May, 1996

COMMUNITY MANAGEMENT OF OPERATION AND MAINTENANCE OF PIPED WATER SUPPLY

FOR
USER GROUP COMMITTEE

Module-UGC-CD-PWS 1

INTRODUCTION

Your Piped Water Supply Scheme is now ready. Your are to be fully responsible for the operation and maintenance. In order to do this, you as beneficiaries, have to know that your scheme covers either one, or more villages. Your domestic point is part of this system. It is imperative that as beneficiaries, you should know what your roles and responsibilities are when it comes to day to day management of your scheme and your domestic point.

By now you all know that, your piped water scheme is centrally managed by your Water Company and by your elected Board of your water company. The Chairperson or one of your committee members is a member of this company. He is your active representative to the company. The fact that your domestic point is located close or far from the Central Authority of your company, does not put you in a better or awkward situation when it comes to operation and maintenance of your scheme in general and your domestic point in particular. You all have equal right to be served by your company and you also have equal social roles and responsibilities towards the scheme.

In this module, you will be exposed to different components of your piped water scheme and your roles and responsibilities which you as beneficiaries, will have to shoulder in order to sustain it both at scheme and domestic point levels.

The module is divided into two main parts. The first part explains the different components of the piped water scheme and what operation and maintenance responsibilities are necessary. The second part of the module explains the requirements of the different levels of community committees in operation and maintenance management of the piped water scheme.

1. MAJOR COMPONENTS OF YOUR PIPED WATER SCHEME

Although most activities of operation and maintenance will be carried out by a technicians paid by your company it is equally important that you understand what constitutes this components and how it should be operated and maintained so that the scheme lasts for as long period as possible.

There are 4 major components in piped schemes, these are:

1. Water Source.

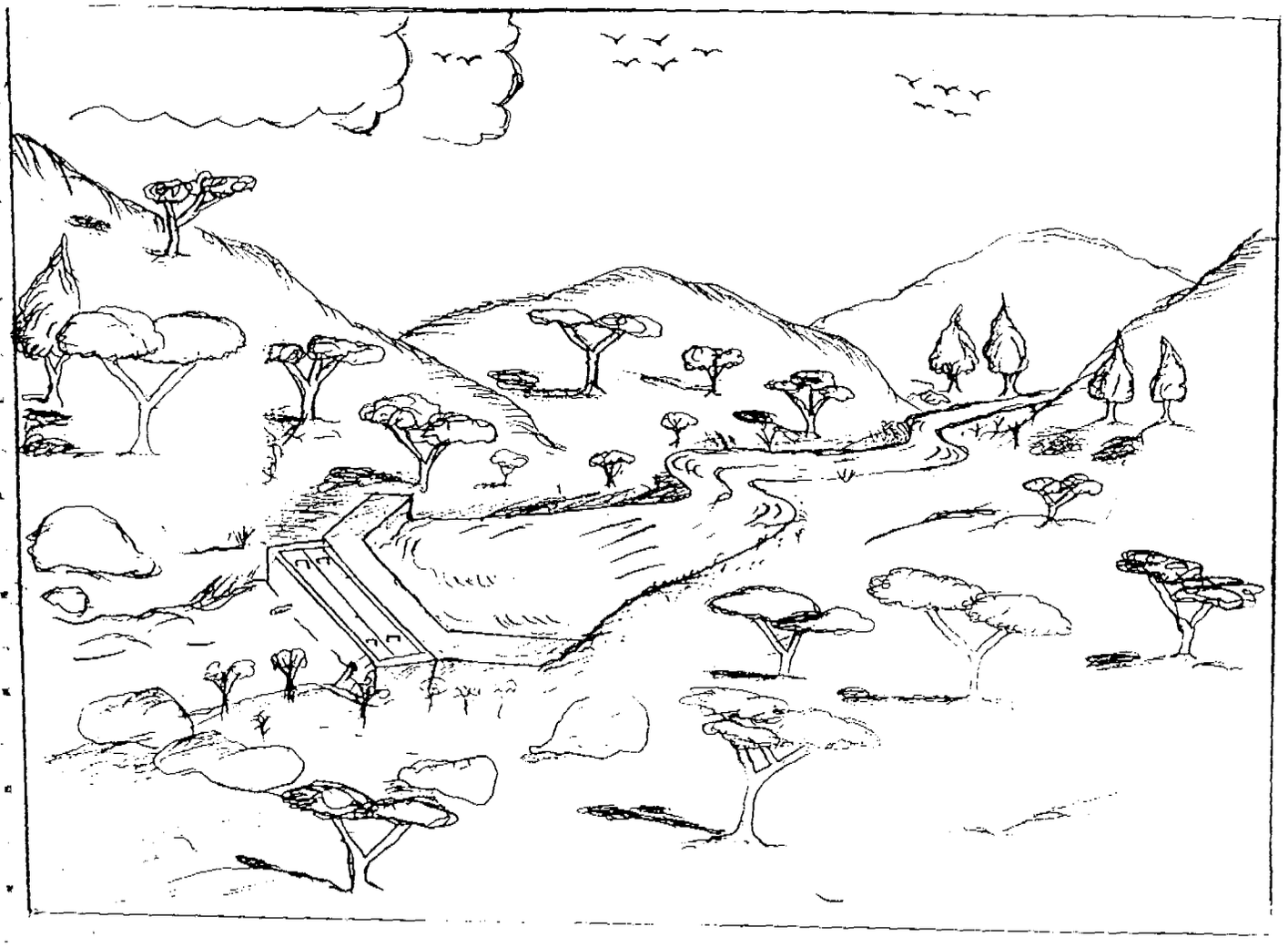
This component of the scheme seen in diagram (1), is situated in a remote area, and in your case, it can be high up on a hill or mountain. Sometimes, it can be situated in a flat area, if the system is a machine pumped bore hole. Some of you might have been there when the intake was being constructed.
In piped schemes there are two components of a source. These are.

(i) **A source - where the water is taken from.**

The source may be a stream, river, spring etc located somewhere above the village to be served, or it can be within a village where a side river well can be constructed.

(ii) **A catchment area -** It is where the water in the source comes from. In gravity piped scheme, the catchment area is situated higher than the source and intake. For river and stream sources the catchment area stretches back for long distances.

An illustration of a gravity water source showing the catchment area.



Maintenance of a source.

Activities in the catchment area affect the water in the source. This can determine whether there is enough water, whether the water is clean or muddy and whether the water is polluted. Human activities almost always have a negative impact on the source. These human activities include, bush fires or/and charcoal burning.

Bush fires and/or charcoal burning should be discouraged because the activities destroy the vegetation. Vegetation is important to help the soil to absorb and hold water, and when vegetation is destroyed, soil erosion takes place. Soil erosion causes the water to become muddy.

2. An Intake.

An intake is a man made structure utilizing sources like ground water, spring, rivers etc., to form a reservoir from which water is diverted, to the pipes which carry the water to the people who will use it. In gravity water supply, an intake is always positioned at a height suitable enough ground for the system to be supplied.

You can see the following components: In an illustration of an intake:

- **intake chamber:** a chamber which fills with water from the source.

- **valve chamber:** a chamber to protect the control valve on the transmission line.

- **weir:** a concrete or masonry wall built across the stream. The level of the stream rises behind the weir and water flows into the intake chamber.

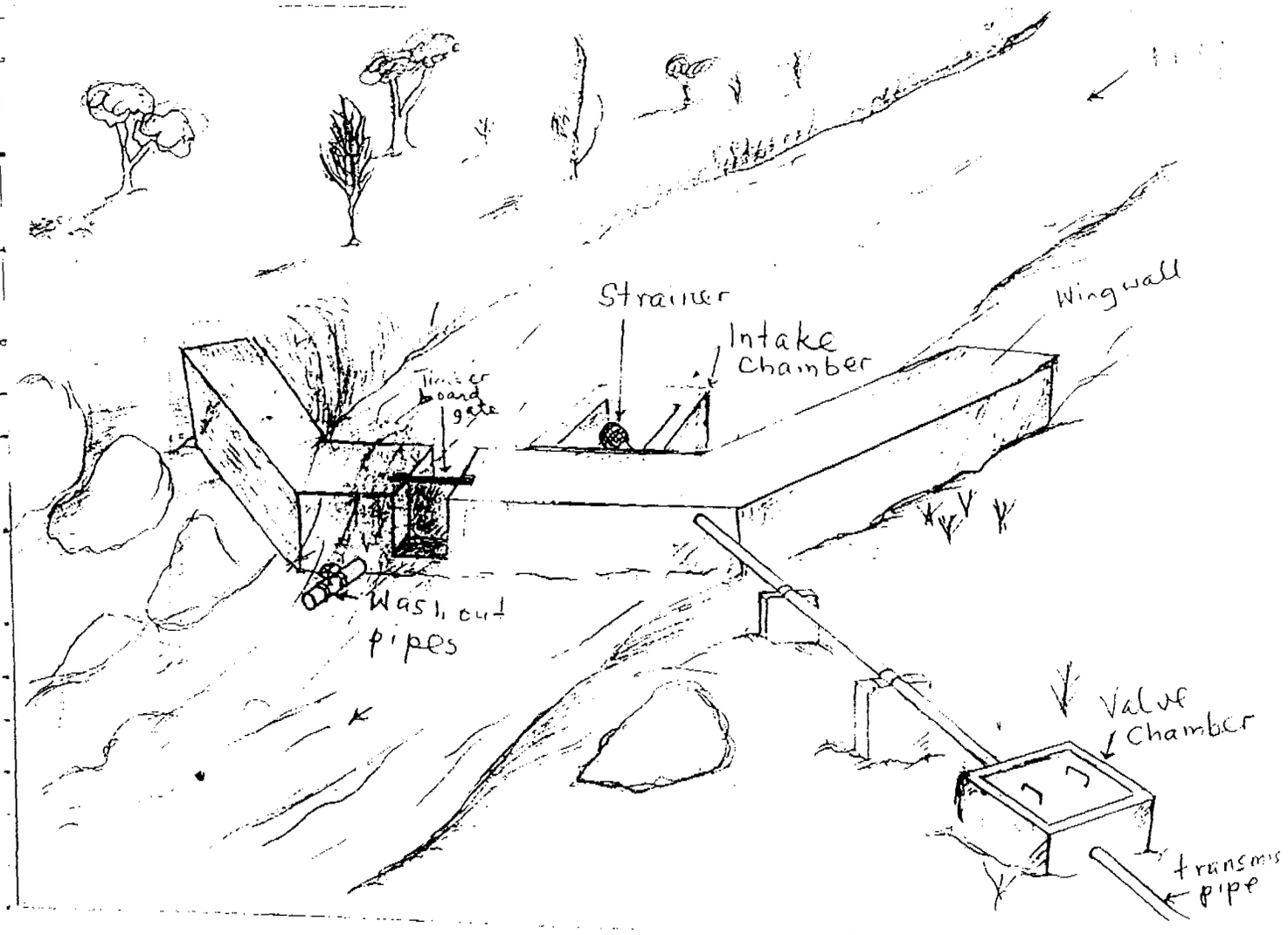
- **intake gates:** several boards fitted into grooves in weir
  * The intake gate are taken out in order to drop the level of water in the stream. This is usually done when cleaning out the silt which builds up behind the weir, or when making repairs to the weir or intake chamber.

- **transmission pipe:** a pipe that carries water from intake to village storage tank.

- **a washout pipe:** a pipe that supplies water, sand and silt out of intake chamber (a plug at the end of the pipe prevents water from running out through the pipe all the time.

- **wing walls:** walls which prevent water from flowing around the intake and so direct water into the intake chamber.

Illustration of a stream intake



3. Storage Tanks

Components of a Storage Tank

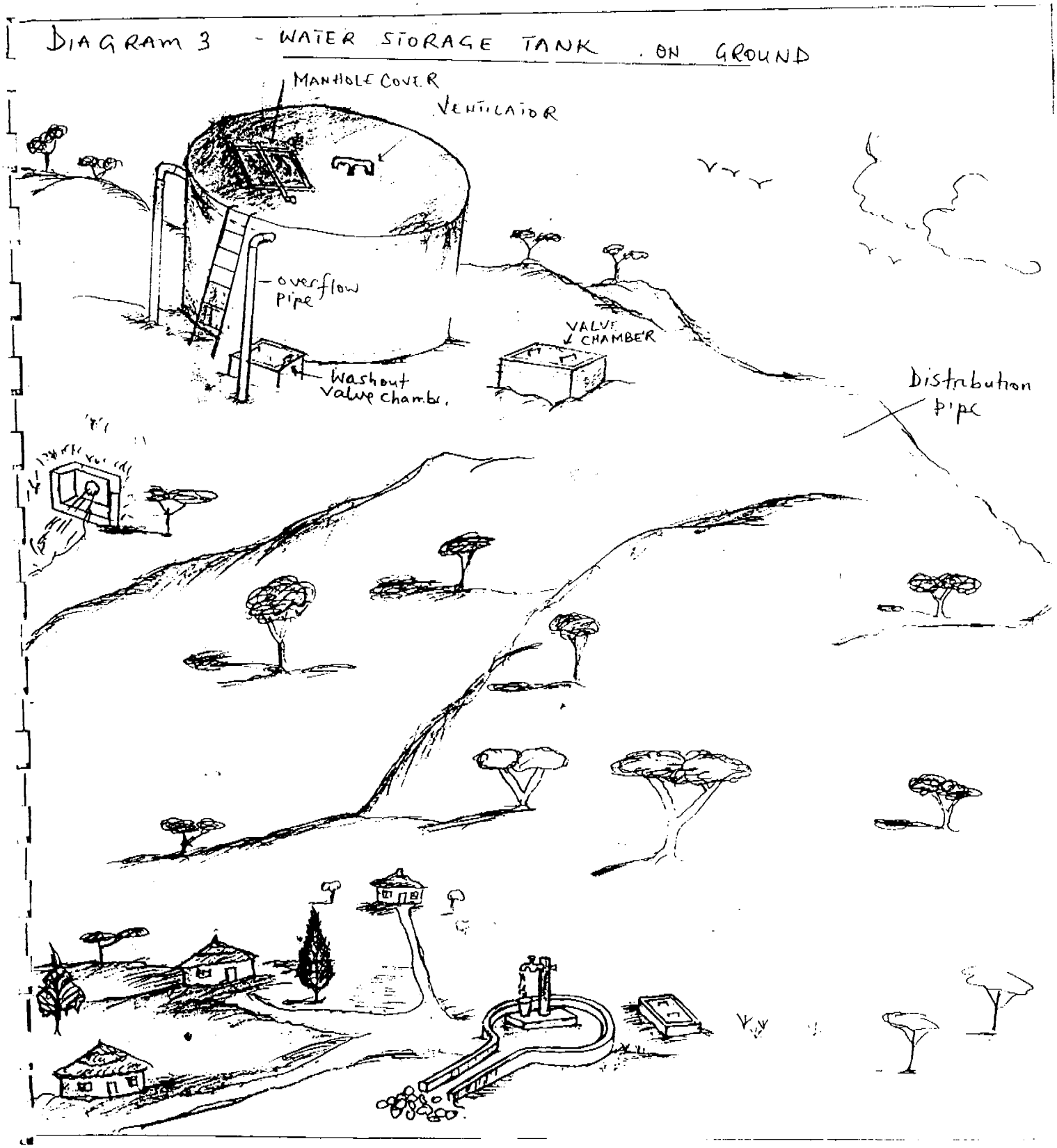
Storage tanks may be built on high ground above the villages, or raised on a platform.

The tank must be higher than the connections to be supplied with water, because water will only flow DOWN.

A storage tank has the following components.

- **roof:** The storage tank is too big to be covered by removable concrete slabs. So this part is build as a flat roof on top of a tank
- **entry hole and cover:** The technician climbs into the tank through this opening in order to do maintenance and repair work.
- **ladder:** After entering through the entry hole, the mechanic climbs down the ladder. Storage tanks may also have a ladder for the outside, in order for the mechanic to get up to the entry hole.
- **ventilation pipe netting:** The ventilation pipe must be covered with netting or wire mesh to keep mosquitos and flies away from breeding in the tank.
- **inlet pipe:** carries water from the transmission pipe into the tank
- **outlet pipe:** carries water from the tank to different users.
- **strainer:** on outlet pipe.
- **washout pipe and valve or plug:** to be opened when cleaning the tank.

An Illustration of Water Tank



- **Clean the tank and strainer keep tank covered:**

  The tank should be cleaned. If the tank is not kept covered, animals, snakes, and other undesirable things can get into the water. If the strainer is not kept clean, water will not flow to the users.

- **Repair tank:**

  A leaking tank is just like a leaking pipe: some villages may not get enough water, or any water at all, as a result. Leaks left unrepaired will become more serious over time. Furthermore, the leakage can lead to erosion around the tank.

- **Keep mosquito mesh on ventilation pipe in good repair:**

  Otherwise tanks become a breading ground for mosquitos and flies. Malaria and other diseases may increase as a result.

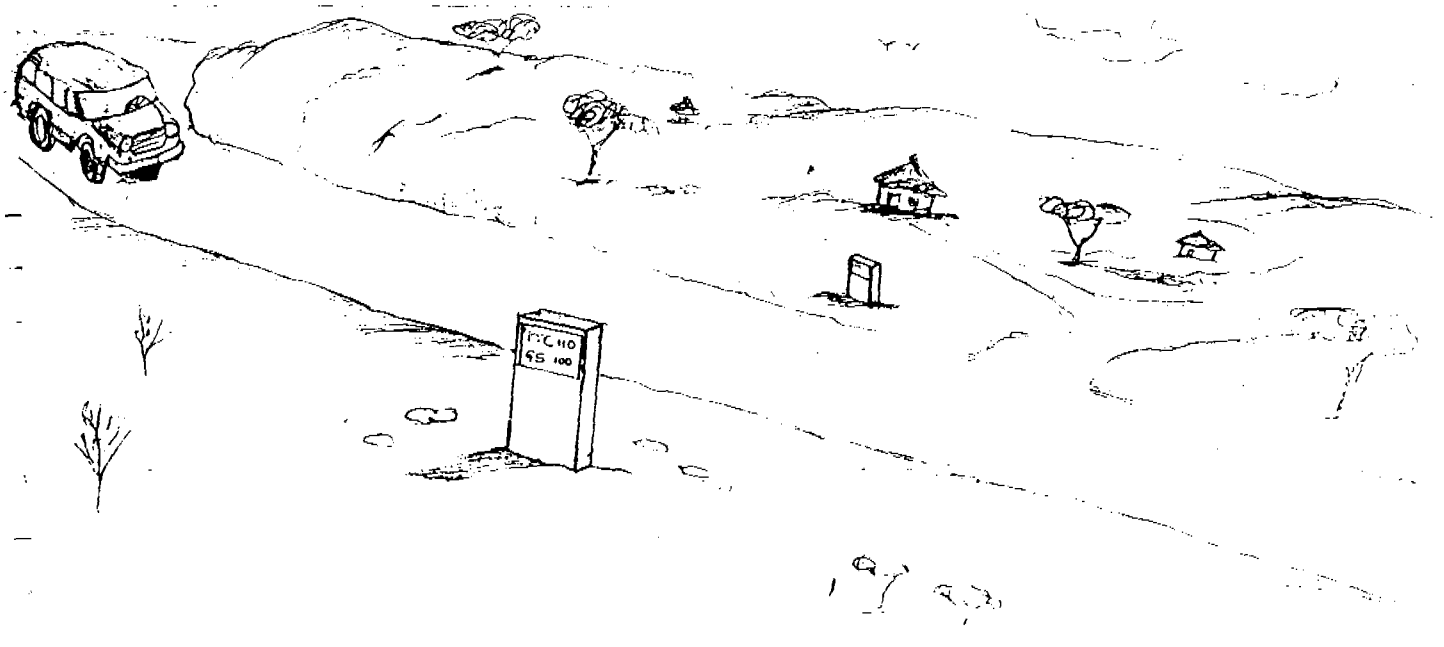
4. Distribution system

   Components of a distribution system

- Distribution main and distribution pipes carry water from storage tanks to the connections where users actually collect water.

  If the distribution main is buried, as is usually the case, there will be pipe markers every several hundred meters to show where the transmission pipe passes. Pipe markers are especially important at road crossings, so that the people maintaining the road how to avoid the pipes with the graders.

- **An Illustration of pipe markers:** a concrete slab on which is written the type and size of pipe (and type of valves, if any) which is buried below.

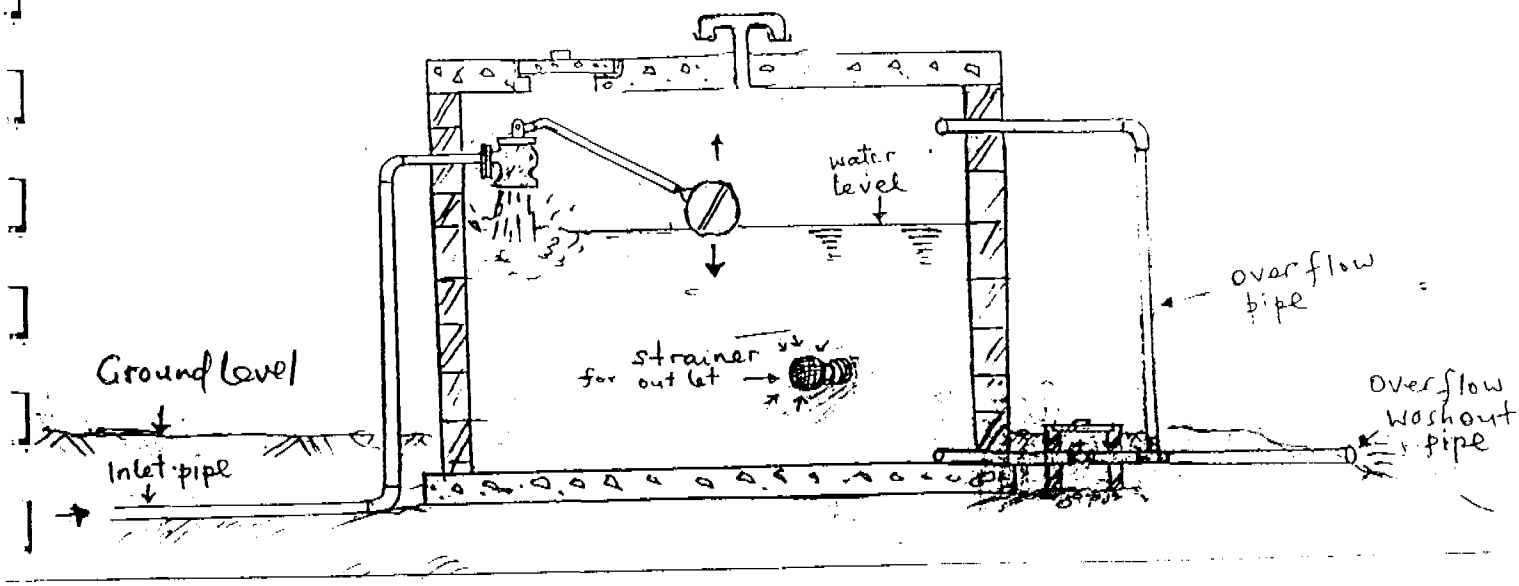


- **float valve:** valve inside the tank which automatically closes the inlet pipe when the tank is full of water.

  One end of the float valve fits on the end of the inlet pipe. This is attached to a rod or "arm" with a ball floating at the end.

An Illustration of a Float Valve

Diagram 4 - Float Valve inside the tank



When the tank is full of water
the float valve is up, and
the inlet pipe is closed.

When the tank is NOT full, the
float valve is down, and
the inlet pipe is open.

- **overflow pipe:** pipe to let out water when the tank is full, in case the float valve is broken, or for any reason it fails to close properly when the tank is full.

Maintenance of the Tank

- **Repair float valves:**

  The most common repairs are to release a jammed valve or replace the pin which holds the arm and ball float to the valve. A broken or jammed float valve will cause the tank to overflow when the tank is full. This wastes water, and the result may be that some villages in the same scheme get more water than they need while other villages do not get enough.

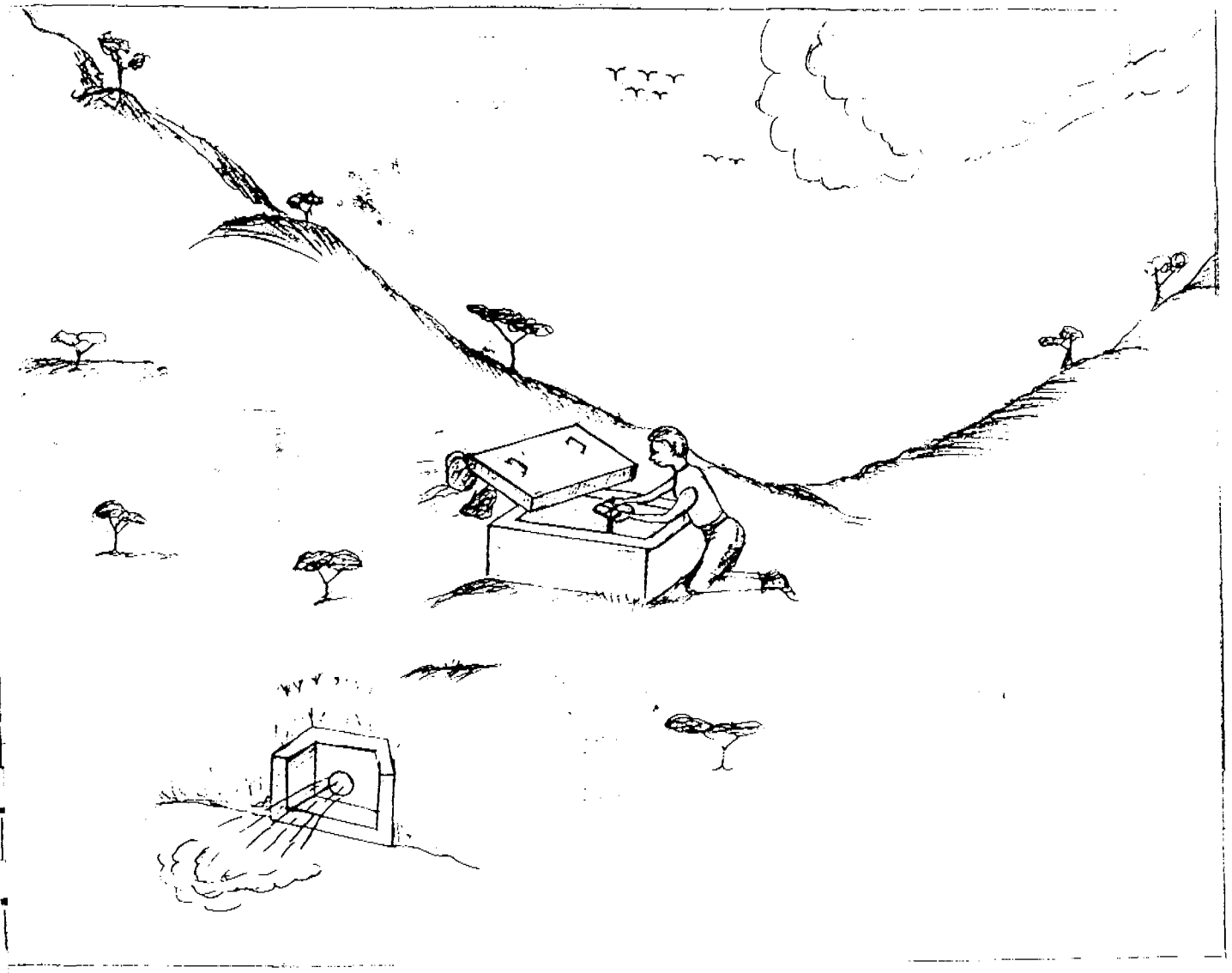
- **Clean the tank and strainer keep tank covered:**

  The tank should be cleaned. If the tank is not kept covered, animals, snakes, and other undesirable things can get into the water. If the strainer is not kept clean, water will not flow

Silt, sand and mud which get into the distribution main will tend to collect at low points on the pipeline. therefore, a washout pipe and valve is usually placed at these low points along the distribution main. For instance, if the pipe goes down a hill and up the other side, a washout will be placed at the bottom of the hill or in a depression.

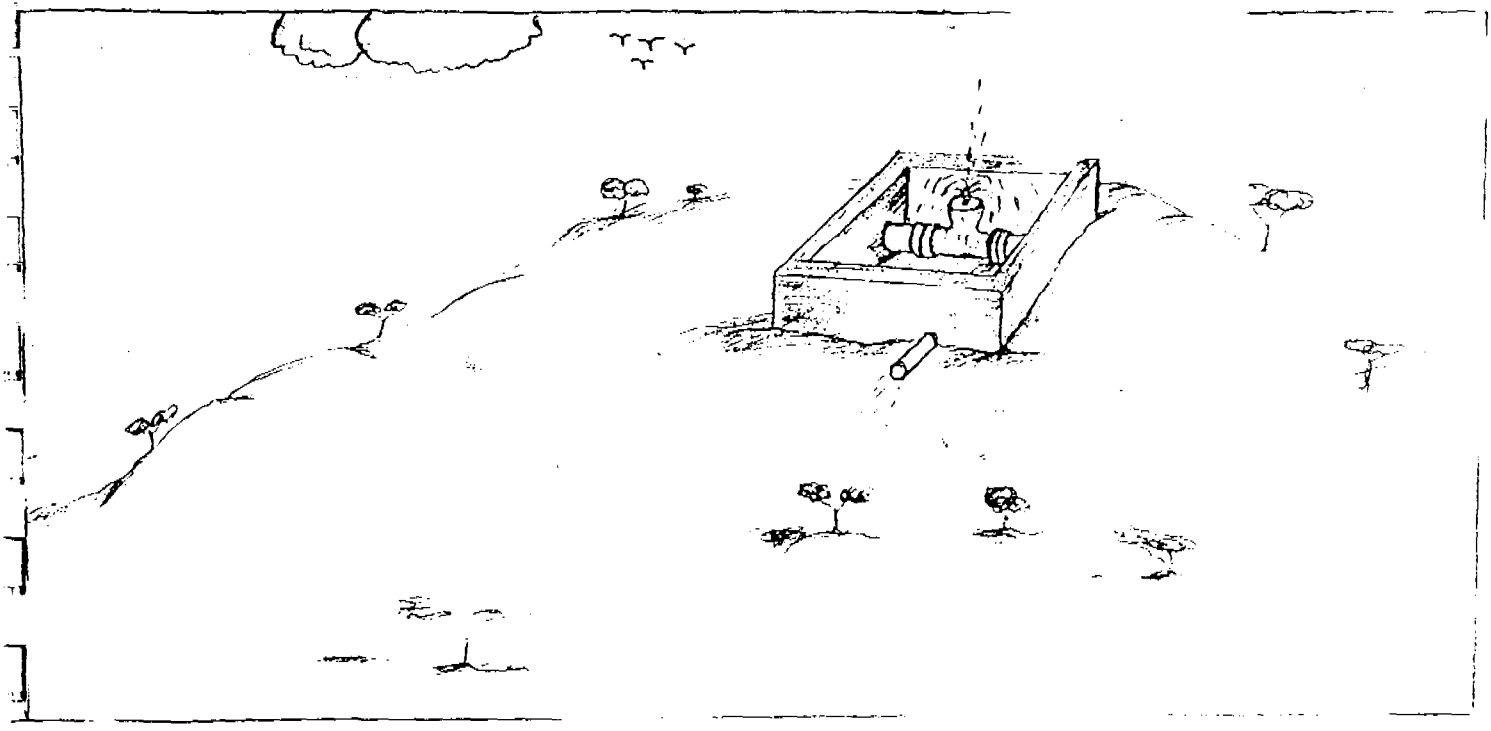
The washout on a distribution main works just like the washout on the intake chamber. When the washout is open, the water washes out the silt and sand which has accumulated in the transmission pipe.

- An Illustration of washout: pipe and valve placed at low points along the distribution main.



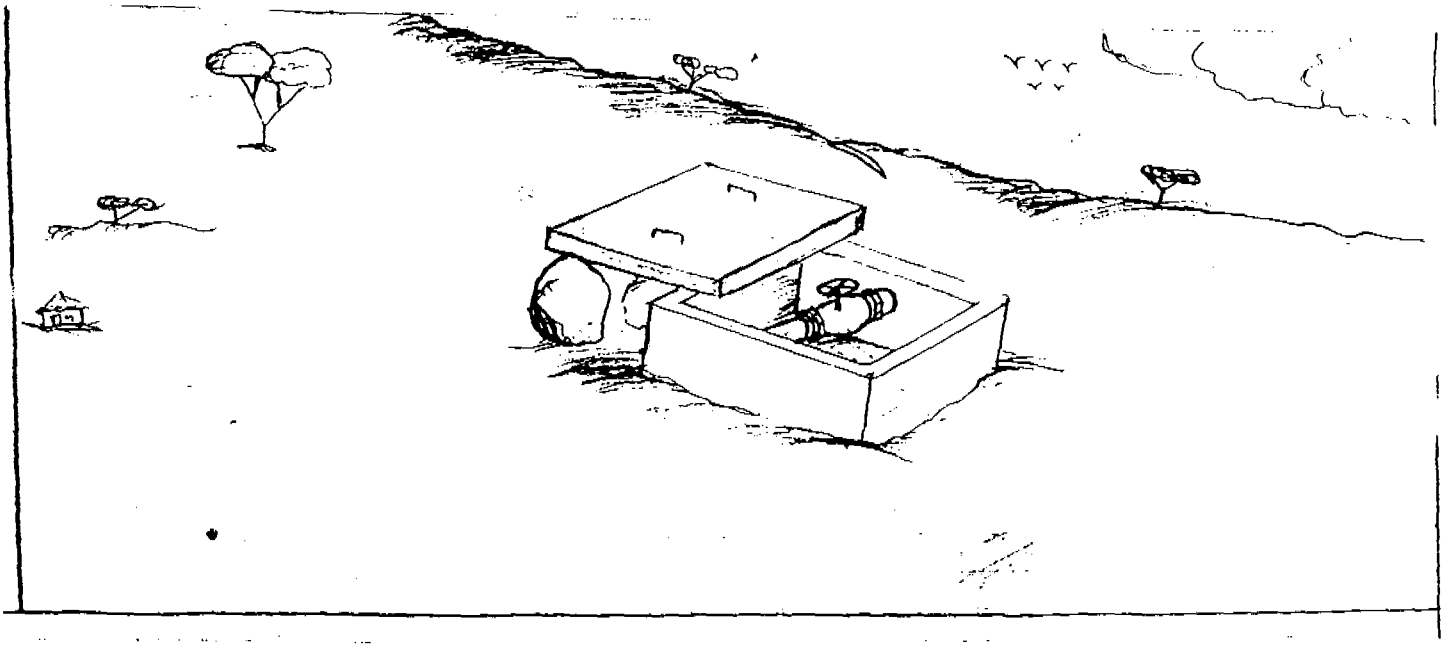
Air in the pipe can block the flow of water, just as much as sand and silt. Air collects at the high points along the transmission pipe. Air valves placed at these points let out air as it accumulates.

An Illustration of an air valve: valve which opens automatically to let out air in pipes.



Valves are also installed on a pipe to permit shutting of the water while maintenance work is being done. Under normal conditions, isolating valves are left open. They should also be completely open or completely closed. Opening them partway wears out the components inside.

An Illustration of a control valve: a gate valve or stopcock installed on a pipe to permit shutting off water to the section of the pipeline.



Connections

In the past when MAJI designed the Piped Water Schemes, it was assumed that people would collect water from public domestic points. In practice, many people and institutions have made private connections to the schemes after they were handed over. Often, these connections were made without authorization from the District Water Engineer or water committee. Through DWSSP private connections are allowed provided the source has enough water.

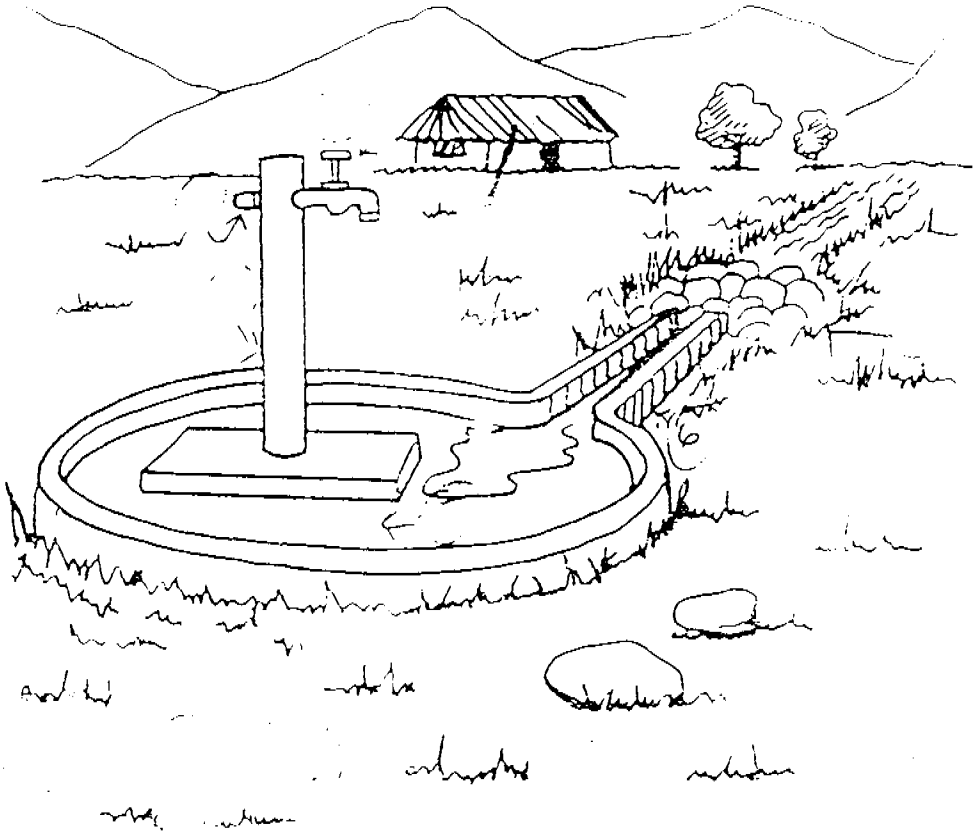
Private connections usually leads to higher water consumption on a scheme. This is because private connections allow people to use water for commercial purposes, and because the convenience of private connections encourages people to use more water.

Below is a list of basic types of connections which have been made, and the estimated average amount of water consumed per day from each type of connection:

Types of Connections	Estimated Average Water Consumption
Domestic Points:	25 litres per person per day
Private Domestic Connections:	
standpipes only	75 liters per person per day
indoor plumbing	125 liters per person per day
Institutions:	
Boarding schools	70 liters per student per day
Health Clinics	50 liters per bed perday
Hospitals	400 liters per person per day
Other Residential institutions	varies widely
Businesses:	
Guest houses	200 liters per bed per day
Shops	75 liters per day
bars	400 liters per day

Components of a Domestic Point

An Illustration of a Domestic Points



- **stop cock:** placed on the distribution pipe (underground) just before a domestic point
- **valve box:** a piece of plastic pipe with concrete cover. which fits around the stop cock
- **pipe stand:** a steal pipe or concrete block to support and protect the distribution line where it comes out of the ground
- **bibcock:** the valve which the user turns on to get water from the domestic point.
- **plug:** instead of a second bibcock. In the future, when many more people will be using the domestic point, the users can decide to remove the plug and replace it with a second bibcock.
- **apron:** concrete slab around the pipe stand.
- **drainage furrow (also called flume):** a long channel, usually lined with concrete, which leads the water away from the immediate area of th apron. The drainage furrow and apron thus serve to keep the domestic point free of mud and standing pools of water.

soak pit: a pit filled with gravel or stones, at the end of the flume. If the soak pit is well maintained, it allows excess water to soak quickly into the ground without creating pools of water.

drain: an extension of the flume but without the concrete lining. A drain is an alternative to a soak pit. A domestic point should have one or the other.

Components of Private Connections

To install a private connection, there must be a service pipe, which takes water from the distribution main to the household, business, or institution.

There SHOULD be a stop cock on this service line, just next to the distribution main so that water can be cut off if any part of the connection is leaking or needs repairs.

Individuals and particularly institutions may install storage tanks.

- In principle, these tanks should have the same components as a village tank.

- In practice, though, these tanks may have nothing more than an inlet pipe and valve, and an outlet pipe.

- In particular, these private tanks must have float valves to stop the tanks from overflowing.

The service pipe may end in any number of different features.

- A family may simply have a standpipe with bibcock in their compound. This is not very different from a domestic point, except that it is closer and more convenient for the family.

- A family may have indoor plumbing installations, such as sinks, showers, bathtubs, and toilets. There may be just one or two such installations in the case of an individual family. On the other hand, a health centre or a secondary school may have a multitude of installations.

Maintenance of the Distribution system

- **Stop erosion around pipes, pipe supports, and tanks**

  Soil erosion can uncover pipes. When this happens, pipes are more likely to develop leaks or bursts. Buried pipes should be at least one meter under ground. Erosion around pipe supports and tanks can course the structures to collapse.

- **Repair pipes:**

  Leaking or burst pipes reduce the amount of water which reaches the users.

- **Repair pipe markers, particularly at road crossings:**

  if pipe markers fall down and disappear, villagers will dig in the wrong place when they need to make repairs. also, people may build a house on top of the pipe, making it impossible to dig up when repairs are needed. Grader drivers should know to avoid that pipes are there when maintaining the road.

- **Open wash outs once a month, or more often during the rainy season:**

  If sand and silt is allowed to accumulate in the pipes, they will eventually become entirely blocked and no water will reach the consumers. It is often a difficult, time-consuming, and tiring job to locate blocked pipes, dig them up, and unblock them.

- **Check air valves for leaks once a month:**

  If the air valve is leaking, the valve chamber will fill up with water and damage the air valve.

- **Repair valve chambers and their covers, and keep the chambers clean:**

  The chambers were built to protect the valves. If the chambers are left uncovered or fall in disrepair, the valves are more likely to be damaged.

- **Walk along transmission line checking on the components:**

  All of the above tasks require walking along the transmission system about once a month, checking for problems. If maintenance and repairs are not done early and regularly, they will become more expensive and difficult.

Repair leaking installations:

Leaking can be the MAJOR COURSE of water shortages in the system. If a village wastes water, there may not be enough to fill the tanks of other villages. Similarly, if water is wasted by leaking connections in one part of the village, connections in other parts of the village may not get enough water.

At a domestic point, the bibcock is the most common source of leakage. less frequently, the pipe will leak Stop cocks will start leaking, especially if they are abused. One frequent type of abuse is using a stop cock like a bibcock for users to turn water on and off when the bibcock is broken.

On institutional or individual connections, the taps, toilets, tank or service pipes can, and frequently do leak. A leaking flush toilet can waste up to 750 buckets of water per day, or enough water for 450 people. if an institution, for instance, a secondary school or a health centre has several leaking toilets, everyone else served by the gravity system may suffer as a result.

Keep surroundings clean:

Standing water is a source of disease. At domestic points, the flume and soak pit or drain should be kept clear so that water drains away. Outside connections for individuals and institutions should also have good drainage system.

II. COMMUNITY MANAGEMENT FOR OPERATION AND MAINTENANCE OF PIPED SCHEMES

All communities in the Programme area comprise a diverse range of people categorized according to ethnicity, socio-economic status, religion, politics, trade, age and gender. One of the challenges of O&M management is to enable all the people within a community to be organized and work effectively together.

The management of a large scheme supplying several communities is clearly far more complex than the management of a single well. As far as capital costs are concerned, ti may be more cost-effective to supply a large number of people with an extensive distribution network than to have several smaller pipe networks supplying individual groups or communities. However, extensive distribution schemes are only appropriate if all the communities can work effectively together. Furthermore, it cannot be assumed that the operation and maintenance of large schemes will be as cost-effective as small community management schemes. The management of O&M must, therefore, be adapted to community structures and community structures must be supported to cope with O&M.

Community Management

In step four of the Step by Step implementation procedure, it was required to establish user groups and user group committees as well as umbrella organization as an overall management committee with representatives from each user group.

The two committees have different functions.

The tasks of a user group committee include the following:

- to represent the user group in contact with the overall management committee company
- to manage the collection of O&M fund and to keep it safe until is transferred to the Company.
- to organize and supervise preventive O&M activities at domestic point level
- to promote the hygienic and effective use of the domestic point or other facilities at user group level.
- to keep users informed about O&M activities organized by the companyat central level as well as financial management

- The tasks of the water company include:

- **Accountability to users**

  Users must have confidence in the management of their funds. It is, therefore, imperative that the handling of funds is as transparent as possible and that simple, understandable, accounting procedures are followed. Bank account statements and the water supply financial accounts should be made available for all to see. The establishment of an independent committee of user representatives to audit the accounts can help to reassure users that their money is being properly managed. Annual, or bi-annual, user meetings can be an opportunity to show clear and simple statements of income and expenditure for the companies.

- **Identifying O&M Costs and setting up of tariff system.**

  There is little data on the true costs of O&M. However, O&M costs are essential for budgeting and users will want to know them. This is particularly important now that we are moving from subsidized O&M to full cost recovery. O&M funds are expected to pay for the complete overhaul and replacement cost of equipment when it wares out. The estimation of replacement costs is even more difficult than making regular O&M estimates due to the longer time scales involved. Estimates can be made in hard currency of the eventual

replacement or extension costs. The local currency equivalent can be adjusted as exchange rates alter over time to give an indication of th real cost to users who have to raise funds for replacement in their own currency.

Communities may need initial guidance by trainers on the estimation of costs and the preparation of a budget. This may have to be followed by extension staff for supervision.

Easily followed step-by-step procedures encourage maximum community involvement. The simple procedure suggested below might be followed:

(i) Identify the O&M tasks. (these tasks include those given under O&M tasks of different components of piped water supply schemes).

(ii) For each task, identify the labour and material requirements

(iii) Estimate the labour and material costs

(iv) Investigate how costs might be reduced.

(v) Produce a budger.

Costs might be reduced by the optimum use of local resources and by co-operating with other communities. Examples include:

(i). *Labour*
Voluntary work, payment in kind through preferential rights and water for gardening or livestock or use of one mechanic for more schemes.

(ii). *Materials*
Use of local materials, local replication of parts, bulk purchase with other communities

Collection of payments
Contributions must be collected at times when people are able to pay and may therefore be irregular. The method of collecting tariff should not be disproportionately costly compared to the revenue collected. There must be sanctions on those who do not pay.

Safe keeping of money
Money needs to be kept safe. Where rural banks exist a water company account can be opened. It will be inconvenient if a community is far from a bank as money may be difficult to get hold of when needed quickly. In addition, travel and subsistence expenses to deposit and withdraw money can be high. Clearly, there are substantial risks and an additional responsibility if someone, usually the treasurer, has to personally keep O&M money. However, this is often the case. A fund can also reduce in value if kept without some form of inflation protection.

Fund adminstration
The administration of funds requires the issuing of receipts for payments and expenditure, as well as careful keeping of records. Dealing with a bank will add to the amount of administrative responsibilities. Financial reports are necessary to account for the use of funds and to give users feedback on how their money has been spent.

- The administration of O&M funds will require men and women with administrative skills. In rural communities, people such as teachers and retired administrators have the necessary skills but are usually in demand for a range of duties. Experience has indicated that women generally make good treasurers. A role of the programme is to provide appropriate training and initial supervision when needed.

- **Remuneration for maintenance work**
  Remuneration schemes should be arranged to give maximum reward for the minimum down-time. Regular preventive maintenance tasks are sometimes poorly rewarded compared to payment for major repairs. Such an arrangement does not encourage care of the system as it becomes financially more rewarding for a mechanic to let the system deteriorate until it requires major repair work.

Common problems associated with management of O&M in Piped Water Scheme

There are common problems associated with Community Management of O&M which may be overcome by appropriate and timely support. They include:

- Committees fulfil their responsibilities during the construction phase but fail to continue their work after the scheme is completed.

- Committees only become active when there is a breakdown. in the time between breakdowns committees feel there is no need to meet or even collect maintenance fees.

- Forceful personalities dominate the committee

- Unlimited terms of membership result in reduced interest and participation by some members. (Elected fixed term membership might overcome this problem).

- The handling of funds can be a focus for conflict. For example treasurers were often suspected for embezzling funds and to avoid being accused of malpractice many may left the committees.

- Conflict between the decision making role of the company and the authority of village leaders.

- Over-dependence on external support from extension staff.

- Internal community friction adversely affecting committee's work

- Overlapping of roles, especially the involvement of the chairperson and secretary in the handling of funds.

A high turnover of male members compared to female members due to their greater mobility.