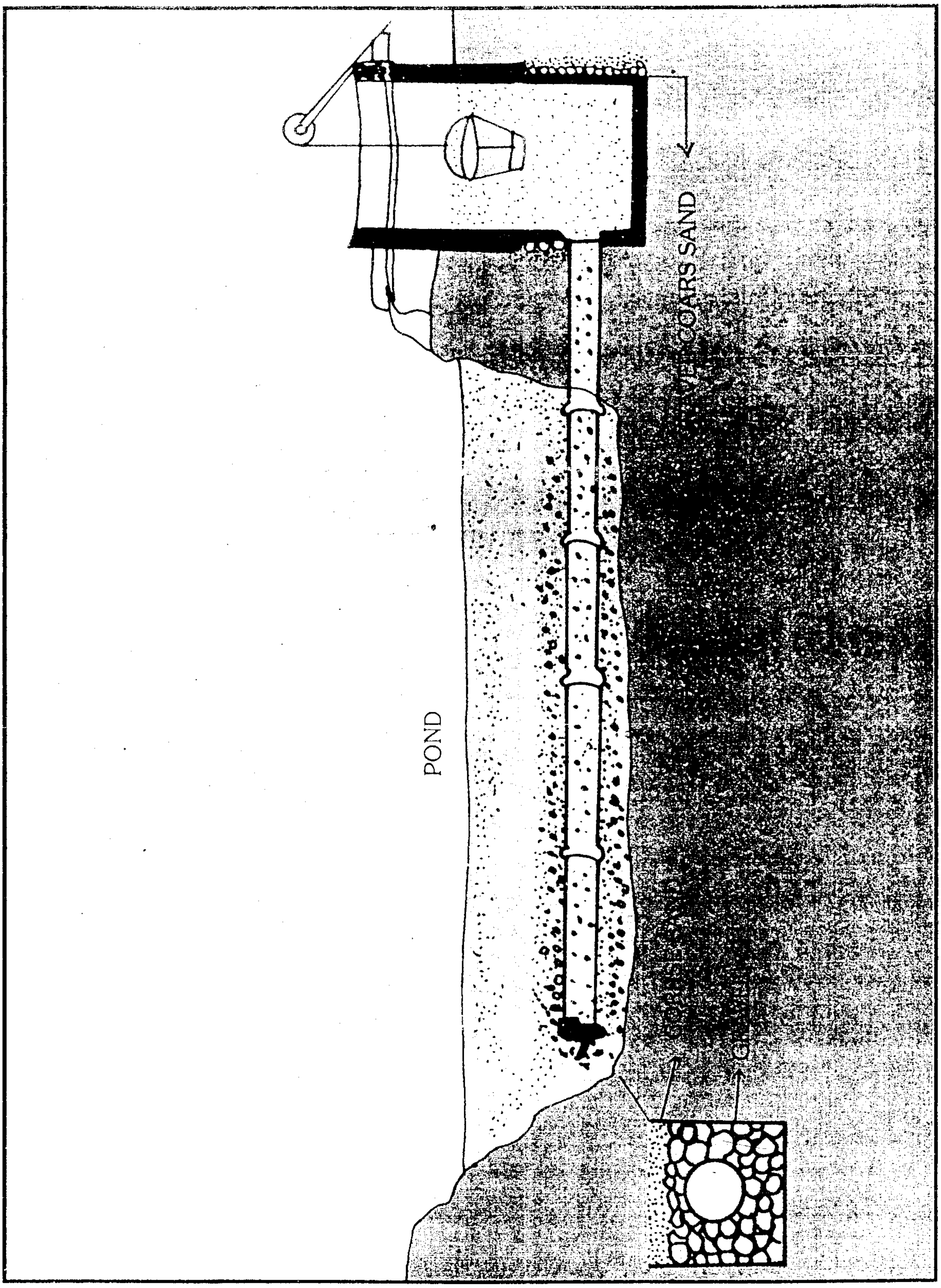


Figure 8 : INFILTRATION WELL

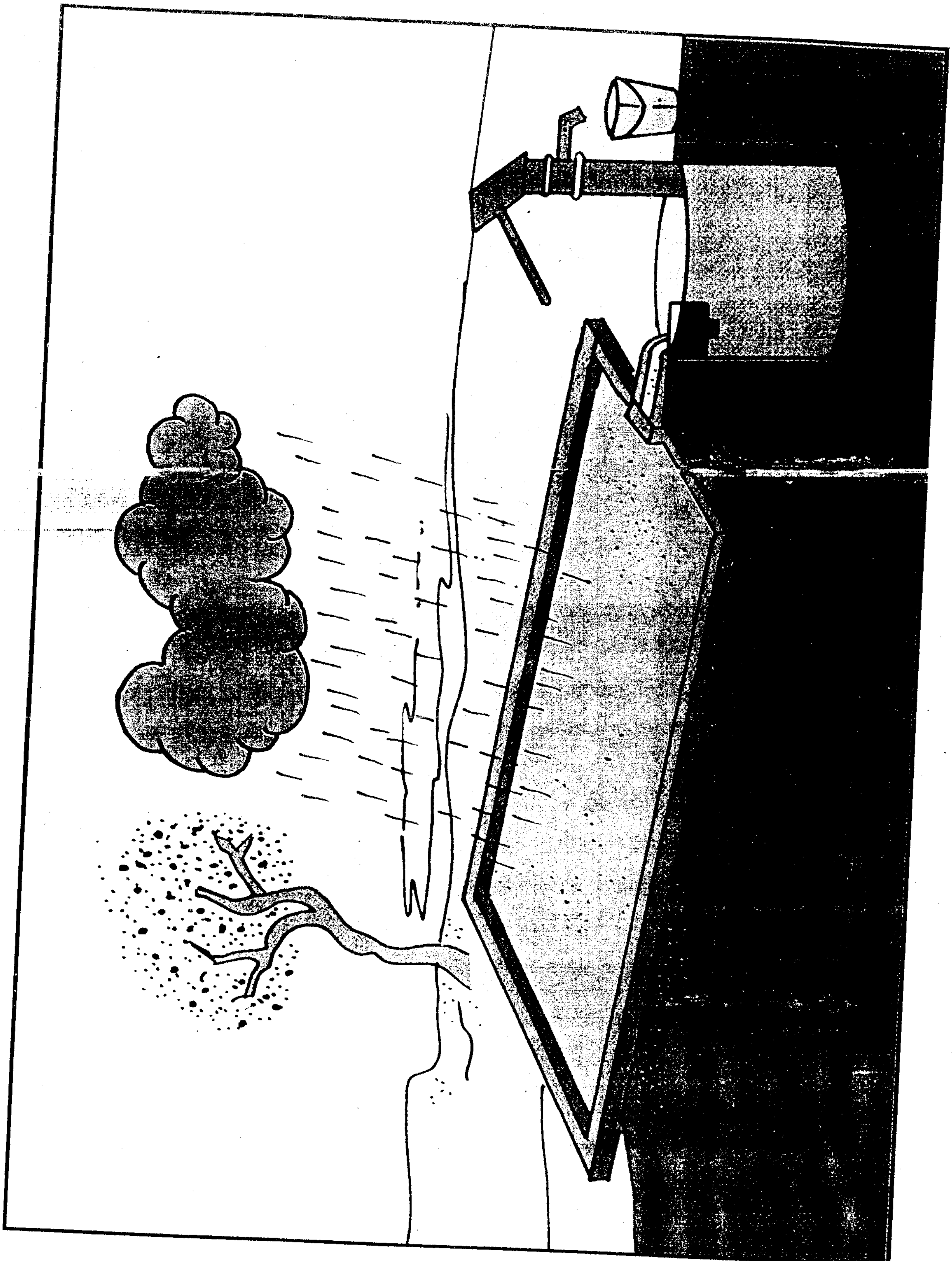


Figure 9 : RAIN WATER HARVESTING

3

ARTIFICIAL RECHARGE OF GROUND WATER

Ground Water, unlike other minerals found in the crust of the earth, is replenishable resource. Rainfall is the source of annual ground water replenishment and the movement of rainwater down to the ground water reservoir takes place by several ways, such as direct infiltration through surface soils and rocks, vertical percolation from surface water bodies and sub-surface movement through the permeable media. In the tropical countries like India the recharge through rainfall takes place only during the short period of monsoon but due to slow subsurface movement of ground water, it is available for use throughout the year.

3.1 Artificial Recharge Methods

Artificial recharge is achieved by three methods, namely,

1. Spreading
2. Induced recharge
3. Injection

The suitability of a particular method is based on the hydrogeological conditions quality of source water and proposed use of recharged water is indicated below:-

a.	Highly premeable surface formation	Spreading method
b.	Shallow aquifers	Spreading method
c.	Source water of inferior quality	Spreading method
d.	Deep acquifers with permeable of semipermeable overburden	Spreading method
e.	Acquifers with limited storage capacity	Induced recharge method

f.	Deep acquifers with impervious overburden	Injection method
g.	Source water of very good quality	Injection method and/or spreading method

3.1.1 Spreading Method

Artificial recharge by spreading method comprises increasing the area of infiltration, thereby allowing more surface for infiltrating waters. It is effected by spreading channels and by recharge basins/ponds/pits. Channel spreading comprises bunding of existing steam or river channels either by bunds (check dams) across the channels or by constructing small "L" shaped levels within the channels. "Spreading channels" are unlined canals where movement of water at very gentle speed effects maximum infiltration. Recharge basins/ponds/pits help in collecting the surface run-off from storm drainage's and allow their collection at places where it can effectively infiltrate into the sub-surface ground water reservoirs. The levels, bunds, ponds, recharge basis etc. which accumulate and keep the water stagnant for a longer period, allow more time for infiltration of water. Artificial recharge by spreading has the disadvantages of loss of surface waters by evaporation and decrease in infiltrating capacity of spreading structures by deposition of silt from the source water and deposition of dust from the atmosphere and growth of vegetation on the infiltration surfaces. However, it has following important advantages over the injection method. The infiltration is almost like natural rainfall infiltration and extreme purity of infiltrating water is not needed. Normal storm run off or primarily treated drainage waters could be utilised for artificial recharge. Cleaning of infiltration surface once in a while is needed but it is an easy process as it involves only scrapping of the surface.

Spreading methods are useful only for recharge to unconfined acquifers. This method which involves stagnation of water, sometimes creates environmental problems. It is, therefore, necessary to adjust supply of water to these structures in such way the large pools of stagnated water are not produced. This is difficult as most of the artificial recharge experiments are based on collection of storm run-off. The best way is, rather to store water underground with the help of sub-surface dykes, so that not only the excess water flows out but is also flushes the accumulated silt on the infiltration surface. The sub-surface structures are more immune to natural catastrophes. Evaporation losses are also minimum as no water is stored above the surface. Such dykes are also useful across the perennial streams. Dykes of 30 cm thick brick cement or stone cement, extending down to the compact bed rock, with mud or clay fillings in excavated position on both sides of the wall provide a perfect impermeable barrier.

3.1.2. Induced Recharge method

The natural conditions like level of ground water (vertical head) are changed to allow rapid movement of infiltrated waters and to allow more space for storage, respectively. This situation has not arisen in our country so far but it was under active consideration whether such induced recharge can be experimented along banks of Ganges to direct flood waters underground, thereby effecting flood control. However, conditions similar to these are likely to be created soon in more areas all over India on account of over exploitation of ground water. In certain heavy rainfall areas where excess rainfall results only in excess surface run-off on account of limited storage capacity of acquifers (especially hard rock areas), the over exploitation has helped in higher recharge (induced recharge). This suggests that over exploitation should be permitted in such areas.

4

SUSTAINABILITY OF ASSETS CREATED

Operation and maintenance by the community of its water and sanitation facilities represents a very important part of the project cycle. This is not only in terms of the actual functioning of the facilities but because it is a big step by the community towards self-reliance.

The community can formally accept through a resolution passed by the village Panchayat and later approved by the higher Panchayati Raj Bodies, the responsibilities for the operation and maintenance of these facilities.

What is the significance of the acceptance?

i) Through this formal gesture, the community emphasizes that is capable of being an equal partner with the government in the area of the water and sanitation.

ii) It recognizes that the government's resources cannot indefinitely support the water and sanitation activities of the community.

iii) The community indicates that it is willing to look for revenue from within the community to sustain water and sanitation facilities over the agreed period.

iv) There is an understanding by the community that is must now evolve, in consultation with the government and NGOs, ways in which such revenue can be collected and establish a firm basis of cooperation within the community, keeping in mind the special need of women, the SC/ST population and the economically weaker sections.

v) The acceptance of the responsibility also suggests that the community realised the link between suitable water and sanitation facilities and the continuing good health and productivity of the household and village.

vi) Above all, by undertaking this responsibility, the community indicates its confidence in itself and its capacity to be self-reliant, as much as is practically possible. A sense of ownership becomes a practical basis for assuming responsibility.

What are the tasks involved?

Operation and maintenance of water and sanitation facilities can be divided into day to day activities which can be carried out by the community and more complex technical activities to be supported by the government's technical agencies or private sector agencies as and when needed.

Day-to-day activities refer to, for example, the following:

(i) Keeping hand pumps in good working order by ensuring that :

- (a) they are operated properly by the users
- (b) there is no trash in the drain hole
- (c) the flow of water is regular and that water is pumped up in 8 strokes
- (d) the pump's handle is not loose or shaky

(ii) Keeping latrines clean and hygiene by :

- (a) good communication with the community on hygiene
- (b) spot-checks of households

(iii) Carrying out minor repair of latrines

(iv) Seeing the waste-water from standpost and household points are properly utilised.

However, the community will, coordination with the implementor, agree formally on clearly defined tasks that will comprise the operation and maintenance exercise. These could be as follows :-

- Defining the normal operating schedule
- Defining the preventive maintenance schedule
- Setting up the procedures for procurement of spare parts, chemicals.
- Identifying agencies to carry out repairs as and when needed
- Employing operating staff, ensuring training

- Establishing backup support systems
- Monitoring of performance
- Setting procedures for data recording in respect of daily operations, water levels, pumping schedules, power-failures, water quality testing results and corrective action taken etc.
- Arranging for collection of revenue.
- Preparing annual budget estimates for operation and maintenance and arranging funds and responses.
- Identifying the rehabilitation needs of the facilities installed and arranging for resources to ensure timely rehabilitation.

Attention will be particularly paid as to how best these details can be communicated effectively in low-literacy areas.

Who will do these daily tasks

Daily operation and maintenance will be the responsibility of a village caretaker, a handpump mechanic, the village mason and of the household itself. So, far as water at public standpost is concerned, the handpump caretaker will do the routine maintenance tasks which will include ensuring proper drainage of water from the standpost and minor repairs will be carried out by the handpump mistry or mechanic. Household members will be expected to look after their latrines as well as the arrangements for proper drainage of dirty water into kitchen gardens etc. Minor repairs of latrines can be carried out by the village mason.

How will village level staff acquire the knowledge to carry out these various tasks?

A detailed training programme will have to be worked out by the implementing agency after discussions with the community and NGOs. It seems likely that technical training will be given by the government's agencies and training in communication skills by a competent NGO. This spirit is needed as the users need to understand the need for using the facilities properly. In that sense, good communication becomes a preventive maintenance activity.

The training programme must focus on training women in the various operation and maintenance activities. However, there is need to ensure that women who are engaged in such activities do not suffer, because, their father, husband, brother, etc. think that they are not contributing sufficiently to household work or income. Close consultation with the community is therefore needed before decisions to train and employ women are taken.

Also, the community should select person from within the community to be trained in administrative duties such as task planning, preparation of task schedules, budget planning, etc.

How will these people be appointed?

At the village level, staff such as the handpump caretaker and mistry will be appointed by the community. In appointing these persons, the panchayat will keep in mind the practical need for training and appointing women as mechanics and perhaps as caretakers. Also, the panchayat could look into the possibility of training women as masons, as has been done in Kerala.

Who will pay the operation and maintenance activities for the staff?

It is expected that the community itself will have to generate the money required to pay for the various activities and the village level staff. The community will decide as to how much is needed, how this money can be collected, who will administer it, the ways of controlling its expenditure, and how the community can keep a check on the accounts.

Panel 1

The development of community's skills is a major factor in the sustainability of the project

Panel 2

Training materials relating to operation and maintenance must be prepared in consultation with the community especially in low literacy areas.

Panel 3

Communication materials must stress the vital connection between the proper operation and maintenance of hardware and the health of the community.

Panel 4

The users must review the question of availability of spare parts and how perhaps local traders could supply these parts.

5

COST RECOVERY

Though cost recovery is a part of the operation and maintenance step, its importance to a successful water supply and sanitation system makes it necessary to give it special attention.

Cost recovery or revenue collection by the government from the community or by the community from itself is crucial for the development of a sustainable water and sanitation system. While this concept is not new to India, effective implementation represents a major problem.

However, if a community has been involved from the very beginning of the project, especially in the planning stages it is in a better position to select the service levels it wants, keeping in mind the financial contributions it can make.

So, cost recovery from the community has three important implications.

i) By having a financial stake in the water and sanitation facilities a sense of ownership is created which contributes to better operation and maintenance.

ii) The original sense of dependence, both financial and psychological, on the government ends and replaced by a feeling of partnership.

iii) A sense of confidence is created in the community about the ability to make important financial decisions based on a more complete understanding of the outcome of these decisions.

The community can elect a representative Pani Panchayat, who will play a leading role in the process of cost-recovery. It will sensitize the community as to the need for this form of participation, clear doubts as they are raised, consult with the community as to how the various steps such as assessing rates, collection, etc. should be finalised. The Pani Panchayat can also appoint the handpump caretaker and mistry.

A competent NGO would be of use here in devising effective training programme and workshops, as well as effective communication material to explain the situation to the community. More than at any other stage of the project, the poorer sections of the community who may also be the least literate have to be informed and educated about their role in this process.

As mentioned earlier, the situation has been one of dependence on the government and so the various tasks involved in cost recovery are still in an experimental stage. However, some of the questions that the Pani Panchayat will have to consider are as follows:-

i) a) What costs should be considered?

b) Payment of bills for chemicals and electricity

c) Provision for minor repairs of handpumps, latrines, etc. as and when needed.

ii) How will be the rates be arrived at?

iii) How should funds be collected? On a voluntary basis as and when the need arises or should a certain fixed amount be set aside for every financial year?

iv) What provision are being made for the economically weaker sections of their community who not be able to pay the amount required? will they suffer as a result?

v) Even if the weaker sections pay (through loans, etc.) what way is there of guaranteeing them equal access to services?

vi) What will happen if a household defaults on payment?

vii) When should the money be collected-monthly, quarterly, half-yearly, yearly?

viii) How does the collection time relate to the agricultural activities?

ix) Who should collect the money?

x) Where will the money be kept and whose responsibility is it?

xi) Will the community be able to examine accounts on a regular basis?

Answers to these questions may differ from state to state, or perhaps even within states and perhaps even from community to community. Therefore, one may come across different variations of a cost recovery system.

In terms of procedure, however, it seems practical that a Pani Panchayat should make a realistic estimate of likely annual expenditure and obtain the approval and sanction of funds from the District Panchayat.

A user who is also an owner will be more motivated towards making a system work effectively.

Owners of systems will be more involved in effective monitoring and timely revenue collections.

The community must have a clear idea not only of the size of its individual contributions, but its total share of the project's finances. This will give it a more realistic idea of the control it can have over the projects' activities.

The system of levying charge related to water and sanitation facilities must be easy to understand and easy to operate by the community at large.

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LIST OF IEC BOOKLETS ON DRINKING WATER AND SANITATION

IEC 01	Guide on Community Participation For Village Level Functionaries ● *S. Ponnuraj*
IEC 02	Guide on Drinking Water and Sanitation For School Teachers ● *B.B. Samata* ● *Anu Dixit*
IEC 03	Guide on Quality of Drinking Water For Grassroot Functionaries ● *A.K.Adhya*
IEC 04	Guide on Water and Excreta Related Diseases For Grassroot Functionaries ● *A.K. Susheela* ● *K. Majumdar*
IEC 05	[illegible]
IEC 06	Guide on Technology Options for Low Cost Sanitation For Implementing Agencies [illegible]
IEC 07	[illegible]
IEC 08	Guide on Sustainability of Drinking Water Sources For Implementers and Users ● *K. Majumdar*
IEC 09	Guide on Role of Panchayati Raj Institutions For Panchayat Members ● *S. Ponnuraj* ● *P. Durga Prasad* ● *S. Srinivasan*
IEC 10	Guide on Sanitation Upgradation For Implementing Agencies and Users ● *B.B. Samata* ● *Anu Dixit*