Operation & Maintenance of Rural Water Supply

Water and Sanitation Programme
Human Resource Development Unit

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Introduction

Problems with the operation and maintenance (O&M) of water supply and sanitation have long been recognized as key constraints to the sustainability of these services. In order to address these problems in both urban and rural areas of Afghanistan, this module proposes a framework for explanation of O&M system and its all aspects. This module has been developed from the last 20 years experiences of DACAAR Water Supply and Sanitation Program in the sector.

The aim of Operation and Maintenance (O&M) programmes, as described in this training package, is to improve the efficiency, effectiveness and sustainability of water supply and sanitation services. Operation and Maintenance activities, which encompass not only technical issues, but also managerial, social, financial and institutional issues, must be directed towards the elimination or reduction of the major constraints which prevent the achievement of sustainability.

This document and the training activities described in it are intended for managers, planners, project implementers, engineers and supervisors who are concerned with the challenging problem of how to implement effective operation and maintenance of rural water supply and sanitation services in Afghanistan. In addition to the traditional management aspects of operation and maintenance, this training package highlights the importance of community participation, with a right gender balance, in order to make more efficient use of local human resources for sustainability.

Goal of Course

To broaden the participant's knowledge of the operation and maintenance system to contribute to the sustainability of water supply programmes and projects in rural areas.

Course Objectives

After completion of this course the participants will have gained:

- To understand the MRRD and other NGOs O&M system
- To update knowledge on O&M issues
- To reinforce management skills on sustainable O&M
- To create specific approaches for better work and planning with communities
- To develop individual assignments based on the lessons learnt and each participant's workplace
- To understand the importance of community participation
- To implement effective O&M of rural water supply and sanitation services

Summary of Training Sessions

Day - I

Opening Session	**1 hour 30 minutes**
Introduction to O&M	**30 minutes**
The importance of O&M for water supply technology	**1 hour**
Sustainability	**1 hour 30 minutes**
Helping people to help themselves	**1 hour**
Total	**5 Hours 30 Minutes**

Day - II

DACAAR Handpump Maintenance System	**1 hour 30 minutes**
Safety	**30 minutes**
Community Management	**1 hour 30 minutes**
Building local capacity	**1 hour**
MRRD O&M System	**1 hour**
Total	**5 Hours 30 Minutes**

Day - III

O&M Requirements for rural water supply	**2 hour**
Spare parts provision	**1 hour**
Monitoring	**1 hour**
Evaluation of training	**1 hour**
Closing ceremony	**30 minutes**
Total	**5 Hours 30 Minutes**

The training course starts at 8:30 and ends at 15:00
Tea breaks for 30 minutes at 10:00 and 13:30
Lunch and prayers at 12:00 – 13:00

DAY I

Training Methodology

The training will be participant centred; participants will be motivated to participate and to be involved in the training. Different techniques such as group discussion, brainstorming, question and answers, role-play and codes will be used during sessions. The participants will be encouraged to share their ideas, observations and experiences with each other.

To maintain continuity during the training a review of the previous day's training will be done every morning and the points, which need elaboration, will be explained to the participants.

Opening Session

Objectives: After completion of this session the participants have:

- Filled out the attendance registration list and profile.
- Be more familiar with the course objectives and the other participants.
- Become aware of the trainers and each other's needs.
- Become familiar with what everyone expects by setting rules.

Time: 1 hour 30 Minutes
Method: Presentation plus brainstorming.
Materials: Handouts A, B, C, colour cards, stationary.
Physical setting: Participants sitting in U shape.

Process:

- Welcoming the participants
- Trainers introduce themselves and give some short information about the training.
- Distribute participants stationary (files, pens, notebook, colour cards and profile list etc)
- Activity filling out colour cards
- Game Fears and Expectations
- Setting ground rules using brain storming method.
- Brief explanation of course objectives and schedule.

Opening Session

A participant is invited to recite verses of the Holy Koran

Introduction: Game for everyone to get to know each other

Fears and Expectations

Participants briefly outline their expectations and fears on different coloured cards. Pin the cards on the board and reflect on the key fears and expectations highlighted by the participants and explain whether it will be possible to address them in the course of the training.

The trainer should say to the participants that he has a fear and some expectations. The trainer fears that participants will expect the trainer to be giving them knowledge. Training is not filling trainees with knowledge:

- Training is about introducing new ideas to participants and encouraging them to make use of them.

- Training is organising the knowledge that trainees already have in a way that they recognise their knowledge and make better use of it.

- Training is participants sharing ideas and experiences so that they enrich each other's knowledge and skills.

Ground Rules

Ask the participants to state what is allowed and what is not. Get consensus and write them on a flip chart. The rules are to be followed by all.

Course Objectives

Show the Course Objectives. Discuss each point briefly to ensure clarity.

Schedule
Explain the Course Schedule and discuss the topics to be covered. Be sure to emphasise the need to be on time for all sessions and to observe the ground rules

Operation and Maintenance Preamble

Session Summary

Objective: After completion of this session the participants will:

- Understand what will be discussed and presented during the following four days
- What will be covered during the 4 days
- The participants will understand they have to participate to get the full benefit of the course, they are required to ask questions and clarify their needs

Time: 30 minutes
Method: Presentation, and brainstorming by group
Material: Flip Chart and Markers, Projector, Portable computer
Handout:
Physical Setting: Sitting as normal in training hall

Process:
The topic is covered by asking questions and illustrating:

- What are the needs during the course
- Materials will be handed out and discussed if so required.
- Deal with specific requests within the framework of the course
- Discuss the expectations to ensure that they are fully understood and can be dealt with.

Operation and Maintenance Preamble

Problems with the operation and maintenance (O&M) of water supply and sanitation have long been recognized as key constraints to the sustainability of these services. In order to address these problems in both urban and rural areas of Afghanistan, this module proposes a framework for explanation of O&M system and its all aspects. This module has been developed from the last 20 years experiences of DACAAR Water Supply and Sanitation Program in the sector.

The aim of Operation and Maintenance (O&M) programmes, as described in this training package, is to improve the efficiency, effectiveness and sustainability of water supply and sanitation services. Operation and Maintenance activities, which encompass not only technical issues, but also managerial, social, financial and institutional issues, must be directed towards the elimination or reduction of the major constraints which prevent the achievement of sustainability.

This document and the training activities described in it are intended for managers, planners, project implementers, engineers and supervisors who are concerned with the challenging problem of how to implement effective operation and maintenance of rural water supply and sanitation services in Afghanistan. In addition to the traditional management aspects of operation and maintenance, this training package highlights the importance of community participation, with a right gender balance, in order to make more efficient use of local human resources for sustainability.

The package is based on material and documentation of MRRD, DACAAR . other NGOs and global experiences provided by various agencies and institutions in the water supply and sanitation sector. We are confident that this document will make an effective and useful contribution to progress in the rural water supply and sanitation sector.

The courses in this training package are based on participatory training methodologies, an important feature of which is to draw on the experiences of all the participants, under the guidance of an experienced facilitator and resource persons. The courses should be adapted to the local situation, and the modules can be modified with additions or deletions according to local needs.

Policy-makers (including staff of international development agencies) who need to optimize the investments in water and sanitation by developing improved management strategies which give a higher profile to operation and maintenance;

Professional staff employed in utilities, local government (both urban and rural), and nongovernmental organizations (NGOs) who are involved in the development of programmes to improve the actual operation and maintenance of water supply and sanitation facilities.

The term “Operation and Maintenance” has been used as a general concept covering a wide range of activities carried out by utilities, government and communities in order to sustain their services and to maintain existing capital assets. Specifically, in the present context:

- **Operation** refers to the procedures and activities involved in the actual delivery of services, e.g. abstraction, treatment, pumping, transmission and distribution of drinking-water.
- **Maintenance** refers to activities aimed at keeping existing capital assets in serviceable condition, e.g. by repairing water distribution pipes, pumps and public taps.

Nine tools are described in this document. They are targeted at:

During the present course we will address most of the above mentioned concerns.

- What are the components needed to make a proper O&M system?
- What do we need to know to enable us to design and implement O&M system?
- What are the essential aspects of O&M system?

The importance of O&M for water supply technology

Session Summary

Objective: After completion of this session the participants will:

- To specify the importance of O&M and management
- To analyze O&M in a wider perspective of sustainability. To define the concepts of operation, maintenance and management
- To raise awareness on present trends

Time:	1 hour
Method:	Presentation, focused group discussion on the importance of O&M, Introductory note
Material:	Flip Chart and Markers, Projector, Portable computer
Handout:	• Copies of selected parts of background information • Copies of all slides
Physical Setting:	Sitting in the training room

Process:
The topic is covered by asking questions and illustrating:

- "Why is O&M important?"
- Ensure that the following ideas are mentioned and discussed by the group: proper functioning, user's satisfaction, sustainability, quality of life, health standards, and credibility of investments
- What are the needs during the course
- Materials will be handed out and discussed if so required.
- Deal with specific requests within the framework of the course
- Discuss the expectations to ensure that they are fully understood and can be dealt with.

The importance of operation and maintenance for water-supply technologies

In many developing countries, operation and maintenance (O&M) of small, community water-supply systems has been neglected. Sanitation, in particular, is given much less attention in practice, even though "water-supply and sanitation improvements" are often mentioned together in project documents. This has led to some alarming statistics, with an estimated 30%–60% of existing rural water-supply systems inoperative at any given time, and more than 2 billion people worldwide lacking access to any type of improved sanitation. The lack of such services is degrading for the affected people and has a serious impact on their health and well-being.

Increasingly, however, governments, external support agencies and local communities are recognizing the importance of integrating O&M components in all development phases of water-supply and sanitation projects, including the planning, implementation, management, and monitoring phases. National government plays a vital role in creating an "enabling environment" within which an O&M policy framework can be developed, one of the key elements of sustainability. Government can foster such an environment in a number of ways, including through legal provisions, regulations, education initiatives and training programmes, and by communicating information. If supportive O&M policy is not forthcoming from the central government, then support for O&M at the local level will be hindered. An important role of local government is to promote an awareness of national policies and to support community water-user committees. Both the project staff and the recipient communities should be made aware of the O&M implications, as the communities themselves have responsibilities in the management and O&M of their water-supply and sanitation systems. However, many local government departments have insufficient resources and are unable to provide effective support. Support by the local government may also be influenced by local politics.

The roles and responsibilities of the actors involved in O&M need to be well defined, especially where governments are shifting from their traditional role as a services provider to that of a facilitator of service provision. There has been a tendency to decentralize O&M activities and to encourage the private sector to get involved in both the construction and upkeep of water-supply and sanitation facilities. Although this trend could increase the flexibility of O&M activities and reduce costs, private sector involvement may be limited by the low profit margins, particularly in areas where rural communities are scattered. Private-sector accountability is also a concern when there are no controls or regulations. Communities that contract services from the private sector need to ensure that the job is well done at a fair price. To some extent, the communities themselves can monitor the quality of the work, even though they may initially require assistance from the central government (e.g. from the national water agency). Nevertheless, informal community-based monitoring is no substitute for developing government guidelines to ensure there are minimum-quality standards for the work, and that interventions are cost-effective. It is also important that the guidelines be conveyed to the communities, since they have increasing responsibilities, not only in the O&M of their water-supply systems, but also in their financial management. Regulation, control and monitoring require extensive efforts and commitment by governments, and consider-able human and financial resources.

Sector professionals use a number of terms to describe affordable, simple technologies that can be adapted to local conditions and be maintained by the communities them-selves. Such terms include: appropriate technology, progressive technology, alternative technology, community-based O&M, village-level operation and maintenance management (VLOM) technology, intermediate technology, village technology, low-cost technology, self-help technology, technology with a human face. In this document, we propose to use the term "sustain-able technology at community level", since this encompasses precisely the aims of this publication. Water-supply and sanitation projects should not be viewed as an end in them-selves, but as the initiators of benefits that continue long after the projects have been handed

over to the community. However, to ensure that long-term benefits do, in fact, accrue, the projects must be sustainable, which means appropriate technologies must be selected, and O&M should be integrated into project development from the beginning. Although, community-based projects may take longer to develop than short-term, agency-managed projects, the longer development time can be used to identify factors that would influence service sustainability. Often, critical aspects of O&M development have been neglected in short-term, agency-managed projects. Effective O&M brings about important health benefits by sustaining accessible water supplies in adequate quantity and quality; by reducing the time and effort spent on water collection; by allowing better sanitation facilities to be provided; and by providing income-generating activities.

This document focuses exclusively on community water supply in developing countries (i.e. services that can be managed by communities in rural or low-income urban areas). It is designed to help planners and project staff select water-supply technologies that can be maintained over the long term in rural and low-income urban areas. As has been repeatedly demonstrated worldwide, the selection of a particular technology and users participation can have far-reaching consequences for the sustainability of the services. For many years, technical criteria and initial investments were emphasized when choosing such technologies. Although these aspects are important, the roles of financial, institutional, social and environmental factors are also germane for ensuring the sustainability of services. In this manual, it is proposed that an O&M component be added to the selection process. With new actors, such as formal or informal private entrepreneurs, becoming increasingly involved, O&M is no longer simply a technical issue. It is now seen as encompassing social, gender, economic, cultural, institutional, political, managerial and environmental aspects, and is viewed as a key factor for sustainability.

Defining sustainability

Session Summary

Objective: After completion of this session the participants will:

- To analyse O&M in a wider perspective of sustainability.

Time:	1 hour 30 minutes
Method:	Interactive presentation of the factors and process dealing with sustainability
Material:	Flip Chart and Markers, Projector, Portable computer
Handout:	• Forms for exercises • Copies of selected parts of background information • Copies of all slides
Physical Setting:	Normal sitting arrangement in training hall

Process:
The topic is covered by asking questions and illustrating:

- Pose questions so that the group can interact, e.g. by explaining the situation in their own words or by experiencing or proposing new ideas.
- The presentation starts by re-minding the participants of the close links between operation and maintenance and sustainability (slide 1).
- The first message to be conveyed is that sustainability is a process which starts right from the planning stage, and that O&M is not simply what happens after the system has been constructed.
- The first slide, representing a graphic of sustainability, may now be presented. More details are provided below in the section on background information (slide 1).
- The second message deals with the factors that influence sustainability. The facilitator can refer to the second slide and to the content details under background information (slide 2 & 3).
- Another effective way to help the participants' comprehension is to explain the drawing with sustainability circles, step by step.
- Each group must choose five major management attributes, which they think are needed for the proper management of projects (slide 4&5).

Defining sustainability

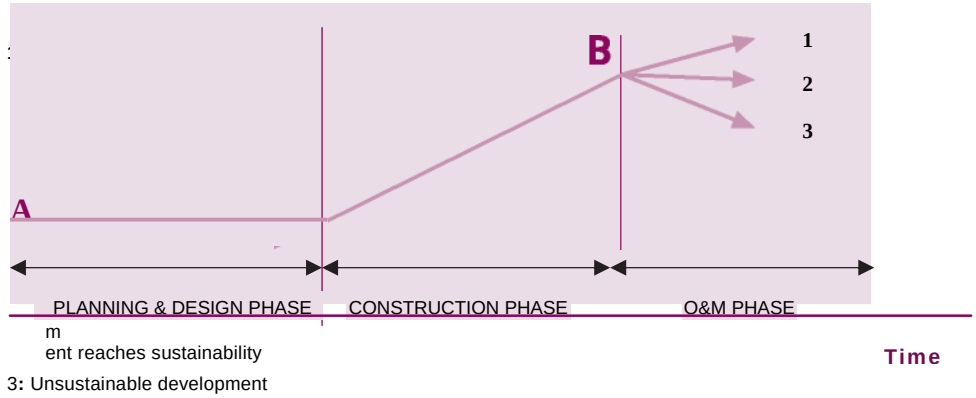
"Sustainability" is now commonly used in the jargon of development staff. In this document, we have adopted a definition of sustainability that was developed throughout the 1990s. The definition is based on inputs from major conferences and events, and on field experience.

A service is *sustainable* when:

- It functions properly and is used.
- It provides the services for which it was planned, including: delivering the required quantity and quality of water; providing easy access to the service; providing service continuity and reliability; providing health and economic benefits; and in the case of sanitation, providing adequate sanitation access.
- It functions over a prolonged period of time, according to the designed life-cycle of the equipment.
- The management of the service involves the community (or the community itself manages the system); adopts a perspective that is sensitive to gender issues; establishes partnerships with local authorities; and involves the private sector as required.
- Its operation, maintenance, rehabilitation, replacement and administrative costs are covered at local level through user fees, or through alternative sustainable financial mechanisms.
- It can be operated and maintained at the local level with limited, but feasible, external support (e.g. technical assistance, training and monitoring).
- It has no harmful effects on the environment.

The importance of O&M for sustaining the level of services is illustrated in Figure 1.1 with a project designed to raise community benefits from level "A" (benefits are unsatisfactory, or non-existent), to level "B". The project cycle includes three main phases: i) planning and design; ii) construction; and iii) O&M. If O&M is unsatisfactory in phase iii) of the project cycle the level of benefits will not be sustainable.

Figure 1.1 **Sustainability in the project cycle**



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ent reaches sustainability

3: Unsustainable development

Factors that undermine the sustainability of improved services

The following factors commonly undermine the sustainability of services:

- The project is poorly conceived (e.g. a project that only increased the number of water points, or sanitation facilities, as a way of improving accessibility to these services, without considering the wider range of factors needed to sustain the benefits).
- The project did not sufficiently involve the community, who therefore did not feel that the project was theirs. As a result, demand for the improved services suffered, and the services became unsustainable. Demand and community involvement (of both men and women) are key factors in generating long-term community commitment to improved services and in sustaining the services. Involvement also makes the community members responsible for the choice of technology and makes community members aware of the financial, managerial and technical implications of their choice, including the future O&M tasks associated with the technology.
- The performance of the project facilities was either not assessed, or was insufficiently monitored, during the O&M phase of the project cycle.

Factors that contribute to the sustainability of improved services

Sustainability relies mainly on four interrelated factors: i) technical; ii) community; iii) environmental; and iv) the legal and institutional framework. A financial dimension underlies all of these factors.

Technical factors

- Technology selection.
- Complexity of the technology.
- The technical capacity of the system to respond to demand and provide the desired service level.
- The technical skills needed to operate and maintain the system.
- The availability, accessibility and cost of spare parts.
- The overall costs of O&M.

Community factors

- The demand or perceived need for an improved service.
- The feeling of ownership.
- Community participation (men/women, social groups) in all project phases, including planning, designing, constructing and managing the services, and in the O&M of the services. Community members should also be involved in generating demand for improved services.
- The capacity and willingness to pay.
- Management through a locally organized and recognized group.
- The financial and administrative capacity of management.
- The technical skills to operate and maintain the service, implement preventive maintenance activities, and perform minor and major repairs are all present in the community.
- Sociocultural aspects related to water.
- Individual, domestic and collective behaviour regarding the links between health, water, hygiene and sanitation.

Environmental factors

- The quality of the water source (this will determine whether the water needs to be treated, and will influence the technology choice).
- Adequate protection of the water source/point.
- The quantity of water and continuity of supply.
- The impact of wastewater or excreta disposal on the environment.

It is fundamentally important to integrate the water, hygiene and sanitation practices, because poor hygiene or inadequate access to sanitation facilities can jeopardize health benefits gained from improving access to water supplies.

Legal and institutional framework

All the above factors evolve within a legal and institutional framework. At national level, there must be clear policies and strategies that support sustainability. Support activities,

such as technical assistance, training, monitoring, and setting-up effective financing mechanisms are all likely to influence the effectiveness of O&M.

In many developing countries, a decentralization process of the way in which institutions provide water-supply and sanitation services is being implemented. The main trends are towards letting the municipalities assume responsibility for the services, and towards involving the private sector (formal and informal) more actively in O&M. The changing role of local institutions requires that their capacities be strengthened. Decentralization without building local capacities may lead to a sector performance even worse than that before decentralization.

Nongovernmental organizations (NGOs) are valuable counterparts in many planning and implementation activities. Public/private partnerships may also play an important role in O&M. Participation of the private sector may range from simple maintenance tasks, to the operation, maintenance and management of the entire system under well-regulated and controlled concession contracts.

Communication between central and local levels of government, and between the water and sanitation institutions and the development agencies, will help to coordinate activities and implement policies. A proper information and monitoring system relies on effective communication.

Capacity-building is needed at all levels, especially in a changing environment where new roles and responsibilities are introduced by new development processes.

Processes which influence sustainable operation and maintenance

Processes differ from factors since they focus on the approach and the methodology of working. In the past, it was thought that the development or consolidation of factors alone could contribute to greater efficiency, effectiveness and sustainability. Now, however, it is realized that processes also have an important role to play. Among the processes can be listed the following: demand from the communities; responsiveness from sup-porting institutions and agencies; participation of communities (men and women) through the whole project cycle; linking technology choice with operation and maintenance; integration of water, sanitation, health and environment; planning with a gender perspective; effective decentralization; communication among all stakeholders; public/ private partnership; co-responsibility between community and municipality; and capacity-building at all levels.

Demand for an improved service by the communities is a prerequisite for sustainability. It is an expression of their commitment, and a way to make communities responsible for their choices and future tasks. However, demand should be promoted because communities must be made aware of the different technology options available, and of their financial consequences. The concrete expression of demand varies from one country to another and from one development agency to another. Demand can be manifested in the form of an initial contribution in cash or in kind to the capital costs, or in the form of a written solicitation from an organized community group to the municipality.

Responsiveness of support institutions and agencies is the capacity of municipalities, nongovernmental organizations (NGOs), and other institutions and agencies to respond adequately to the needs and demand of communities. In many

countries, municipalities need to be consolidated in their ability to deal with rural communities.

Participation of communities (men and women) throughout the whole project cycle is essential since it is a way to motivate, make responsible and build the capacities of communities in their new tasks and functions.

Linking technology choice with operation and maintenance at the planning stage is the key in the technology selection process. Indeed, communities must be able and willing to operate, maintain, administrate and finance the new service.

Planning with a gender perspective implies that the roles and functions of both men and women are clearly defined for management, operation and maintenance, since these might also highlight the need for specific capacity-building activities.

The **decentralization process,** which is underway in most developing countries, has a definite impact on the way institutions deal with the provision of water supply services. The main trend is for municipalities to be responsible, while the private sector (formal and informal) can contribute actively in the maintenance of systems.

Communication from central to local level and vice versa, and between private agencies and development agencies can enhance the coordination of activities and implementation of policies. Furthermore, a proper information and monitoring system relies on effective communication channels.

Public / private partnership can have an important role in the operation and maintenance of improved water supply and sanitation services, where the private sector can operate, maintain, and manage the service under contractual agreements.

Co-responsibility between communities and municipalities implies that the tasks, responsibilities and functions of both parties are clearly defined. This is especially true now that municipalities are increasingly being given the legal and constitutional responsibility for the provision of public services. At the same time, community management is being promoted as a key element of sustainability. Efficient dialogue and a clear definition of roles need to be worked out, developed and consolidated.

Capacity-building at all levels is needed, especially in an environment of changing roles and responsibilities induced by the decentralization process.

Sustainability

Read the first story about the Bridge.

1.1 The Bridge

There was once a poor village in Afghanistan. The village was situated on one side of a deep and narrow river and the road to the main town was on the other side. The villagers had built a bridge to cross the river made of rocks and wood but they were always having to work together as a community to repair the bridge and it took a lot of labour and a lot of trees to keep it fixed.

Then one day an NGO stopped their big white vehicle on the other side of the river. They came to the village and told the villagers “we are going to build you a bridge”. The villagers were very happy. After a long time, so long the villagers had almost given up hope, the big white vehicle came back, and the engineers destroyed the old bridge and soon work started on the new bridge.

The villagers worked on the project and the NGO paid them well so they were happy. They didn’t know what the bridge would look like when it was finished because no one asked them for their opinion but they didn’t mind because they were getting a bridge.

When the bridge was finished some of the villagers were a little worried because a small stream usually came down from the mountainside in spring just where the support on one side of the bridge was situated. The villagers were afraid that the stream would damage the foundation of the bridge in the spring. But they did not say anything. Soon the bridge was finished and the engineers left, the NGO left and the villagers were very happy.

In the spring there was a flood and the usual water came down from the mountain and started under-cutting the foundation of the bridge. People discussed it but no one did anything because they thought that maybe the NGO would come back. After three years the undercutting of the foundation was so bad that the support fell down then the whole bridge fell down. The villagers had no bridge at all and although they had been able to mend their old bridge no one in the village was skilled enough to build a new bridge in the old style of rocks and wood.

Ask the questions

1. Were the people better off before the NGO came or after?
2. What mistakes did the NGO make?
3. Was it a good idea for the people to say nothing?
4. Was the project sustainable?
5. What should the NGO do in future to make their projects more sustainable?
6. Would it have been better if the NGO had used only local resources.
7. What are local resources?

Read the second story

1.2 The Kind NGO

There once was a poor village called Yakshera. The village was in such a remote area of Afghanistan that it was very difficult to buy fertiliser and anyway the farmers were too poor to purchase it because the price was so high. Instead they used traditional fertiliser. Also they had only local varieties of wheat to grow. This local wheat was strong and healthy but had a low yield.

One day an NGO came to the village and said to the villagers that they wanted to help them with their agriculture. The NGO staff talked to the villagers for a long time and found out what were their agriculture problems. Then after that they set up an agriculture programme that made the villagers very happy.

First they brought in improved seed and best quality Pakistan fertiliser and after that every year at planting time they brought in enough seed and fertiliser to supply the whole village. They sold the seed and fertiliser to the villagers at subsidised price. The villagers were very happy and soon they did not bother to keep very much seed wheat themselves because the NGO was supplying it. Soon also there was very little local variety of wheat being grown in the village. The NGO also brought in good quality chemical sprays against wheat pests and different diseases, which they brought from Pakistan, Iran and even from Europe. They sold it at subsidised prices to the villagers. Soon the villagers were getting huge crops and they were living better and getting enough to eat.

After four years, the NGO started having money problems. They tried not to let the villagers know because they did not want to worry them. So when one day the NGO told the villagers that they would not be working with them any more the villagers were shocked. The NGO disappeared just before planting time in the fourth year. When the planting time came the villagers did not have enough seed to plant because they had expected the NGO to sell them seed wheat as usual. In addition the only wheat the villagers had was improved wheat and without fertiliser the yield of the improved wheat was very poor.

The villagers did not know what to do and for two years they faced worse problems than they faced before the NGO came because they had poor harvest from the improved varieties without fertiliser. Eventually they went back to growing the local variety of wheat that did not need fertiliser.

Ask the questions

1. Were the people better off before the NGO came or after?
2. What mistakes did the NGO make?
3. What mistakes did the community make?
4. Was the project sustainable?
5. What should the NGO do in future to make their projects more sustainable?

Ask the participants to explain:

What does sustainability mean?

Why does DACAAR want all its projects to be sustainable?

Sustainable projects are:

- Projects which can be continued by the people themselves after the NGO leaves.

DACAAR does only sustainable projects because:

- DACAAR wants beneficiaries to be better off when DACAAR leaves a project area, not worse off.

Sustainability of DACAAR Water Supply Projects

Ask the participants to discuss how people in the villages they come from organise to carry out communal activities

Note to the trainer

Make sure that you get the full picture of community-based co-operation for example:

- Conflict resolution (elders of the whole community usually meet together to resolve conflicts)
- Repair of intakes (usually all families in a village get together to do co-operative work such as repairing intakes).
- Community sharing of irrigation water (communities usually have their own rules for the management of irrigation water; these rules are recognised by all and are enforced by one person who is agreed by the community).

Ask the participants whether they think these activities are sustainable and why?

These activities are sustainable because they are managed by the community themselves. The community does not depend on anyone else to do the job for them.

Form the participants into groups to discuss the following three parts of the Water Supply project strategy. Participants should answer the following guidelines:

1. What is DACAAR's strategy in this respect?
2. Does this strategy help to make the sustainable? How?

Site Selection
The community select the site for the well themselves together with the Site Engineer. This gives a sense of ownership. It also means that if any problems arise later because of the location of the well then the community is likely to take action themselves (by calling the handpump mechanic and/or consulting with the area HITeam) to solve the problem.

DACAAR also has certain guidelines which also must be followed; the guidelines are designed to ensure that the well remains public, can be used by women and provides safe water.

Installation of Wells
The community has to provide local construction material for the apron such as sand, gravel and rock. All unskilled labour has to be provided free by the community. This leads to a sense of ownership of the well which means that in future if there are problems with the well, particularly the apron etc it should be easier to motivate the community to take responsibility for repair themselves.

Installation of Baths and Latrines
The community has to build the superstructure themselves and to provide all materials such as: sand, gravel and rock.

This leads to a sense of ownership of the baths and latrines which means that the families involved are more likely to maintain the baths/latrines themselves.

1.3 Helping People to Help Themselves

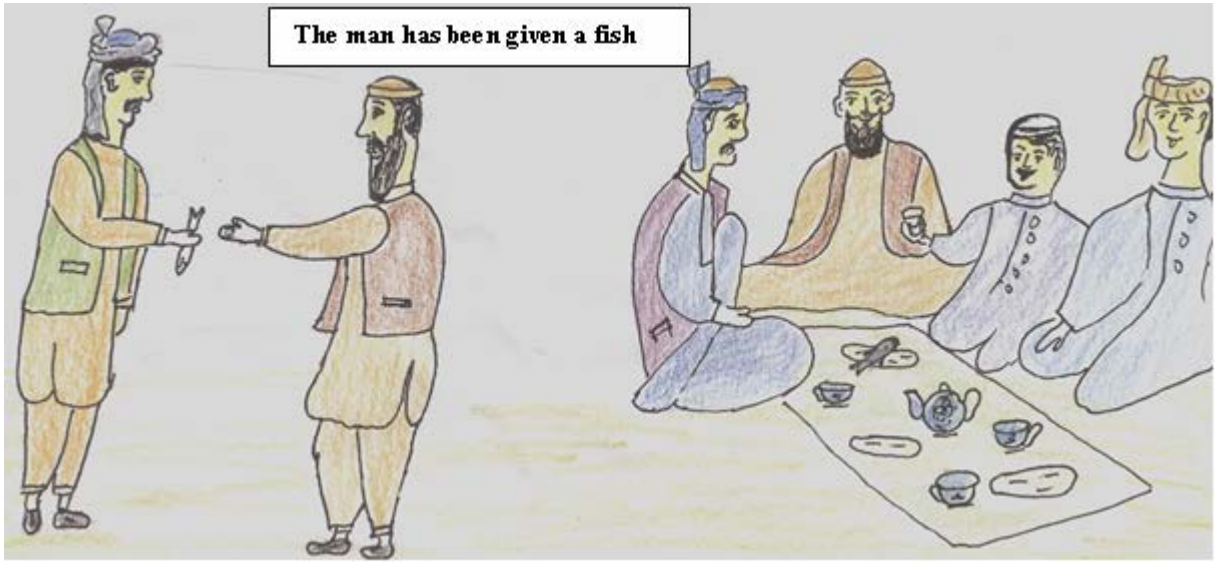
When we were discussing DACAAR's policy and philosophy we said that DACAAR's second policy after sustainability was to create independence not dependence. Now we will discuss this,

Display this chart on the board

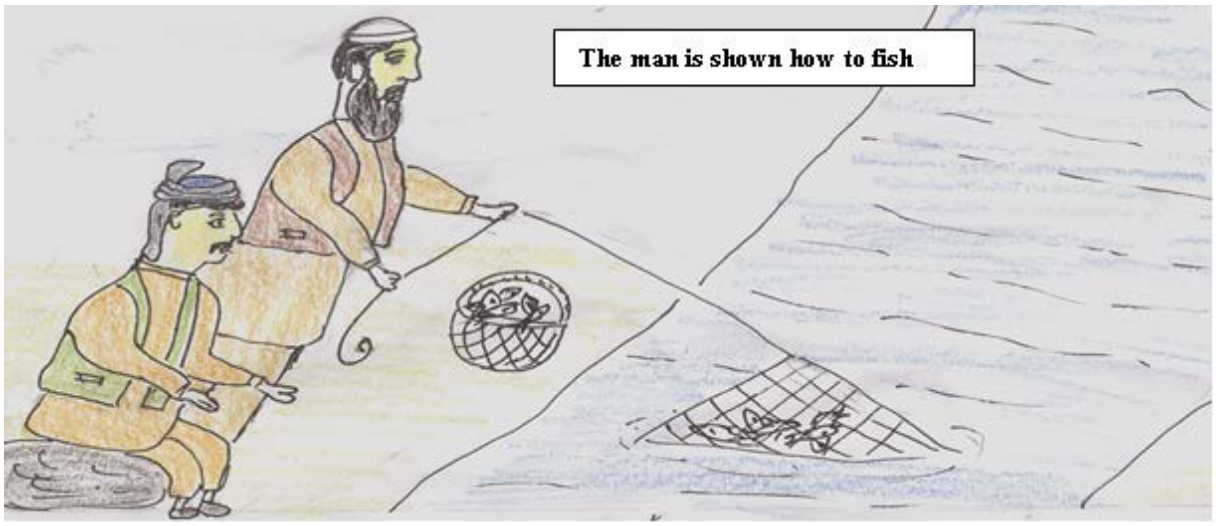
Feed a man a fish and you feed him for a day

Teach him how to fish and you feed him for life

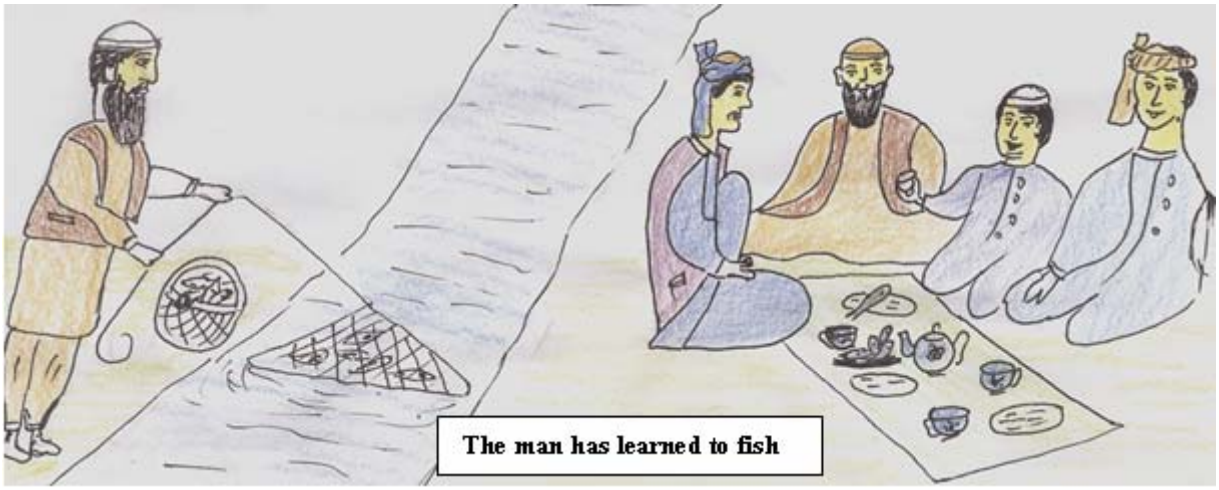
Ask one of the participants to explain what is in the drawing



The man has been given a fish to eat



Ask the participants what is the difference between giving a man a fish every day and teaching him how to fish?



- The difference is dependence and independence.

Return to the story about the Village handpump. Did the NGO in the story make the villagers dependent on them or not?

They created dependence in that the people in the village were waiting for the NGO to return to repair the well, in that way the project was not sustainable.

Tell the participants that you are going to show them a small play

1.4 River Code

Explain the River Code using the drawing on the chart.

Place string in two lines to represent the banks of the river. Pieces of paper/cloth are used to represent stepping stones in the river and an island (a piece of bigger paper/cloth) is put in the middle of the river.

Two men come to the river and look for a place to cross. The current is very strong and they are both afraid to cross-stepping stones.

A third man comes along and sees their difficulty. He leads them up the river and shows them the stepping stones. He encourages them to step on stones but both are afraid, so he agrees to take one man on his back. By the time he gets to the middle of the river, the man on his back seems very heavy. He has become very tired, so he puts him on the little island.

The third man goes back to fetch the second, who also wants to climb on his back. But the third man refuses. Instead he takes his hand and encourages him to step on the stones himself. Halfway across, the second man starts to manage alone. They both cross the river. When they get to the other side, they are extremely pleased with themselves and they walked off together completely forgetting about the first man, sitting alone on the island. He tries to get their attention, but they do not notice his frantic gestures for help.

Questions about the River Code

After playing the River Code ask the following questions:

Q. What did you see happening in the play?

Q. What different approaches were used to help the two men across?

Q. Who could each person represent in real life?

Q. What does each side of the river represent?

A. Not developed and developed

Q. Why are some people left in the middle of the river?

A. Because of dependence

Q. In what ways can development projects build a sense of dependence?

A. If the development aid does not build the capacity of the people

Q. What must we do to ensure that those we work with develop a sense of independence?

A. Building their capacity and involving them in projects.

Q What is the connection between independence and sustainability?

A. Development projects which, create dependence, are not sustainable

DAY II

DACAAR Handpump Maintenance System

Objective

By the end of this session the participants will have understood:

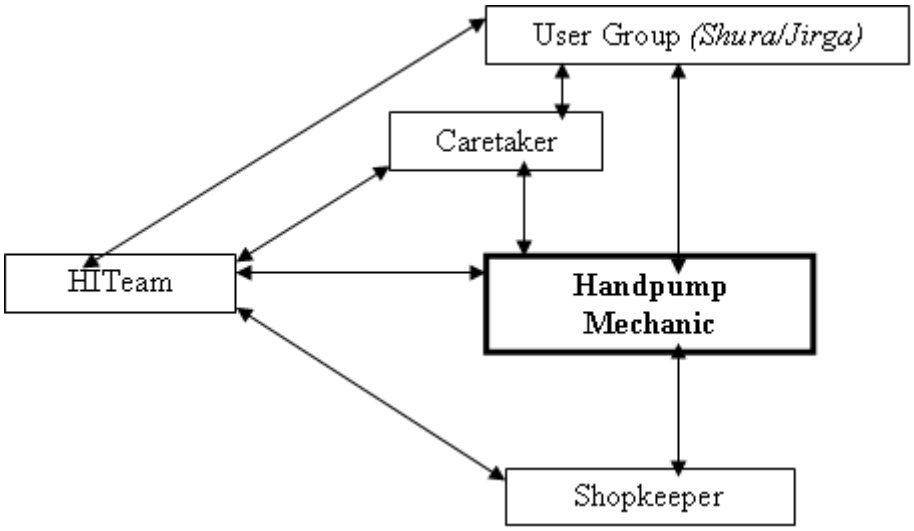
- What is the handpump maintenance system
- What is the rationale for the handpump maintenance system

Time:	1 hour 30 minutes
Method:	Presentation, group work, discussion
Material:	Flip Chart and Markers, Projector, Portable computer
Handout:	• Forms for exercises • Copies of selected parts of background information • Copies of all slides
Physical Setting:	Normal sitting arrangement in training hall

Process:

1. DACAAR Handpump Maintenance System

Brainstorm the participants on which people are involved in maintenance of the handpump by writing 'handpump mechanic' in the centre of a flip chart and letting the participants fill in the other stakeholders in the handpump maintenance system.



When you have finished this chart, take each stakeholder in turn and list their responsibilities and their role in the maintenance system.

1.5 HITeam

1. Helps HPM to solve problems with User Groups particularly concerning payment.
2. Checks that the HPM is doing repairs correctly.
3. Helps the HPM with any repair problems
4. Helps the HPM to motivate communities to solve repair problems
5. Checks on the quality of spare parts in the shop
6. Motivates shopkeepers to stock good quality spare parts
7. Distributes chlorine to HPMs
8. Removes the handpump when necessary
9. Trains handpump mechanics

1.6 Handpump Mechanic

1. Ensures that the User Group including the Caretaker knows who he is and how to contact him
2. Carries out repairs on handpumps as soon as possible after being informed
3. Regularly inspects all handpumps in his area
4. Removes the handle on hand pumps when necessary.
5. Checks the quality of spare parts in the shop
6. Motivates shopkeepers to stock good quality spare parts
7. Informs the HITeam of major technical or social problems with wells eg. well privatised, well collapsed, well dried etc.
8. Informs the User Group of the cost of spare parts
9. Uses the auger to deepen wells
10. Chlorinates wells as necessary

1.7 Caretaker

1. Ensures that he knows who the handpump mechanic is and how to contact him
2. Solves conflicts between the User Group and the HPM
3. Motivates the community to use the well properly :
    - Not to allow children to play with the handpump
    - To dig and maintain drainage for waste water from the well
    - To keep the apron clean, and
    - To ensure that the well water is safe by not stabling animals near the well and not putting latrines near the well
4. If the mechanic removes the handle or even the handpump, the caretaker will keep the parts safely until needed.
5. Calls the handpump mechanic as soon as the handpump needs repair.
6. Collects payment from the User Group for regular maintenance and for spare parts and give to HPM.

1.8 Shopkeeper

1. Keeps a stock of all spare parts of the handpump
2. Sells these spare parts at a reasonable price.
3. Ensures that his spare parts are of appropriate quality
4. Keeps in contact with different dealers of handpump parts so as to keep a regular supply

1.9 User Group (Shura/Jirga)

1. Regularly pays the HPM his agreed wage.
2. Pays for spare parts as necessary
3. Uses the handpump properly as advised by the caretaker
4. Co-operates with the caretaker
5. Ensures that the well is available for public use and particularly for all women in the User Group
6. Ensures that the Caretaker does his job

Divide the participants into groups and give them the Handpump Group Work.

1.10 Responsibility of the Handpump Mechanic and the Community

Ask the participants how much handpump mechanics are supposed to be paid per year.

The payment to handpump mechanics varies between districts. The range is from 21-28 kg of wheat or maize per year.

Brainstorm the participants on what problems they face in collecting this payment. Write the problems on a flip chart. The Water & Sanitation Programme staff who are assisting in the training should then go through the problems discussing possible solutions with the handpump mechanics.

Ask the participants how they usually collect the fee.

The handpump mechanic should collect the fee by discussing in advance with the Caretaker when he makes his routine visit to the handpump. He should ask the Caretaker when the fee will be ready. If there is any problem the handpump mechanic should call a meeting with the elders or the User Group.

Ask each trainees how often they can visit the handpumps in their own area for routine maintenance. Ask them what is the rule regarding number of routine visits per year which they should make to each handpump.

It is not clear how often handpump mechanics should visit each handpump and it should be decided with the mechanics.

Brainstorm the participants on what problems they face in visiting wells regularly. Write the problems on a flip chart. The Water & Sanitation Programme staff who are assisting in the training should then go through the problems discussing possible solutions with the handpump mechanics.

Brainstorm the participants on what the handpump mechanic should do on routine maintenance visits.

1. They should visit the Caretaker and ask him if there are any problems
2. They should check the:

- drainage
- sources of contamination,
- cleanliness of the apron,
- public usage or not of the well.
- functioning of the handpump

Through these monthly visits the handpump mechanic should introduce himself to all the User Group families and ensure that they know how to contact him. He should also ensure that the Caretaker knows how to contact him.

Brainstorm the participants on what problems they face in routine visits to wells. Write the problems on a flip chart. The Water & Sanitation Programme staff who are assisting in the training should then go through the problems discussing possible solutions with the handpump mechanics.

Brainstorm the participants on what problems they face with each of the stakeholder groups. Write the problems on a flip chart. The Water & Sanitation Programme staff who are assisting in the training should then go through the problems discussing possible solutions with the handpump mechanics.

2 HANDPUMP GROUP WORK

2.1 Group 1

Criteria for Removing Handpump Handle and Handpump

Ask the group to list the circumstances under which the handpump handle should be removed by the Mechanic.

Criteria for Removing Handpump Handle (Mechanic)

1. When the well is dry
2. When the well is not providing safe drinking water (water is contaminated)
3. If the handpump is not working and cannot be fixed immediately.

Ask the group to list the circumstances under which the handpump itself should be removed by the HITeam.

Criteria for Removing Handpump (HITeam)

1. When there is no User Group
2. When the well is completely collapsed and the User Group is not willing to improve new sources
3. When User Group is refusing to use the handpump and contribute to the maintenance of the water point, in this case a written document should be taken from the User Group.
4. When the User Group is not drinking the water (too salty, bad smell etc).
5. When the well has been privatised.
6. When the handpump is causing conflict among the User Group.

Ask the group whether the Mechanic should inform the User Group about removing the handpump handle and if so how they should inform them.

The Mechanic should inform the User Group before removing the handle either by visiting them individually or better by calling a meeting of al the User Group.

2.2 Group 2

Criteria for Chlorination

Ask the group to:

1. Describe the information HPMs should give to User Groups regarding benefit and use of chlorine.
2. List the circumstances when chlorination should be carried out by the HPM.
3. Describe the chlorination process

Need for Chlorination

Chlorination is required for disinfection when water is contaminated. This means it should be done when the water has a bad smell or there is a visible source of contamination (dead mouse, worms in the water etc), or when there is an epidemic of a water borne disease in the surrounding area (such as cholera).

Criteria for Chlorination

1. When the handpump is installed
2. After each repair or deepening of well
3. If the User Group complains of a bad smell or worms in the water
4. If there is an epidemic of a water borne disease in the area (such as cholera)

Chlorination Process

1. Put 300 gms (20 tablespoons) of chlorine in a bucket of water (10 litres).
2. Pour the water and chlorine into the well.
3. Leave the well for 1 hour
4. After one hour, pump until the water no longer smells of chlorine
5. Wait another 4-6 hours before using the water for drinking.

2.3 Group 3

Guidelines for Contamination and Site Selection

What are the guidelines regarding contamination of dug wells?
What are the guidelines regarding site selection for wells?

Contamination of Dug Wells

1. Wells should not be dug in areas where the water table is higher than 5 metres
2. Wells should be dug at least 10 metres away from sources of contamination such as:
   - Standing water
   - Accommodation for animals
   - Latrines

Guidelines for Site Selection

1. All families from the intended User Group should have access to the well
2. If the land for the well belongs to an individual then it should be donated to the community with a written *waqf* document.
3. The well should be placed so that women can use it (not on the side of roads, in bazaars, in mosques etc). If the well has to be placed on the side of a road then the handpump should not be installed until a privacy wall has been constructed for the women.
4. The site should be selected in such a place that it cannot easily be privatised.
5. The User Group should agree on the site.
6. The site should not be contaminated
7. Women should be involved in the site selection as far as possible.

Safety

Objectives

By the end of this session the participants will have understood:

- What are the dangers involved in handpump maintenance and repair
- How to avoid these dangers

Time:	30 minutes
Method:	Presentation, brainstorming, discussion
Material:	Flip Chart and Markers, Projector, Portable computer
Handout:	• Forms for exercises • Copies of selected parts of background information • Copies of all slides
Physical Setting:	Normal sitting arrangement in training hall

Process:

3 Safety

Ask the participants what are the dangers involved in maintenance of wells and repair of handpumps, ask them to prioritise the dangers.

In general the dangers involved in maintenance of wells and repair of handpumps are as follows:

1. Falling down the well
2. Objects falling down the well onto the head of the person working in the well
3. Lack of oxygen in the well

Brainstorm the participants on how to avoid these dangers.

Falling down the well	▪ Always wear a helmet in the well
Objects falling down the well onto the head of the person working in the well	▪ Always remind the people at the top of the well to be careful not to drop anything into the well and to keep children away. ▪ Always wear a helmet in the well
Lack of oxygen in the well	▪ Before going into a well lower a candle or a hurricane lantern into the well, if the flame goes out then the well has gas in it and it is very dangerous to enter the well.

3.1 Lack of Oxygen

Show the participants the bottle and oxygen experiment.

Brainstorm the participants on the situations where lack of oxygen is a problem.

- If machinery is used inside a well (water pump for example leads to a build up of carbon monoxide)
- If dynamite or other materials are used for blasting inside a well. After blasting there will be no oxygen in the bottom the well and anyone going down will collapse very quickly and suffocate.
- If there is waste material (particularly vegetable material) in the bottom of a dry well this may lead to a build up of different gases meaning that there will be less oxygen.

Brainstorm the participants on how to solve the problem of less oxygen.

- Use a blower to blow air into the bottom of the well until a flame lowered into the well burns properly.
- Use other equipment such as bundles of wet straw or a wet blanket to force air down into the well until a flame lowered into the well burns properly.
- Put lime mixed with water into the well until a flame lowered into the well burns properly.

Bottle and Oxygen Experiment

Materials Needed:

1 glass jar with airtight lid
A small piece of candle stuck onto the bottom of the jar
Box of matches

Experiment
Light the candles in the jar, when it is burning properly put the lid on the jar and close it tightly. After some time the flame will go out due to lack of oxygen.

Explain to the participants that, like humans, flames need oxygen to survive. So where a flame burns there is oxygen and there is no danger for humans.

Community management

Session Summary

Objective: After completion of this session the participants will:

- Participants understand the concepts of community participation and community management
- Participants are familiar with the pros and cons of degrees of community involvement in management
- Participants are aware of the resistance to change and how to deal with this when working with communities
- Participants have identified ways to approach the community and facilitate community management

Time:	1 hour 30 minutes
Method:	Presentation, discussion and group exercise
Material:	Slides, Flip Chart and Markers, Projector, Portable computer
Handout:	Copies of slides, exercise sheet and extract from background information
Physical Setting:	Normal training hall seating, group activity done outside

Process:
The topic is covered by asking questions and illustrating:

- Discussion on “What is a community?” and “What is community management?” (slide 1, 2&3)
- What is the difference between community participation and community management (slide 4)?
- Ways to approach community (slide 5).
- Why involve communities in the management, operation and maintenance of RWSS (slide 6)?
- Goal of community management (slide 7)
- Characteristics of community management (slide 8).

The concept of community management

Community management has different connotations in the literature. This was also the case with community participation, the definition of which already in 1982 ranged from the provision of free community labour inputs in government projects, to autonomous self-reliant development. Despite or perhaps because of the unclear definition, community management of water supply and sanitation systems has increasingly been seen as a fundamental option for sustainable development. Community management of services backed by measures to strengthen local institutions in implementing and sustaining water and sanitation programmes, was one of the guiding principles adopted in the New Delhi Consultation in 1990 and reconfirmed in Agenda 21.

Why is it believed that community management of water supply and sanitation systems will be any more successful in achieving sustainable coverage than the top-down approaches from the past? Experience in many developing countries shows that even very good water agencies cannot successfully operate and maintain a network of widely dispersed water systems without the full involvement and commitment of the users. Despite the best endeavours of central agencies, the overstretching of staff, transport and budgets has led to breakdowns in the system, dissatisfied consumers and demoralized agency personnel. Many governments are becoming convinced that centralized systems cannot deliver the required services for the sector. This resulted in a strong push towards decentralization which started in the late 1980s.

Hopes are now high with respect to community management, because it is believed that this approach seeks to make the best use of the available resources in the community with some support from government agencies. It puts the people in charge of their own water systems in a flexible partnership with the supporting agencies. Communities take on more tasks and responsibilities, and relieve the agencies of all routine management and maintenance duties. This frees the agency's resources, which can be used to reach more people. Successful community management is claimed to build community confidence and stimulate wider development efforts. It is also stressed that there is still a lot to learn.

Much of this learning is at the level of the agencies and institutions, which often hold the purse strings and so can dictate the course of development. Increasingly, governments and institutions are trying to adopt a more integrated and demand-responsive approach. This is stimulated by the growing pressure to focus on sustainable functioning and effective use of water supply and sanitation systems. Another reason why government agencies are searching for alternatives and are amenable to participatory approaches is that, over the past two decades, blueprints of development strategies have been shown to be ineffective in meeting the basic needs of large numbers of marginalized, vulnerable people. Thus public sector agencies are showing a growing interest in participatory approaches that involve the community in their attempt to do more with fewer financial resources. They are developing, for example, links with NGOs that used similar types of approaches.

In this context, it is surprising that agencies do not have internal mechanisms to learn from their experience with communities, to learn how to work with them, and to share this among their staff. What is needed is an approach to learning that allows the development of new methodologies and promotes change in the prevailing attitudes, behaviours, norms, skills and procedures within the agencies.

Not only do the agency staff have to learn to work with the communities and overcome the top-down approach from the past, but the communities also must come to grips with working with the agency staff in a horizontal relationship. In the future, the push for change will be more radical, with increasing decentralization and with communities who will bear a larger share of the cost. Then the paradigm shift from communities participating in agency projects to agencies participating in community projects will become even more important.

According to Franz Gahwiller of SKAT (Swiss Centre for Development Cooperation in Technology and Management), "... we usually do not allow for the required time to initiate a process of change. Such a process may take years and years, but we want the communities to manage their systems as soon as possible. Moreover, the societal environment for such processes of change needs to be democratic."

Some findings from the field

In 1995 a participatory action research (PAR) project on community management for rural water supply was initiated by IRC together with partner organizations in six countries (Cameroon, Colombia, Guatemala, Kenya, Nepal and Pakistan). Local research teams worked closely with community members in 24 communities to better understand community management and to explore possible improvements. The essence of this project is to help communities to gain a better understanding of the problems they face and to let them become a key factor in problem-solving. "The knowledge we gain from this 'research' is much more valuable than gifts. It is something we keep for life" (villager from Nkoundja, Cameroon). Community members thus become catalysts and in beginning to understand and discuss their problems, they create the space to allow a range of actors to participate and express their views.

A first assessment of the situation in the six countries indicates that:

- In each country, community management of completed rural water supply systems is the accepted national policy, but implementation is not universal and each agency has its own procedures.
- None of the governments so far treats communities as future managers in the sense that they can make their own choices from a range of options, each with their own pros and cons. Nor do they train communities for all community management aspects. Training is focused on technical tasks and book-keeping, and is mostly given to men.
- Experience with existing community managed water supply systems varies. In Cameroon, 438 projects that were built and managed by the community showed a breakdown rate of 9%, whereas many others built without community involvement are no longer operational. Other reports indicate that a number of community managed systems do not function well, partly for technical and ecological reasons, and partly because of poor administration and lack of management training and back-up support.
- A considerable number of community members are not served because of poor water distribution and poor network management. Several of these persons contributed to the construction of the system in cash or kind, but do not obtain the benefits.
- Although existing systems have technical, managerial and socioeconomic problems, the communities only mention the technical problems. The other problems are revealed only after further probing and discussion.

- Record-keeping of finances and of agreements made in meetings is very limited and erodes the confidence of the community members. There is a similar weakness in communication and information-sharing which are mainly in the hands of the local leadership.
- Many ESAs (external support agencies) stipulate preconditions for future management, usually the formation of a water committee with some women represented. However, little is done in developing management tools or management training.

Another participatory evaluation of 40 community managed water systems in Ecuador revealed that the systems do provide water but are in need of both technical improvements and better management.

On the positive side, the above-mentioned PAR project already shows that working in a horizontal way with the communities and helping them to clarify their problems is a very powerful tool for change. Communities in Kenya, for example, were initially timid but are now enthusiastic about the management of the water system, and are undertaking tasks in a transparent way. An overall picture is emerging that communities are capable of managing their water supply systems, but they need back-up support. The agencies also clearly need support. Strategies and tools for enhancing management capacity in communities are developed and tested in the project, which now offers a flexible sup-port approach, called Participatory Action Development for community management. This approach aims at responding to the concrete needs of communities related to the management tasks and skills in their public services, and at finding solutions to problems and conflicts in the management of rural water supply by communities.

"Revisiting" community management

Instead of trying to refine the existing definitions of community management or add another version, there seems to be an easier way to increase our understanding of what it encompasses. Community management deals with two dimensions: communities and management, and the relation between them.

Communities are groups of people with common but also conflicting interests and ideas and different socioeconomic and cultural backgrounds. The identity of the people in the communities is shaped by their history and their socioeconomic and environmental conditions. Some of them, often the economically better off, may be better informed and know more about the world, but on the other hand, may have certain interests in keeping the status quo and therefore may not be willing to solve certain problems. Women may have different interests from men and their views may not have been heard in the past, or their position may make it difficult to achieve changes on their own. Men, women and children have different needs, different access to resources, and different areas in which they can take decisions. Yet, all of them have equal rights to contribute to and benefit from development activities, thus making it necessary to strike a gender balance in programme activities, problem identification, conflict resolution, and joint management of common interests.

The water supply system may be one such common interest, but at the same time can be a major source of conflict. This brings us to the dimension of **management.** Management is a concept which is very much being developed and is changing to entail sharing of responsibilities in new ways. It is becoming more focused on learning, creating an enabling

environment, and building trust, and places strong emphasis on communication and holistic approaches. A collective learning process starts with dialogue, or an open exchange of ideas in the group. This permits the participants to discover their potential and perspectives. This dialogue differs from the more common discussion, which has its roots with 'percussion' and 'concussion', literally a heaving of ideas back and forth in a winner-takes-all competition. Team learning develops the skills of groups of people to look beyond individual perspectives. It requires a positive learning environment. This is not easy, particularly in a politicized environment such as the water and sanitation sector. Not only are good facilitation and a variety of techniques required, but also leadership training for group members and a review of the historical developments with the community. Equally important is the need to review, with the sector staff, the social missions of their institutions and their own aspirations. This requires building confidence and trust, helping them to become self-confident and gain self-esteem. A guide to this process was already provided in ancient China (c. 700 BC):

> "Go to the people, live among them, learn from them, love them, start with what they know, build on what they have. But of the best leaders when their task is accomplished, their work is done, the people will remark: We have done it ourselves!"

The community is not the only actor, but can benefit from partnerships with water sector institutions and the private sector. There is no blueprint on what the inputs of different actors can be in the different project stages, but what may be expected is that the role of the government or NGOs who were initially the project leaders will reduce over time, and the role of the community water enterprise (water committee, users' association, private enterprise, etc.) will increase. The different actors or their representatives thus have to come to an agreement on what the specific contributions and responsibilities will be over a period of time. This they can only do on the basis of informed decision-making which particularly addresses the expected service level, and the long-term management of the system which is still the weakest issue today. The discussion may include possible future extensions of the system, not in great detail, but the basic concept should be clear.

Some concluding remarks about community management

Although a paradigm shift seems to be emerging, the principal challenges to put community management into mainstream practice are still huge. Currently in most countries, community management of rural water supply systems is the accepted national policy. However, there is still a considerable gap between policy and practice. In fact, communities are not treated as future managers in the sense that they can make their own choices from a range of options. Nor do they get the opportunity to learn the required management skills.

This and the lack of back-up support for problems going beyond the community level are important reasons for the sub-standard performance of many systems. This will continue to be the case unless the managerial aspects are better taken in hand and practical management tools are developed together with communities. Management skills also include handling of conflicts because communities consist of people who do not necessarily share the same interests and values. Often conflicting interests exist both within the community and between the community and outsiders.

Gradually we see agencies starting to participate in the development endeavour of the communities instead of the community participating in the agency's projects. This paradigm shift, however, will only materialize if new learning approaches and participatory methods are adopted in challenging institutional settings where community know-ledge and institutional knowledge are equally valued and people start to respect each other's views.

The partnership approach, for agencies, means that new coherent strategies and methods are needed to further build management capacity in the communities, and through dialogues with them. This also implies that agencies need to make the necessary adjustments and strengthen their own capacity to provide effective support to the communities.

Also institutional change is needed which allows for harnessing the partnership between communities, governments, NGOs and the private sector. The relationship should be transparent, based on mutual understanding and appreciation of the different 'social' missions of the institutions.

For a community to share management responsibilities to a greater degree, stake-holders should be allowed to learn about the system in all its aspects. Support strategies should create sufficient learning opportunities and start a process of dialogue for all involved. The challenge is how to make possible this continuous process, knowing that 'each place, each culture, each experience requires its own approach'.

Building Local Capacity

Objectives

By the end of this session the participants will have understood:

- Why does DACAAR want to build local capacity?
- How does DACAAR build local capacity?

Time:	1 hour
Method:	Presentation, brainstorming, role play and discussion,
Material:	Slides, Flip Chart and Markers, Projector, Portable computer
Handout:	Copies of slides, exercise sheet and extract from background information
Physical Setting:	Normal training hall seating, group activity done outside

4 Building Local Capacity

4.1 Sustainability of the Handpump Maintenance System

Remind the participants what sustainability means.

A sustainable project is one that can continue after the agency leaves because the project does not include any skills or any materials which the people do not have or cannot find themselves. A sustainable project creates independence and an unsustainable project creates dependence.

Remind the participants of the story of the fish.

Give a man a fish and he is dependent on you for food, teach him how to fish and he can provide himself with food without your help.

Ask the participants how this applies to projects involving wells and handpumps. If you give people a well with a handpump how do you ensure that the well continues after the project has left, for example if the handpump breaks down. With a sustainable project the people can fix the handpump themselves with an unsustainable project they have to wait for the agency to come back and fix it.

Ask the participants why it is important to have handpump mechanics?

Handpump mechanics are important because otherwise the people would have to wait for the agency engineers to return to fix the handpump.

- Do the Handpump Mechanic Payment Role Play
- Do the Spare Parts Role Play

4.2 Handpump Mechanic Payment Role Play

Old man	Why don't you young men fix this handpump, it has been out of order for two months now and it is causing everybody a lot of problems. My grandson has diarrhoea for the last week from drinking that canal water.
Young man	We informed the handpump mechanic two months ago but he still hasn't come.
Old man	So what are you going to do about it?
Young man	Well, you are going to the bazaar tomorrow, maybe you could go and see him.
Old man	Alright and I will tell him that if he doesn't come by the end of the week, next year we will not pay any wages to him we will pay the wages to Abdullah's son and send Abdullah's son to the next district to learn how to fix handpumps
Later	
Young man	So, Uncle, what did the handpump mechanic say.
Old man	He said, he was very sorry but really he didn't receive the message. He will come tomorrow.

1. Ask the participants why it is important that the handpump mechanics be paid by the community?

It is important that the handpump mechanic be paid by the community so that the community is responsible themselves for the maintenance of the handpump and also that they able to control the process.

2. Ask the participants what might have happened if the handpump mechanic was not paid by the community but paid by the agency?

The handpump mechanic might not have listened to the community complaining, the community would have to go to the agency and the agency would then speak to the handpump mechanic.

4.3 Spare Parts Role Play

Old man	Why don't you young men fix this handpump, it has been out of order for two months now and it is causing everybody a lot of problems. My grandson has diarrhoea for the last week from drinking that canal water.
Young man	The handpump mechanic came yesterday and he said the handpump needs a very simple spare part.
Old man	So did he fix the handpump?
Young man	No, he didn't.
Old man	Young man, don't irritate me, if the solution to the problem was so simple why wasn't it done – you young people have no common sense.
Young man	Uncle, please don't get cross, it wasn't our fault, the handpump mechanic doesn't have any more of this type of spare part. Now he has to wait for the agency to send him some more spare parts.
Old man	Well, fine, when will the agency be bringing him some more spare parts.
Young man	Well, that's just it you see – the agency don't have the spare part either – they have to get it from Iran or Pakistan. We just have to wait for the agency.
Old man	I see, so one day, when I am dead and buried maybe you will fix this handpump.

Ask the participants why it is important that the spare parts are available locally?

If the parts are not available locally then the handpump mechanic is dependent on the agency. For the people and the handpump mechanic to be independent the whole process has to be within their control.

4.4 Private Sector Capacity Building

Tell the participants the following story.

In Deh Bala village there were 200 households, some people were poor and some have more land. Their water source was a very dirty canal and there was a lot of diarrhoea in the village in the summer because of the dirty water. One day an agency came and installed one well with handpump, 20 baths and 20 latrines. The local government also provided one well to this village, but of course, even then two wells, twenty baths and twenty latrines was not enough for the whole village.

Ask the participants what the people in the rest of the village can do/should do?

1. They can wait for another agency to come and give them more wells, baths and latrines.
2. Individual families or communities can install their own wells, baths and latrines

Let us discuss these two options.

1. Wait for Another Agency
Discuss with the participants the answers to the following questions.

- Is it possible for agencies to put in enough wells for all the population of Afghanistan?

It is not possible for agencies to put in wells for all communities in Afghanistan. One major problem is that the population of Afghanistan is likely to grow from 22 million to 32 million in the next ten years. At present agencies have provided enough wells for only 14-15% of the population. If agencies continue to put in wells at the same rate (which is not likely because less aid is coming to Afghanistan now not more) then the percentage of the ever-growing population which have access to safe water is likely to get smaller.

- Should the people of Afghanistan be dependent on agencies or should they try to be independent.

As we have mentioned many times already in this training, it is always better to be independent than dependent.

Therefore the people should try to be independent. This means that the people who can should supply water and latrines for themselves.

Now let us look at the second suggestion we made earlier for the people in the village.

2. Installation of Private Wells, Latrines and Baths

This is a good suggestion; at least some people will get access to safe water. The problem is that the technical skill to install a well with handpump or a latrine slab, is not always available and the handpump, latrine slab and other necessary items such as concrete components may also not be available.

Ask the participants what is needed to solve the problem of non-availability of concrete components and lack of skills for installing wells, latrines etc.

1. Agencies should teach somebody the necessary skills
2. Agencies should support individuals to produce the necessary materials
3. Agencies should encourage shops to stock the necessary equipment.

Brainstorm the participants on what is actually involved for each task.

i. Learning the Necessary Skills

- Skill of installing handpumps
- Skill of installing latrine slabs and PVC pipes
- Skill of installing bath tiles and drain pipes
- Skill of knowing good quality of : concrete/cement, PVC, handpump spare parts

ii. Support for Producing Necessary Materials

- Design drawings and moulds for:
    - Latrine slabs
    - Well rings
    - Pedestal slabs
    - Top ring
    - Supporting beams
    - Half rings
    - Bath tiles
- Skill of knowing good quality cement/concrete and steel bars
- Skill of making good quality concrete

iii. Encouraging Shops to Stock Necessary Equipment

- Show shopkeepers where to get spare parts and handpumps.
- Skill of recognising good quality spare parts
- Skill of pricing

Ask each participant to write a list of the skills and equipment he has and the skills and equipment he thinks he could use. He should then present his case and describe how he would finance himself and to whom would sell his product.

The Water Supply staff should finalise with each handpump mechanic a plan for expansion of his activities into the private sector.

MRRD Operation and Maintenance System

Session Summary

Objective: After completion of this session the participants will:

- Understand MRRD O&M system.
- All implementer to consider and apply MRRD WatSan O&M system in projects.
- Address the sustainability concerns.

Time: 1 hour
Method: Presentation, and discussion
Material: Flip Chart, Markers, Projector, Portable computer
Handout: Copies of slides and background information
Physical Setting: Normal training hall seating, group activity done inside.

Process:
The topic is covered by asking questions and illustrating:

- What are the core guiding principles of MRRD O&M strategy?
- How is the institutional arrangement of the MRRD O&M system?
- How and when to apply the O&M system?

MRRD Operation and Maintenance System[1]

A functional Operation and Maintenance System should be established to address the sustainability concerns.

1. Core Guiding Principles

The O&M strategy is guided by the following guiding principles.

- Operation and Maintenance cost should be borne by the community beneficiaries.
- The stress shall be on preventive maintenance system to minimize sudden breakdowns of handpump/ water points.
- Community should make its own decisions, should be in the driver's seat and manage the scheme. Other actors should strictly work as facilitators.
- Beneficiary communities should have strong sense of ownership.

2. Institutional Arrangement

The following institutional arrangement is proposed for handpump O&M system.

2.1 CDC/WSUG

At the village level, CDC/WSUG will be the focal point and responsible for operation and maintenance of the system. It is a credible organization at the village level which is elected/ selected by people and involved in planning and implementation of the scheme. Its decisions are generally accepted and respected by communities.

The functions of "CDC/WSUG" in the operational and maintenance of water supply and sanitation will include the following:

- Appointing handpump caretakers for each handpump. The caretaker will keep pump/well surroundings clean, inform pump mechanic about repair and help handpump mechanic in repairs.

- Sign a contract with the Hand Pump Mechanic specifying
  his duties and what the User group will pay him (in cash or kind) on annual basis for his services. (A sample in contract Annexes 4 or 6)

- Fixing user charges and establish O&M Fund. It is expected that 1500 Afgani per family per year[2] will be adequate to take care of minor and major handpump repairs.

- Stocking of fast moving spare parts.

[1] Ref., Draft Report On Sustainable Handpump O&M System in Afghanistan, A Way Forward, Arun Kumar Mudgal, October 2005 and

[2] MRRD-UNICEF Project, Draft Afghanistan: Community Management of Rural Water Supply Installations in Heart Province

- Maintain accounts and other ledgers as required.
- Periodically, inform the community about progress and expenditure details.
- Managing O&M of all water facilities in the village including schools within the village through a pump mechanic trained by the project.

2.2 Hand Pump Caretaker

Each caretaker/elder of the hand pump has the following responsibilities regarding the maintenance and repairing of the hand pump.

1. Undertake the preventative maintenance of the pump
2. Ensure that user groups keep the platform clean
3. Inform the community representatives and the mechanic regarding repairing needs of the hand pump.
4. Assist the hand pump when repairing the pump
5. Assist collect the grain/money for the cost of spare parts as well as wages of hand pump mechanic.
6. Act as a motivator to promote health and hygiene practices, proper use of hand pump and sanitation in villages

Criteria for selection of handpump caretaker in the villages are:

- Should serve the community voluntarily.
- Be a representative (Male/female) of the user groups.
- Should have leadership capabilities.
- Should have ability to read and write.
- Should be accessible, via greed linkages, to female users.

2.3 Handpump Mechanic

He/she will be an entrepreneur trained by the project and will look after 100-150 handpumps. He will be provided with a set of tools. CDC/WSUG/ will enter into a contract with the handpump mechanic for maintenance of all village community handpumps including the handpump in the village school. The payment for labor charges and spare parts costs will be made by CDC/WSUG. The functions of the handpump mechanic will include the following.

- Visit each handpump at least once every quarter.
- Cary out preventive maintenance to avoid breakdown.

- Repair pump with help from caretaker.
- Purchase spare parts from an approved spare parts shop if CDC/WSUG so desire on actual payment basis.
- Get the signature of the pump caretaker in his/her logbook during the visits of the water source.

Criteria for selection of hand pump mechanic:

1. Preferably to be introduced by the representatives of the user groups.
2. Be a permanent resident of the area
3. Committed to serve that community.
4. Should have the confidence of the community.
5. Preferably be literate.
6. The hand pump mechanic preferably should have a relevant background such as a blacksmith or bicycle mechanic
7. Should have mechanical knowledge, ability and interest.

2.4 Valve Man

For each pipe scheme one or more Valvemen will be selected to maintain and operate the system in the same manner as handpump mechanics.

The valve man will receive technical training, and be equipped with the necessary tools for his work. Owing to the complicated nature of his task he should work as a paid skilled labor during the implementation of the project and receives on-the job training.

2.5 Spare Parts Shop

The spare parts shop will provide quality spare parts to CDC/WSUG on payment basis. The project will train some mechanics attached to the shop who could also offer installation and maintenance services to CDC/WSUG and private households (HHs). RRD will work with spare parts shop to ensure that spare parts are of good quality and prices are reasonable.

2.6 Regional Technical Support Unit (RTSU)

Regional Technical Support Unit (RTSU) with assistance of Provincial RRD will monitor hand pump maintenance. They visit each Handpump Mechanic every three months to discuss and assist in resolving problems at individual water points. They also inspect the water points on a routine basis.

Their role is to:

- Assess the functioning of the maintenance arrangement including the performance of the hand pump mechanic and the spare parts distribution. If the team observes a

problem such as non-payment of repairs and spare parts by user groups, the mechanic is performing poorly and lacking in skill or unavailability of spare parts, the team must take steps to rectify the situation

- Assist on conflict resolution between different actors at the village level, handpump mechanic and spare parts shop.
- Monitor the performance of the hand pump and well for technical weaknesses.
- Collect the information recorded by the hand pump mechanic on repairs, maintenance and spare parts used.
- If necessary the team will chlorinate wells.
- If a handpump mechanic leaves or needs replacing the team help select and train a new mechanic.
- The team supplies the hand pump mechanics and the construction teams with packets of chlorine
- Hold group discussions separately with men and women on issues related to health and hygiene. Use multimedia approach for effective delivery of messages.
- Brief RRD officials on issues needing their attention. If there is need for engineering inputs, RRD will be informed about the need.
- Record relevant data in a computer based data sheet.

This team will be a mobile team provided with a four-wheel motorized transport and cover 1500-2000 handpumps. It will comprise of driver-cum-handpump mechanic, a male sociologist and a female sociologist. The role will include the following.

RTSU will form as its backbone for both monitoring of O&M and health and hygiene awareness creation.

2.7 MRRD/RRD

MRRD/RRD will lead the programme at the national and provincial level. Their role will include the following.

- Develop policy framework for construction and O&M of water facilities in rural areas at the national as well as state level.
- Keep database on water supply facilities and their status.
- Analysis of data and identify priority areas.
- Do need and resource-based planning.
- Share data base with donors/NGOs who intend to take up construction of new facilities and guide them to needy areas.

- Fund RTSU teams and supervise their function.
- Intervene when a repair is beyond community's reach by providing funding and technical support to CDC/WSUG.
- Build capacity at different levels in cooperation with donor/NGO partners.
- Coordinate construction of new facilities by different agencies in provinces.

MRRD/RRD role will be that of policy maker, coordinator and facilitator rather than programme implementer. Capacity building at RRD will be undertaken based on agreed areas.

DAY III

Operation and Maintenance Requirements

Session Summary

Objective: After completion of this session the participants will be able:

- To identify the rural water supply technologies which are most frequently used in the participants' projects
- To identify the operation and maintenance requirements of both water supply and sanitation technologies
- To review problems in spare parts availability.

Time:	2 hours
Method:	Presentation, group assessment, and introductory note
Material:	Slides, Flip Chart and Markers, Projector, Portable computer
Handout:	Copies of all slides, form for exercises, selected extract from background information
Physical Setting:	Normal sitting arrangement in training hall

Process:
The topic is covered by asking questions and illustrating:

- What types of technologies are being promoted in their rural water supply projects (slide 1, 2 & 3).
- Group assessment of basic O&M requirements and activities in a particular system which will be chosen by the groups, including their frequency, human resources and skills, and requirements for tools, equipment, materials and spare parts (to fill in exercise sheet on "Assessment of basic O&M requirements")
- Problems in the availability of spare parts are often encountered in the operation and maintenance of water supply projects. This session reviews the main characteristics of the problem, which must be taken into account in planning for spare parts (slide 4).

Technology Selection and its O&M Requirements

When choosing a technology, the rationale for using a particular water source should be considered. Several types of water sources, such as wells, ponds, rivers or springs are traditionally used for different purposes and they may not be operational all year. Some water sources are more reliable, convenient, or provide water that tastes better. If users perceive an "improvement" as something "worse" in any one aspect, they may return to their traditional, contaminated source. Chlorinating water, for instance, may introduce odour or taste and it may be necessary to explain the need for chlorination to users.

The following list of community water sources and intake technologies is not exhaustive, but represents those most commonly found in developing countries:

Spring water captation

a. Brief description of technology

Spring water captation systems abduct and protect groundwater flows at the points where these arrive at the surface to facilitate their abstraction. Spring water is usually fed from a sand or gravel water-bearing ground formation (aquifer), or a water flow through fissured rock. Where solid or clay layers block the underground flow of water, it is forced upward and can come to the surface. The water may emerge either in the open as a spring, or invisibly as an outflow into a river, stream, lake or the sea. The main parts of a spring water captation are a drain under the lowest natural water level, a protective structure providing stability and a seal to prevent surface water from leaking in. The drain is usually placed in a gravel pack covered with sand and may lead to a conduit or a reservoir. The protective structure may be made of concrete or masonry and the seal is usually made of puddled clay and sometimes plastic. A screened overflow pipe guarantees that the water can flow freely out of the spring at all times. To prevent contamination infiltrating from the surface, a ditch (known as the interceptor drain) diverts surface water away from the spring box and a fence keeps animals out of the spring area. There are many types of spring captations, ranging from a simple headwall with backfill to more complicated structures like tunnel systems for collecting water from a larger area.

Initial cost: Capital costs vary considerably and depend on a large number of factors.

Dimensions: From 0.5 m2 to many square metres.

Yield: From many litres per second to less than 0.1 l/s .

Area of use: In areas where groundwater arrives at the surface, usually at hillsides or mountainsides.

Construction: Spring water captation systems are constructed on-site, often by local craftsmen.

b. Description of O&M activities

Operation

Water should be permitted to flow out freely all the time so that it will not find another way out of the aquifer. Operation may include activities such as opening or closing valves to divert the water to a reservoir, a conduit or a drain. The spring and surroundings must be kept clean.

Maintenance

Prevent contamination (e.g. from open defecation, latrines, cattle-gathering places, use of pesticides, chemicals, etc.) both in the area where the spring water infiltrates into the ground (if possible) and in the immediate surroundings of the spring. Check the surface drains, the animal-proof fence and gate, and repair if necessary. Protect from vegetative growth both in the area where the spring water infiltrates into the ground (if possible) and in the immediate surroundings of the spring (prevent clogging of the aquifer by growth of roots). Check the water flow from the spring box. If there is an increase in turbidity or flow after a rain storm, surface run-off has to be identified and the protection of the spring improved. If the water flow decreases, it has to be suspected that the collection system is clogged. It may then be necessary to take out the gravel and replace with new gravel or, in case a seep collection system is used, to clean the collection pipes. Regular water samples must be taken and analysed to check for evidence of faecal contamination. Annually, open the washout and remove all accumulated silt. Check all screens; if damaged or blocked, replace with non-rusting materials, e.g. copper or plastic screening, and clean if dirty. After cleaning, make sure to close the washout valve thoroughly and replace and seal the manhole cover. Disinfect the spring box every time a person enters to clean or repair it, or when there is bacteriological contamination. Leaks in the protective seal, undermining of the headwall, and damage caused by erosion or settlement of soil must be repaired.

Organizational aspects

In many cases, springs are communally owned. Users may need to establish an association which can effectively deal with issues such as control and supervision of water use, prevention of contamination of water, execution of O&M activities, financing of O&M, monitoring of water quality and the system's performance, etc. Proper management may also prevent conflicts over these and other matters. For the execution of O&M tasks at the spring site, a person who lives or farms near the site could be appointed. This person could also be made responsible for water allocation to users at or near the site, and be involved in monitoring activities. His or her authority should be clear and accepted by all users.

c. O&M requirements

Activity	Frequency	Human resources	Materials and spare parts	Tools and equipment
Clean well surrounding	Weekly	Local		Broom, bucket, hoe, machete
Check turbidity	After each flood	Local		
Check water quality	Occasionally	Local		Bucket, watch
Repair fence and clean surface	Occasionally	Local	Wood, rope, wire	Machete, axe, knife, hoe, spade, pickaxe
Check water quantity	Regularly	Area	Laboratory reagents	Laboratory equipment
Wash and disinfect the spring	Annually	Local	Chlorine	Bucket, wrench, brush
Repair piping and valves	Occasionally	Local or area	Spare pipes and valves, cement, sand, gravel	Bucket, trowel, wrench, flat spanners
Repair cracks	Annually	Local	Cement, sand, gravel, clay	Bucket, trowel, hoe, spade, wheelbarrow

d. Actors implied and skills required in O&M

Actor	Role	Skills
User	Use water, report malfunctioning, keep site clean, assist in major repairs	No special skills
Caretaker	Keep site clean, check for damage, perform small repairs	Basic skills
Water committee	Organize bigger repairs, control caretaker's work	Organizational skills
Mason	Repair masonry or concrete	Masonry
External support	Check water quality, guide and stimulate local organization	Microbial analysis, extension work

e. Recurrent costs

Recurrent material costs are usually very low. The recurrent personnel costs, in cash or kind (for caretakers, watchmen, labourers, committee members and craftsmen), will need to be added but will also usually be low. Total recurrent costs are usually less than US$ 1 per year per capita, which often includes O&M costs for the water transport system. Several sources report that "O&M costs are minimal and, for this reason, spring water technology is the technology of choice wherever the sites permit it." However, problems may arise when a sudden large investment is needed for a large repair or replacement of the system.

f. Problems, limitations and remarks

Frequent problems. Erosion or collapse of the spring box due to wrong design, construction errors, large surface runoff flows, and damage caused by people or animals. Leaks in the box or leaking taps and valves. Contamination of the spring water due to cracks in the seal or to people's behaviour. Damaged piping because of faulty construction, abuse or corrosion. Improper drainage of surface runoff, outflow and wastewater. Clogged pipes because of siltation or plant roots. Poor accessibility for water users.

Limitations. Springs may not deliver enough water or become dry during certain seasons of the year. Not all springs produce clean water of acceptable taste. Springs may be sited too far from households or on privately owned land. In some cases, the cost of construction, large repairs or replacements may be beyond the capacity of communities. Some spring water is very corrosive.

Remarks. Usually spring water is of good quality but this should be checked; examples exist where the water was fed from a polluted stream which had gone underground or where the catchment area was contaminated. Unprotected springs are almost always contaminated at the outlet.

Reinforced concrete reservoir

a. The technology

Reinforced concrete reservoirs are used to store clean water for release on demand. They are usually made of concrete reinforced with steel bars or steel mesh, although some low-cost construction techniques use bamboo or other materials to reinforce the concrete. Reservoirs may also be made of masonry, or ferrocement. Chemical additives are of-ten mixed with the concrete to make it more impermeable to water. Reinforced concrete reservoirs are built at the site on a solid foundation. If the base is not solid enough, another site should be chosen, or arrangements made to stabilize the construction.

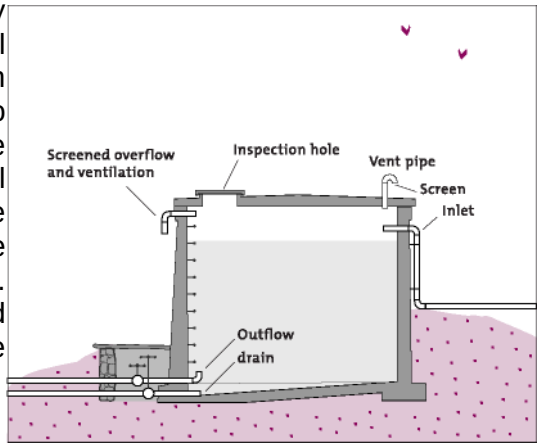


Figure 7.3 **Reinforced concrete reservoir**

To protect the water from contamination, the reservoir is covered with a roof, usually made of reinforced concrete, but other materials can be used. In the top of the tank an aeration pipe with a screen allows fresh air to circulate in the tank, but keeps rodents and insects out. A manhole in the roof allows access to the tank for cleaning and repairs. Water flows into the reservoir through an inlet pipe above the water level in the reservoir. This prevents back-flow and allows the water to be heard entering the tank. At this point, a chlorine solution is often added for disinfection. Outlets are built a little above the floor of the reservoir, which has a slope pitched down towards one point with a washout pipe for flushing.

Range of depth: Usually between 1.5–3.0 m.

Expected useful lifetime: 30 years.

Use: For reservoirs larger than about 3 m3 where sand, cement, gravel and reinforcing materials are available.

b. Main O&M activities

Operation consists of opening and closing the valves, and managing a chlorinator, if provided. If the reservoir does not deliver directly to a tap, water distribution is usually carried out by a caretaker.

A well-designed and well-built reservoir needs very little maintenance. The surroundings must be kept clean on a regular basis; every two months the valves must be closed and opened to prevent them from sticking, and the screens must be checked. Occasionally, a screen or tap may need to be repaired. Once a year, or sooner if contamination is suspected, the reservoir must be drained, de-silted, cleaned with a brush and disinfected with chlorine. Any leaks or cracks in the concrete have to be repaired as soon as possible.

If needed, a caretaker can be appointed to regulate the inflow and outflow. A concrete reservoir has few other organizational requirements.

c. Actors and their roles

Actors	Roles	Skill required
Water user	Assist in reservoir cleaning	Simple
Caretaker	Regulate water inflow and outflow, organize cleaning, and warn if repairs are needed	Basic skills
Water committee	Supervise the caretaker, organize repairs	Basic skills
Mason	Perform repairs.	Technical skills
External support	Check water quality, motivate and guide local organization	Highly qualified

d. O&M technical

Activity and frequency	Materials and spare parts	Tools and equipment
Regularly		
— clean the surrounding area.	Broom, machete, hoe, etc.	
At least monthly		
— open and close the valves.		
Occasionally		
— repair the valve;	Washer, spare valve.	Wrench, spanner, screwdriver.
— repair the screen;	Plastic or copper screen, wire.	Pliers, wrench, tin cutter.
— repair the concrete lining.	Cement, sand, gravel, additives.	Trowel, spade, bucket, wheelbarrow, ladder, rope.
Annually		
— clean and disinfect the reservoir.	Chlorine.	Brush, broom, bucket, ladder.

e. Potential problems

- cracks and leaks form owing to a poor foundation, design or construction;
- exposed metallic components become corroded;
- the water becomes contaminated owing to a poorly-covered manhole or broken screens;
- reinforced concrete is expensive;
- reinforced concrete is also heavy, and the soil beneath the reservoir may settle if the foundation is inadequate.

Drilled well

a. Brief description of technology

Drilled wells, tubewells or boreholes give access to groundwater in an aquifer and facilitate its abstraction. They differ from dug wells in the small diameter, generally varying between 0.10 m and 0.25 m for the casing, which does not allow a person to enter for cleaning or deepening. The well is usually the most expensive part of a handpump drinking-water supply project. Boreholes can be constructed by machine or by hand-operated equipment and usually consist of three main parts:

- At ground level, a concrete apron around the borehole with an outlet adapted to the water abstraction method prevents surface water from seeping down the sides of the well, provides a hard standing, and directs wastewater away from the well to a drainage channel.
- Below ground but not in the desired aquifer(s), these parts are usually lined with pipe material (mostly PVC and sometimes galvanized iron) to prevent it from collapsing, especially in unconsolidated formations. In consolidated formations, a lining may not be required.
- Below water level in the aquifer sections, the pipe material is slotted to allow groundwater to enter the well. A gravel filter layer surrounding this part facilitates groundwater movement towards the slotted pipes and, at the same time, prevents ground material from entering the well. In consolidated formations this gravel may not be required.

A proper combination of slot size, gravel filter and aquifer material, and extensive sand pumping before the well is brought into production (well development) can considerably improve long-term performance.

Initial cost: Capital costs vary considerably and depend on a large number of factors.

Range of depth: From a few metres to over 200 metres.

Yield: From less than 0.3 litre to over 10 litres per second.

Expected life: Over 25 years.

Area of use: In areas with suitable aquifers.

Construction: In most countries, drilled wells are constructed by public or private sector drilling companies.

b. Description of O&M activities

Operation

Operation of the well itself is usually not required. When the production capacity of the well is lower than the demand, daily monitoring of the water level may be necessary. Abstraction of the water from the well is usually done by the users, often women and children, or by a caretaker.

Maintenance

Apart from cleaning the apron daily and occasionally cleaning the drain and repairing the fence, if there is one, there are hardly any maintenance activities. Rarely, when a well has to

be desilted or rehabilitated, all appliances have to be removed and a specialized company will have to come and do the job. There are various rehabilitation techniques such as forced air and water pumping, brushing, and treatment with chemicals. It is very difficult to deepen an existing drilled well.

Organizational aspects
Users may need to establish an organization that can effectively deal with issues such as the control or supervision of water use, prevention of water contamination, execution of O&M activities, financing of O&M, and monitoring of water quality. Although the number of O&M activities required is limited and they usually cost very little, they should be given ample attention, as many wells have been abandoned because they were contaminated or had collapsed as a result of lack of maintenance.

c. O&M requirements

Activity	Frequency	Human resources	Materials and spare parts	Tools and equipment
Clean well site	Daily	Local		Broom, bucket
Clean drain	Occasionally	Local		Hoe, spade, wheel-barrow
Repair fence	Occasionally	Local	Wood, nails, wire etc.	Saw, machete, axe, hammer, pliers, etc.
Repair apron	Annually	Local	Cement, sand, gravel	Trowel, bucket
Rehabilitate well	Very rarely	National	Gravel, pipe material etc.	Various special equipment

c. Actors implied and skills required in O&M

Actor	Role	Skills
Water user	Use water, keep site clean, assist with major maintenance tasks	No special skills
Caretaker	Monitor water use, keep site clean	Basic skills for cleaning and disinfection
Water committee	Supervise caretaker, organize major maintenance, collect fees	Organizational skills
Specialized well company	Rehabilitate the well	Very special skills
External support	Check water quality, stimulate and guide users' organization	Microbial analysis, extension work

d. Recurrent costs

Recurrent material costs are usually low. The recurrent personnel costs, in cash or kind (for caretakers, watchmen, labourers, committee members and craftsmen), will need to be added but will also usually be low. Occasional large maintenance activities such as rehabilitation of the well may require a high investment, which may pose problems if this has to be financed by the community. The life expectancy of a good well is over twenty years but after a few years the yield may diminish drastically and rehabilitation may be necessary.

f. Problems, limitations and remarks

Frequent problems. Bad water quality or collapse due to corrosion of the galvanized iron lining, poor water inflow because of inadequately developed well, entrance of ground particles in the well because of wrong screens or wrong development, contamination due to wrong apron design or construction or neglect of maintenance, collapsing of borehole where no lining is applied or where the lining is not strong enough.

Limitations. Well construction depends on geohydrological conditions like presence, depth and yield of aquifers and presence of rock formations above them. Wells constructed at locations which are too far from the users' households, or which are too difficult to reach, will not be sufficiently used or maintained. Wells should not be drilled near places with latrines or where cattle gather and vice versa. The usually recommended minimum distance is 30 metres, although this is no guarantee that contamination will not occur. The investment in labour, cash or kind needed for the construction of an improved dug well may be beyond the capacity of the community. It may be impossible to transport the heavy equipment and materials needed to the drilling site.

Remarks. In many cases, wells are not only used for drinking-water supply but also for irrigation. When assessing the development potential of wells with the community, it is important to place this in a wider context, including all water uses and their effect on water availability.

Deep-well piston handpump

a. Brief description of technology

In a deep-well piston handpump, the piston is placed in a cylinder below the water level which is usually in the range of 15 to 45 metres below the ground. The pumping motion by the user at the pumpstand is transferred to the piston by means of a series of connected pumping rods inside the rising main. On the up-stroke, the plunger lifts water into the rising main and replacement water is drawn into the cylinder through the footvalve. On the down-stroke, the footvalve closes, and water passes the plunger to be lifted on the next up-stroke. The pumping height is limited only by the effort needed to lift water to the surface. Nowadays most cylinders have an open top, which allows the piston and footvalve to be removed through the rising main for servicing and repairs while the rising main and cylinder can stay in place. The pump rods have special connectors allowing for assembly and dismantling with no or only very simple tools. The joints incorporate pump rod centralizers that prevent wear of the rising main. To a large extent improved models can be maintained at village level.

Initial cost: Most good pumps cost US$ 300–500.

Range of depth: 15–45 metres, depths up to about 60 m are possible

Yield: 0.25–0.36 litre per sec at 25 m and 0.18–0.28 litre per sec at 45 m depth

Useful life: 6 to 12 years

Area of use: Rural and low-income peri-urban areas where groundwater tables are within 60 m, but preferably within 45 m from the surface

Construction: Afridev/Aquadev, Bestobell Micro, Bush pump, Blair pump, India Mark II and III, Kardia, Tropic (Duba), UPM, Volanta, etc.

b. Description of O&M activities

Operation

Operation of the pump is done by moving a handle up and down or by rotating the handle of a flywheel. This can be done by adults and even children. Handle forces are usually kept within acceptable limits (depending on brand and lifting heights). Pump and site must be kept clean.

Maintenance

Preventive maintenance usually consists in checking pump functioning and cleaning the pump and site daily, greasing weekly, checking all parts of the pump stand monthly, and taking the whole pump apart for a check, cleaning the parts with clean water and painting the pump stand annually. Pump rods that show bad corrosion must be replaced. Under normal conditions, a galvanized steel pump rod needs replacement every five to six years. Rising mains consisting of galvanized iron have to be removed and checked and pipes with badly corroded threads must be replaced. Small repairs are the replacement of bearings, cupseals and washers, straightening bent pumping rods, etc. Major repairs may involve the replacement of the plunger, footvalve, cylinder, pump rods, rising main, pump handle, fulcrum, etc. With open-top cylinder pumps, all preventive maintenance activities can normally be executed by a village pump caretaker. For major repairs and problems, external support may be needed. Closed-top cylinder pumps often need special lifting equipment to pull up the rising main and cylinder for maintenance of parts down in the hole.

Organizational aspects
Most deep well pumps are too expensive for family use and will have to be used at communal level. The price of these pumps also means extra effort in fund-raising. Communities have to organize themselves in order to maintain the pump in good working condition. Often a caretaker is appointed and a pump committee coordinates activities. External support is often provided by state or nongovernmental organizations but becomes costly. In some cases small private enterprises, paid directly by the communities, are now doing this job very satisfactorily.

c. O&M requirements

Activity	Frequency	Human resources	Materials and spare parts	Tools and equipment
Clean pump and site	Daily	Local		Broom, brush
Grease bearings	Weekly	Local	Grease or oil	Lubricator
Check pump stand parts	Monthly	Local		Spanner
Replace pump stand parts	Occasionally	Local	Nuts and bolts, bearings, pump handle	Spanners, screw-driver
Replace cupseals	Annually or less	Local or area	Cupseals	Spanners, wrench, knife, screwdriver etc.
Redo threads in pump rod or main	Occasionally	Local or area	Oil	Pipe threader, tackle
Replace footvalve, plunger or cylinder	Occasionally	Area	Footvalve, plunger or cylinder	Spanners, wrench
Replace pump rod or main	Occasionally	Area	Pump rods or main tubing	Spanners, wrench, pipe threader
Repair platform	Annually	Local	Gravel sand, cement	Bucket, trowel

d. Actors implied and skills required in O&M

Actor	Role	Skills
User	Pump water Keep site clean Warn in case of malfunctioning	No special skills
Caretaker	Keep site clean Regularly check pump Do small repairs	Basic maintenance
Water committee	Supervise caretaker Collect fees	Organizing skills
Area mechanic	Perform more major repairs	Some special skills, depending on brand
External support	Check water quality, stimulate and guide local organization	Microbial analysis, extension work

c. Recurrent costs

The costs for preventive maintenance may range between US$ 12 and US$ 60 per pump per year for spare parts and materials (based on price indications from several brands). The recurrent personnel costs, in cash or kind (for care-takers, committee members, and, in case larger repairs are needed, mechanics or other skilled people), will need to be added.

d. Problems, limitations and remarks

Frequent problems. Replacement of plunger seals is the most common repair needed. Problems with local manufacture, centring mostly around quality control, are often reported.

Hook and eye connections of pump rods tend to break more often than conventional connections. Rods also reportedly get disconnected or bend spontaneously sometimes. Especially where groundwater is corrosive, corrosion has been reported to affect the pump rods (if not made of stainless steel), the rising main (if galvanized iron), the cylinder, and the pump head bearing housing and other pump stand parts. Broken or shaky handles, mainly due to worn-out or otherwise affected bearings.

Limitations. The maximum lift differs by brand, varying between about 45 and 60 metres. The forces required to turn the handle of the pump may be high in certain cases, depending on the brand and on the depth of the well.

Remarks. The quality of the material used for the rising main should be as high as possible to reduce the number of repairs needed on this part. Many of these pumps can be produced in developing countries. Rigorous quality control is needed. Piston pumps may be driven by a windmill but often rotary pumps are preferred because of their lower starting torque.

Public standpost

a. Brief description of technology

At a public standpost or tapstand people from several households can take water from one or more taps. Because they are used by many people and are often not so well taken care of, their design and construction must be sturdy compared with domestic connections. The standpost includes a service connection to the supplying water conduit, a supporting column or wall, and one or more 0.5-inch (or 1.25-cm) taps protruding far enough from this column or wall to enable easy filling of the water containers.

The taps can be a globe or a self-closing type. The column or wall may be of wood, brickwork, dry stone masonry, concrete, etc. Some standposts have a regulating valve in the connection to the mains, which can be set and locked to limit maximum flow. A water meter may also be included. A solid stone or concrete slab or apron under the tap and a drainage system must lead spilled water away and prevent the formation of muddy pools. A fence may be needed to keep cattle away. The residual pressure head of the water at the tapstand should preferably be between 10 and 30 metres and should never be under 7 or over 56 metres. The location and design of public standposts have to be determined in close collaboration with the future users.

Initial cost: In 1995, the cost of a self-closing tap for 0.5 to 1-inch pipes was US$ 12 (UNDP/APSO, 1995). Cheaper taps can be found. Other costs depend largely on the standpost design.

Number of taps: Usually 1 to 3, or more.

Users per tap: Maximum 200 people.

Yield: 0.2–0.4 litres per sec per tap.

Area of use: Piped public water systems.

b. Description of O&M activities

Operation

Users clean and fill their containers at the tap. Bathing and washing of clothes is usually not permitted at the standpost itself. The tap site has to be cleaned daily and the drain inspected.

Maintenance

The drain must be cleaned at least once a month. Formation of pools must be prevented at all times. Occasionally, a rubber washer or other part of a tap may have to be replaced. The fence may need repair too. Serious cracks in the structure must also be repaired, and when wood rots it must be treated or replaced. Occasionally the tubing may leak or need replacement.

Organizational aspects

A caretaker or tap committee may be appointed to keep the tap functioning and the surroundings clean, and to regulate the amounts of water used. The committee may also collect the fees for water use. Sometimes water vendors fill their tanks at public tapstands at special rates for resale to people living far away.

c. O&M requirements

Activity	Frequency	Human resources	Materials and spare parts	Tools and equipment
Tap water	Daily	Local		Jar, bucket, can, etc.
Clean site	Daily	Local		Broom or brush
Inspect and clean drain	Daily	Local		Hoe, spade
Repair or replace valve	Occasionally	Local	Rubber or leather washer, gland seal, Teflon, flax, spare valve	Spanners, screwdriver pipe wrench
Repair fence	Occasionally	Local	Wood, steel wire, nails	Machete, pliers, hammer
Repair valve stand, apron or drain	Occasionally	Local	Wood, nails, cement, sand, water, etc	Hammer, saw, trowel, bucket, etc.
Repair piping	Occasionally	Local	Pipe nipples, connectors, elbows etc., oil, Teflon, flax or plumbing putty	Pipe wrench, pipe cutter, saw, file, pipe threader

d. Actors implied and skills required in O&M

Actor	Role	Skills
User	Tap water, keep site clean	No special skills
Caretaker or tap committee	Clean site, perform small repairs, collect fees	Basic skills
Communal water committee	Organize more major repairs, collect fees	Organizing and bookkeeping skills
Mason	Repair tapstand and apron	Masonry
Plumber	Repair piping and taps	Basic plumbing
External support	Monitor hygiene, train committee members	Training skills and microbial testing

e. Recurrent costs

Recurrent costs for a tapstand comprise a few minor repairs to the taps every year and occasional repairs to the pipes, column, wall, apron or drain.

f. Problems, limitations and remarks

Frequent problems. Tampering, insufficient maintenance, and conflicts over use due to bad location of tapstand or unsolved social problems. Poor drainage. Often taps are not closed after use and even left open on purpose to irrigate a nearby plot. Tapstands at the tail end of a piped system often have insufficient water pressure.

Limitations. If people are willing to organize communal use and maintenance, the only limitation is the cost.

Remarks. Special attention should be given to how the water is handled after collection at the tapstand in order to prevent subsequent contamination

Spare Parts Provision

Session Summary

Objective: After completion of this session the participants will:

- To review the problems in spare parts availability

Time: 1 hour
Method: Presentation and discussion
Material: Flip Chart and Markers, Projector, Portable computer
Handout: Copies of slides and background information
Physical Setting: Normal sitting arrangement in training hall

Process:
The topic is covered by asking questions and illustrating:

Problems in the availability of spare parts are often encountered in the operation and maintenance of water supply and sanitation projects. This session reviews the main characteristics of the problem, which must be taken into account in planning for spare parts. The overhead sheets and background information (see below) will be useful in preparing the presentations, in which the participants will describe their experiences. In addition, a spare parts supplier could be invited to share his experience and perceptions during the session.

Spare parts provision in general

Instead of being one of the principal items on a check-list for sustainability, spare parts are often considered long after the technical and operational designs of a water supply or sanitation project have been decided. Spare parts provision should therefore be one of the deciding factors in technology selection, and not merely an unplanned consequence.

Spare parts can be defined as all the materials and items needed for the efficient and sustainable operation and maintenance of a water supply or sanitation system. They include:

- Mechanical, hydraulic, electrical and electronic parts
- Tools
- Seals and washers
- Fuel, lubricants
- Paint
- Chemicals and other consumables
- Parts for essential transport and communication equipment
- Stationery

Towards sustainable spare parts provision

Spare parts provision should be viewed as much from the demand side as from the supply side. Furthermore, sustainable spare parts provision depends also on strategic issues.

Such elements as the need for spare parts, their cost, and accessibility to spare parts are likely to influence the **demand for spare parts.** The following items should be considered in analysing this demand.

<u>Need for spare parts</u>

- Assessment of the spare parts needed for a particular technical option, based on the technical characteristics and experience;
- Identification and inventory of the spare parts required, based on an accurate diagnosis of the problems most likely to occur, and their periodicity;
- Estimate of the spare parts needed for emergency repairs, accidents, or scheduled replacement;
- Variations in the frequency of this need, which communities should be aware of;
- Determination of proper timing for initiating repairs or replacement, in addition to the activities needed for simple maintenance of the system;
- Proper operation and maintenance, including effective preventive maintenance, in order to decrease the need for spare parts and their frequency;
- Interchangeability of some spare parts with other brands or technologies.

<u>Cost of spare parts</u>

- Can the cost of spare parts be met according to the tariff in place?
- Are the transport costs to obtain the spare parts included in the tariff? If not, how may these be met?
- What financial mechanisms are available in case the budget cannot cover the cost of spare parts?
- How does the cost of imported spare parts compare with similar parts produced

locally or in neighbouring countries?

- How significant are exchange rate fluctuations on the cost of spare parts?

Accessibility to spare parts

- The distance between the village and the location of the shop which is selling the spare parts could be a factor influencing the demand for spare parts;
- This demand can be divided into three categories: 1) *frequently needed* spare parts, for which the sales outlet or mechanic should be in the village or as close as possible to it; 2) *occasionaly needed* spare parts (every six months to a year), for which the distance should not be too far; 3) spare parts for *major repairs or replacement,* which may be ordered only from the regional or state capital.

Factors likely to have an influence on the **supply side** are the availability and use of local materials and locally manufactured parts, location of marketing and sales points, and the profit perspective. The following items should be reviewed.

Use of local materials and locally manufactured parts

- Making better use of materials from sustainable local sources;
- Having options for recycling and re-use or restoration of worn-out parts;
- Improving the reliability of the products (quality control) and the guarantees;
- Improving compliance with delivery deadlines through bonuses or other mechanisms, including penalties for delay;
- Encouraging local entrepreneurs or cooperatives to undertake the manufacture of spare parts;
- Making sure that the parts are guaranteed to remain available over a period of time;
- Learning from the experience of local manufacturers in other sectors;
- Balancing the proportion of imported spare parts with those manufactured locally;
- Offering incentives to local entrepreneurs (e.g. tax breaks, subsidies, preferential consideration against foreign suppliers, etc.).

Quality of spare parts

- Type of material used;
- Quality of manufacture, quality control;
- Interchangeability.

Marketing and sales points

- Encouraging local entrepreneurs, mechanics and shops to undertake the distribution and supply of spare parts, making them aware of the market potential and of the three categories of spare parts, as described above under “accessibility”;
- Installing, where possible, a revolving fund for spare parts which is managed by a cooperative of users or mechanics;
- Making sure that the provision of spare parts through donor assistance or government channels is only temporary, and promoting the development of the private sector;
- Creating better links between the supplier and the user;
- Ensuring stock control, warehousing and sustainable outlet options.

Perspective on profits

- Involving local manufacturers, entrepreneurs, mechanics and shops by offering them some kind of benefits or profit (e.g. a defined profit margin, percentage of sales as own income, free stock for first sales, etc.);

- Making sure that donor-assisted or heavily subsidized prices do not "kill" the market, which means that market prices should be realistic right from the start in order to keep the system sustainable.

- **Strategic issues** for improving spare parts provision include efficient planning, whether to standardize or not, approaches to reducing the need for spare parts, appropriate pricing policy, private sector involvement, and capacity-building.

Efficient planning

- Planning for spare parts provision should start as early as possible in the project cycle.
- During a feasibility study, the project should assess the following: types of spare parts currently available locally or in neighbouring countries; the distribution network; type of equipment used in other projects and regions; the possibility of inter-changeability; the possibility of local manufacture (in steel works and plastic works); the cost of spare parts to the customer; the level of import taxes; and national policy regarding spare parts provision.
- Implementation of the project should ensure the sustainability of spare parts provision on a long-term basis.
- After the construction phase, regular monitoring and evaluation of the equipment will help to determine the right time for repairs and rehabilitation within the economic life-span of the scheme; feed-back to the manufacturers on any weakness in the manufacturing of the equipment can help them.

Whether to standardize

Several countries have chosen to standardize their choice of technology. There are positive as well as negative aspects which should be carefully considered (see Table below) before making a decision. Whatever the choice, it could be for a certain number of years only.

FOR STANDARDIZATION	AGAINST STANDARDIZATION
■ Wide use of the same item of equipment encourages agents and shopkeepers to store and supply these spare parts because of the "guaranteed demand"	■ The chosen technology does not respond totally to the needs and preference of the users
■ Proliferation of brands and technology makes it difficult to organize spare parts availability	■ The market is closed for new, innovative and cheaper technologies
■ Prices and markets can be more easily researched	■ Poor incentive for involvement of the private and research sectors
■ Users become familiar with one type of product or technology	■ Possible conflict with donor policies on technology choice
■ Training of personnel can be standardized.	■ Competition between different brands can bring down prices and lead to improvements.

Approaches to reducing the need for spare parts

- Better design of equipment to make them last longer.
- Better engineering to reduce operation and maintenance requirements.

- Better use and operation, by instructing the users on how to reduce wear and tear in the equipment.
- Introduction of a **maintenance "culture"** that promotes prevention rather than cure.

Appropriate pricing policy

- At the outset, donor assistance often includes subsidized prices for spare parts, which can have a negative effect later on. While this type of pricing by donors may be an incentive to local distributors initially, it raises false expectations and does not help to stabilize the market.
- Highly subsidized prices may not be sustainable over a long period.
- Pricing policy could include an agreed margin of benefits for the intermediaries up to the final outlet point, with prices which the users can afford and are willing to pay.
- Free price policies could open up the market for spare parts and their distribution, but will result in higher prices for consumers initially; however, competition between various brands could lead to a fall in prices.
- High taxes on imported foreign equipment for water supply could be reduced.
- Appropriate pricing of spare parts should be one of the key elements in the technology selection process.

Private sector involvement

- Is there a policy towards private sector incentives and promotion?
- Are there manufacturers of spare parts in other sectors, from whom lessons can be learnt and with whom resources and experiences can be shared?
- What are the opportunities for interregional cooperation in terms of shared markets, marketing, agreements on prices, or division of specialization?
- What are the possibilities for joint ventures with firms and manufacturers in developed countries, which will provide technical, entrepreneurial and managerial training?
- Can the links between manufacturers be strengthened?
- How can the informal private sector at local level contribute to the manufacture and provision of spare parts?

Capacity-building

- Assessment of training needs in the private sector for stock management, as well as manufacture, distribution, supply and use of spare parts.
- Opportunities for learning from the experiences in neighbouring countries and from partners.

Monitoring for effectiveness

Session Summary

Objective: After completion of this session the participants will:

- To distinguish between:
  a) monitoring and evaluation
  b) monitoring for efficiency and monitoring for effectiveness
- To raise awareness on the principles of participatory monitoring
- To review data collection methods
- To review indicators and practice methodology for defining indicators

Time: 1 hour
Method: Presentation, and group exercise on indicators and a monitoring system
Material: Slides, Flip Chart, Markers, Coloured cards, Projector, Portable computer
Handout: Copies of slides, Exercise sheets, and background information
Physical Setting: Normal training hall seating, group activity done inside.

Process:
The topic is covered by asking questions and illustrating:

- Ask the participants for their experience in monitoring, and about the problems they faced during monitoring.
- Ask the participants if they have a clear understanding of the differences between monitoring, evaluation, audit, and appraisal (see exercise sheet 1).
- For this purpose the facilitator prepares a Table with 8 columns and 5 rows on a large sheet, as shown below:

	Appraisal	Audit	Mid-term evaluation	Final evaluation	Impact evaluation	Monitoring input/output	Monitoring O&M
What is it?							
What is it for?							
How is it done?							
When is it done?							

- Finally, the facilitator distributes an A4 paper with the main key words (see exercise sheet 2) which will help the participants to fill in the Table above.
- What are the key principles of monitoring (as described in slide 2), and for each point clarify with an example either from the group or from the facilitator.
- Explanation of information flows as shown in slide 3, showing clearly who profits from the monitoring system, who will take action, and what is the time lapse between an incident and the actual solving of the problem.
- What are the steps for planning a monitoring system" (slide 4) provides an overview on how to develop a plan for a monitoring system (slide 5). The group will then focus on two main aspects: a) sources of information for collecting data, and especially b) determination of indicators.

- Distributes copies of “Sources of information” (exercise sheet 2) to all the participants, and then asks them to pair up and review the document. The aim of the exercise is to highlight the tools and methodology which the participants are familiar with or which need some further clarification.
- The facilitator starts by considering the definition of an indicator (see slide 6, excursive sheet 3, slide 7), and then proceeds with the methodology, explaining the format:

Monitoring for effectiveness

Monitoring in perspective

Until recently, monitoring and evaluation were focused on finance, implementation and construction targets and were viewed as the routine collection of data in project operations. In general, evaluation assesses the development of a project for the purpose of making decisions on funding and drawing useful lessons. In 1983, the World Health Organization developed the Minimum Evaluation Procedure (MEP) which focused on the functioning and utilization of water and sanitation facilities and on hygiene education. The MEP emphasizes cheap, simple and quick methods. It developed 17 measurable indicators and added a new dimension to monitoring and evaluation by focusing on the project's functioning and utilization of outputs. Gradually, issues such as relevance, efficiency, effectiveness and sustainability were added.

Since then, there have been several significant developments in monitoring and evaluation, e.g. more groups and actors are concerned with monitoring activities; there is an interest in monitoring behavioural change; the process of monitoring has changed from a central "monolithic" type to participatory monitoring; monitoring should become integrated in regular activities; and there is an emphasis on the timely use of the results of monitoring.

Definitions

Appraisal

What is it?	Assessment of a situation
What is it for?	Design or implementation of future activities
How is it done?	Field studies; participatory appraisals
When is it done?	Planning phase of a project

Audit

What is it?	Occasional analysis of use of resources (inputs)
What is it for?	Control of use of resources and achievement of results
How is it done?	Check of expenditures and income, using accounts/books
When is it done?	End of fiscal year or end of project phase

Monitoring

What is it?	Continuous and systematic review of activities, processes, use of inputs, and realization of outputs
What is it for?	Control of achievement of targets and results fixed by a plan (performance, efficiency) and decisions about activities Control of achievement of objectives (effectiveness)
How is it done?	Integrated and inherent management tool, through determination of indicators, collection/analysis of data Monitoring efficiency: through project activity reports Monitoring effectiveness: participatory process
When is it done?	Monitoring efficiency: during project planning and project implementation Monitoring effectiveness: at end of project implementation and during project life

Evaluation

What is it?	Occasional assessment of the development of a project
What is it for?	To take decisions on improvement of project performance, or modifications of project activities and objectives, or continuation or end of project
How is it done?	Auto-evaluations, external evaluations, participatory evaluations
When is it done?	Mid-term evaluations, final evaluations, impact evaluations (after project implementation)

Indicators

An indicator is a variable which can be measured (quantity) or appreciated (quality or trend), and which can show changes in a given phenomenon and the achievement of a result or an objective.

An indicator has several characteristics including:

- Definition of a quality (what?)
- Definition of a measure (how much?)
- Definition of a target group (who?)
- Definition of a time horizon (when?)
- Definition of a place (where?)

Example: All water points will be located within a radius of 200 metres of at least 8 settlements, by December 2000, in the region of Kebri.

In addition, an indicator must be:

- **Relevant** (it measures what is needed, and is related to the objectives) ▪ **Sensitive** (it responds to variations and changes)
- **Simple** (the community and other actors can understand it; the data will be easy to act upon; there is a limit to the number of indicators)
- **Feasible** (information can be collected easily, not costly).

These last four specific characteristics can serve as selection criteria for the determination of indicators.

There are several ways to determine indicators. In many cases, indicators are selected from a document and applied to a project without knowing if they correspond exactly to what is needed and if they are appropriate.

It is possible to determine indicators which correspond exactly to what the project or the community wants to measure. The following steps are recommended:

Step 1: Clarification of the issue to be monitored
The issue to be monitored normally corresponds to one of the results or objectives which the project is trying to reach. It has to respond to a question: What do I want to know?

Step 2: Description of characteristics
An inventory is made of the major relevant characteristics which correspond to the issue to be monitored. In some ways, it is the same as describing the issue.

Step 3: Identification of variables

For each characteristic, one will try to identify quantifiable variables (time, percent-age, ratio, price). It can be that the variable is more of a qualitative nature.

Step 4: Selection of indicators

Variables are then analysed through a selection process, with the following criteria (as seen above): relevance, sensitivity, simplicity, feasibility.

The determination of indicators can be carried out with the community, or with other stakeholders who have a direct interest in monitoring. The indicators are then formulated and tested. The test could reveal that the indicator is too difficult to measure, or that it does not have much relevance.

At community level, very simple and basic indicators can be formulated, which concern the functioning and use of the system, as well as its management. The community has a direct interest in monitoring, since it is the community that has to act and will benefit from an efficient system.

Examples of indicators

Example from the MEP (Minimum Evaluation Procedure) of WHO

1. *Measuring functioning of systems*
   Indicators for water supply:
   - Water quantity (litres/person/day)
   - Water quality *(E. coli,* concentration of fluorides and other chemicals)
   - Reliability (frequency and duration of breakdowns)
   - Convenience (distance)

   Indicators for sanitation:
   - Proportion of households having an improved latrine
   - Hygienic state of latrines (% of clean latrines/number visited)
   - Reliability of installations (qualitative: % in good state/number visited)

   Indicators for hygiene:
   - Understanding the language of the messages (% of people speaking the language)

- Understanding the content of the messages (proportions of those with good, medium, low understanding)
- Access to the messages (number of people reached by TV or radio, etc.)

2. *Measuring use of systems*

Indicators for water supply:

- Proportion of households using the system
- Volume of water used, by destination

Indicators for sanitation:

- Proportion of users using the improved latrines

Indicators for hygiene:

- Behaviour in terms of water storage
- Cleaning of hands after defecation
- Knowledge of oral rehydration

Example from: D. Narayan. *Participatory evaluation: tools for managing change.* Washington, DC, World Bank, 1993 (World Bank Technical Paper No. 207)

1. *Sustainability*

Reliability of the system:

- Quality of water at source
- Number of facilities in working order
- Adequate maintenance (low frequency of breakdowns, quick repairs, low down-time of facilities)

Human capacity development:

- Management abilities (who decides? men/women)
- Knowledge and skills (understanding by men/women for improvement of the system; proportion of technical skills available)
- Confidence (rating scales on self-perception, leadership, initiative and sense of efficacy)

Local institutional capacity:

- Autonomy (who defines the rules? who controls the finances?)
- Supportive leadership (style of management, working methodology)
- Systems for learning and problem-solving (systems in place to resolve conflict, and corrective actions)

Cost-sharing and unit costs:

- Community contribution
- Agency contribution
- Unit costs

Collaboration among organizations:

- Planning (collaboration, participatory planning)
- Activities (collaboration)

2. *Effective use*

Optimal use:

- Number and characteristics of users
- Quantity of water used (all purposes)
- Time taken to use facilities
- Management of water resources (protection)

Hygienic use:

- Water quality at home

- Water transport and storage practices
- Home practices to improve water quality
- Site and home cleanliness
- Personal hygiene practices

Consistent use:
- Pattern of daily use
- Pattern of seasonal use

3. *Replicability*

Community's ability to expand the services:
- Additional water or latrine facilities built
- Number of upgraded facilities
- New development activities initiated

Transferability of agency strategies:
- Proportion and role of specialized personnel
- Established institutional framework
- Budget size and sheltering
- Documented administrative or implementation procedures
- Other special conditions

Course Evaluation

Objectives

Through the completion of course evaluation questionnaire the participants will have understood the strengths and weakness of the course and the extent to which participants have understood the concepts discussed with them.

To assess the degree of information being assimilated by the participants

To identify the strengths and weakness of the training course

To get an idea about the effectiveness of the facilitator

ANNEXES

ANNEX 1

MRRD Operation and Maintenance System

A functional Operation and Maintenance System should be established to address the sustainability concerns.

1. Core Guiding Principles

The O&M strategy is guided by the following guiding principles.

- Operation and Maintenance cost should be borne by the community beneficiaries.
- The stress shall be on preventive maintenance system to minimize sudden breakdowns of handpump/ water points.
- Community should make its own decisions, should be in the driver's seat and manage the scheme. Other actors should strictly work as facilitators.
- Beneficiary communities should have strong sense of ownership.

2. Institutional Arrangement

The following institutional arrangement is proposed for handpump O&M system.

2.1 CDC/WSUG

At the village level, CDC/WSUG will be the focal point and responsible for operation and maintenance of the system. It is a credible organization at the village level which is elected/ selected by people and involved in planning and implementation of the scheme. Its decisions are generally accepted and respected by communities.

The functions of "CDC/WSUG" in the operational and maintenance of water supply and sanitation will include the following:

- Appointing handpump caretakers for each handpump. The caretaker will keep pump/well surroundings clean, inform pump mechanic about repair and help handpump mechanic in repairs.

- Sign a contract with the Hand Pump Mechanic specifying
  his duties and what the User group will pay him (in cash or kind) on annual basis for his services. (A sample in contract Annexes 4 or 6)

- Fixing user charges and establish O&M Fund. It is expected that 1500 Afgani per family per year[3] will be adequate to take care of minor and major handpump repairs.

- Stocking of fast moving spare parts.

[3] MRRD-UNICEF Project, Draft Afghanistan: Community Management of Rural Water Supply Installations in Heart Province

- M
  aintain accounts and other ledgers as required.

- Periodically, inform the community about progress and expenditure details.

- Managing O&M of all water facilities in the village including schools within the village through a pump mechanic trained by the project.

2.2 Hand Pump Caretaker

Each caretaker/elder of the hand pump has the following responsibilities regarding the maintenance and repairing of the hand pump.

7. Undertake the preventative maintenance of the pump

8. Ensure that user groups keep the platform clean

9. Inform the community representatives and the mechanic regarding repairing needs of the hand pump.

10. Assist the hand pump when repairing the pump

11. Assist collect the grain/money for the cost of spare parts as well as wages of hand pump mechanic.

12. Act as a motivator to promote health and hygiene practices, proper use of hand pump and sanitation in villages

Criteria for selection of handpump caretaker in the villages are:

- Should serve the community voluntarily.

- Be a representative (Male/female) of the user groups.

- Should have leadership capabilities.

- Should have ability to read and write.

- Should be accessible, via greed linkages, to female users.

2.3 Handpump Mechanic

He/she will be an entrepreneur trained by the project and will look after 100-150 handpumps. He will be provided with a set of tools. CDC/WSUG/ will enter into a contract with the handpump mechanic for maintenance of all village community handpumps including the handpump in the village school. The payment for labor charges and spare parts costs will be made by CDC/WSUG. The functions of the handpump mechanic will include the following.

- V
  isit each handpump at least once every quarter.

- Cary out preventive maintenance to avoid breakdown.

- Repair pump with help from caretaker.

- Purchase spare parts from an approved spare parts shop if CDC/WSUG so desire on actual payment basis.

- Get the signature of the pump caretaker in his/her logbook during the visits of the water source.

Criteria for selection of hand pump mechanic:

8. Preferably to be introduced by the representatives of the user groups.

9. Be a permanent resident of the area

10. Committed to serve that community.

11. Should have the confidence of the community.

12. Preferably be literate.

13. The hand pump mechanic preferably should have a relevant background such as a blacksmith or bicycle mechanic

14. Should have mechanical knowledge, ability and interest.

2.4 Valve Man

For each pipe scheme one or more Valvemen will be selected to maintain and operate the system in the same manner as handpump mechanics.

The valve man will receive technical training, and be equipped with the necessary tools for his work. Owing to the complicated nature of his task he should work as a paid skilled labor during the implementation of the project and receives on-the job training.

2.5 Spare Parts Shop

The spare parts shop will provide quality spare parts to CDC/WSUG on payment basis. The project will train some mechanics attached to the shop who could also offer installation and maintenance services to CDC/WSUG and private households (HHs). RRD will work with spare parts shop to ensure that spare parts are of good quality and prices are reasonable.

2.6 Regional Technical Support Unit (RTSU)

Re
gional Technical Support Unit (RTSU) with assistance of Provincial RRD will monitor hand pump maintenance. They visit each Handpump Mechanic every three months to discuss and

assist in resolving problems at individual water points. They also inspect the water points on a routine basis.

Their role is to:

- Assess the functioning of the maintenance arrangement including the performance of the hand pump mechanic and the spare parts distribution. If the team observes a problem such as non-payment of repairs and spare parts by user groups, the mechanic is performing poorly and lacking in skill or unavailability of spare parts, the team must take steps to rectify the situation

- Assist on conflict resolution between different actors at the village level, handpump mechanic and spare parts shop.

- Monitor the performance of the hand pump and well for technical weaknesses.

- Collect the information recorded by the hand pump mechanic on repairs, maintenance and spare parts used.

- If necessary the team will chlorinate wells.

- If a handpump mechanic leaves or needs replacing the team help select and train a new mechanic.

- The team supplies the hand pump mechanics and the construction teams with packets of chlorine

- Hold group discussions separately with men and women on issues related to health and hygiene. Use multimedia approach for effective delivery of messages.

- Brief RRD officials on issues needing their attention. If there is need for engineering inputs, RRD will be informed about the need.

- Record relevant data in a computer based data sheet.

This team will be a mobile team provided with a four-wheel motorized transport and cover 1500-2000 handpumps. It will comprise of driver-cum-handpump mechanic, a male sociologist and a female sociologist. The role will include the following.

RTSU will form as its backbone for both monitoring of O&M and health and hygiene awareness creation.

2.7 MRRD/RRD

MRRD/RRD will lead the programme at the national and provincial level. Their role will include the following.

- Develop policy framework for construction and O&M of water facilities in rural areas at the national as well as state level.
- Keep database on water supply facilities and their status.
- Analysis of data and identify priority areas.
- Do need and resource-based planning.
- Share data base with donors/NGOs who intend to take up construction of new facilities and guide them to needy areas.
- Fund RTSU teams and supervise their function.
- Intervene when a repair is beyond community's reach by providing funding and technical support to CDC/WSUG.
- Build capacity at different levels in cooperation with donor/NGO partners.
- Coordinate construction of new facilities by different agencies in provinces.

MRRD/RRD role will be that of policy maker, coordinator and facilitator rather than programme implementer. Capacity building at RRD will be undertaken based on agreed areas.

ANNEX 2

MRRD Agreement between SO and District Authorities / Shura

A Sample Agreement

SO and District Authorities / Shura

The objective of a SO Water Supply Project is to reduce water-borne diseases through the provision of safe drinking water, improving personal and community hygiene with a Hygiene Education Programme, and provision of a demonstration bath and latrine to the community. SO hopes that the community will replicate the model bath and latrine on their own.

4.4.1 SO and the District Authorities agree to the following:

1. SO will only improve **public** water sources (wells or stand posts). The water sources inside private houses will not be selected for improvement.
2. Each dug-well or tubewell or stand post will be provided for 25 families.
3. All families in the user-group should agree on the site-selection of the well or stand post. Women and children must have free access to the well or stand post.
4. The Field Engineer works with the User-Group to decide the location of water sources and latrines.
5. SO will employ a related man and woman to teach hygiene education in the district.

4.4.2 Responsibility of SO

1. SO will provide all concrete elements required for the wells or stand posts and latrines.
2. SO will provide the skilled labour for the project.
3. The SO Field Engineer Team will construct a concrete apron and drainage system in order to keep the well or stand post area free from contamination.
4. SO will provide the hand pump, rising main, cylinder and pump rods for well projects.
5. SO will bore the tube wells and install the filter and plastic casing for tube well projects.
6. SO will provide the pipes, concrete, and steel for construction of pipe-schemes.
7. SO will improve latrines for some families within each User-Group (3 demonstration latrines per water point).
8. SO will train a mechanic to maintain the drinking water system in working condition.
9. SO will help set up the Water Management Committee (made of representatives of the User Groups) in villages with pipe-schemes.
10. SO will train and employ Hygiene Educator couples (related man and woman) from the district/ village. SO will supply the couple with Hygiene Education materials, and provide advice and support to the couple. The couple will give Hygiene Education sessions throughout the project area.
11. SO's Hand pump Inspection Team will visit the water source regularly, and the shura agrees that the HITeam has the right to remove a hand pump from a well if it is not properly used and maintained.

4.4.3 Responsibility of District Authorities

1. District Authorities guarantee the security of SO staff, the project site, and the SO equipment and tools.
2. District Authorities promote good relations between SO and the communities.
3. District Authorities motivate the communities to make the community contributions.
4. District Authorities agree that the User-Group provides unskilled labour and local construction materials.
5. District Authorities agree that the User-Group must pay for spare parts and for the mechanic's wages.
6. District Authorities agree that the Hygiene Education couple will work to improve hygiene knowledge and practices in the district.

4.4.4 Disclaimer

All projects are to be implemented according to SO's rules and strategy. No group nor individual can force SO to implement projects against SO's wishes or strategy. If such force is applied, SO will stop the project and shift all equipment and personnel to another area.

			Name	*Signature*
Dated:	_____			
Village:	_____	District Governor	_____	_____
District:	_____	Field Engineer	_____	_____
Province:	_____	Shura Member	_____	_____
Project number:	_____	Shura Member	_____	_____

ANNEX 3

MRRD Agreement between SO, User-group, and HP Mechanic

Agreement between
SO, Community User-Group and the Mechanic
on Project Implementation and Maintenance

The objective of a SO Water Supply Project is to reduce water-borne diseases through the provision of safe drinking water, improving personal and community hygiene with a Hygiene Education Programme, and provision of a demonstration latrine to the community. SO hopes that the community will replicate the model latrine on their own.

4.4.5 SO, the User-Group and the Mechanic agree to the following:

1. SO will only improve **public** water sources (wells or stand posts). The water sources inside private houses will not be selected for improvement. All members of the User-Group agree that the water-source will remain for the public.
2. Each dug-well or tubewell or stand post should serve 25 families.
3. All families in the user-group should agree on the site-selection of the well or stand post. Women and children must have free access to the well or stand post.
4. The Field Engineer works with the User-Group to decide the location of water sources, and latrines.
5. SO will employ a couple (related man and woman) to teach hygiene education in the district.

4.4.6 Responsibility of SO

1. SO will provide all concrete elements required for the wells or stand posts, baths and latrines.
2. SO will provide the skilled labour for the project.
3. The SO Field Engineer Team will construct a concrete apron and drainage system in order to keep the well or stand post area free from contamination.
4. SO will provide the hand pump, rising main, cylinder and pump rods for well projects.
5. SO will bore the tube wells and install the filter and plastic casing for tube well projects.
6. SO will provide the pipes, concrete, and steel for construction of pipe-schemes.
7. SO will improve baths and latrines for some families within each User-Group.
8. SO will train a mechanic to maintain the drinking water system in working condition.
9. SO will help set up the Water Management Committee (made of representatives of the User Groups) in villages with pipe-schemes.
10. SO will train and employ Hygiene Educator couples (related man and woman) from the district/ village. SO will supply the couple with Hygiene Education materials, and provide advice and support to the couple. The couple will give Hygiene Education sessions throughout the project area.
11. SO's Hand pump Inspection Team will visit the water source regularly, and has the right to remove a hand pump from a well if it is not properly used and maintained.

4.4.7 Responsibility of User-Groups

1. The User-Group will work with the Field Engineer on the site-selection for wells and stand posts. The site must fit the SO strategy. Women and children must have free access to the water source. The site must also be a suitable distance from all sources of contamination.
2. The User-Group agrees to the following during implementation:
   - Work with the Field Engineer in site-selection for wells and stand posts, and in selecting the proper layout for pipes in pipe-schemes;

- d
  ig the well at the selected site (for dug well projects only);
- Provide local construction materials (gravel and stone) for the concrete elements;
- Provide unskilled labour as required, including the following:
  - Installation of the hand pumps on wells;
  - Construction of apron and curing of apron;
  - Carrying equipment and materials for all project types, including transport of the drilling rig and casing for tube well projects;
  - Transport the required concrete elements from the production site to the location of implementation;
  - Two labourers at the time of boring tube wells;
  - Dig trenches and backfilling trenches for pipe-schemes.

3. For pipe-schemes, the User-Group must agree that the source is public property. If the source water is used for irrigation, all residents and villagers *must* agree on the use of the source for implementation of the pipe-scheme project.
4. The User-Group must select a caretaker. The caretaker will act for the User-Group when dealing with the mechanic or SO staff.
5. The User-Group must keep the area around the water-source clean from contamination, including faeces and garbage. The User-Group must keep the drainage clear of obstruction.
6. The User-Group must agree to pay for the mechanic's wages and for spare parts required for the repair or maintenance of the water supply system.
7. The User-Group will work with the Field Engineer to decide the location of the demonstration latrines. Families with latrine have these additional responsibilities:
   - select a location for latrine according to the following criteria:
     - accessible for all residents in the family;
     - located in an area with good ventilation;
     - be at least 10m from wells and other water sources and from the kitchen;
   - provide local materials (sand and gravel) and build the super-structure for the bath and latrine;
   - use the latrine only for the intended purposes.

4.4.8 Responsibility of Mechanic (Hand pump Mechanic or Valve man)

1. The Mechanic agrees to maintain the water supply system. He will visit every well and stand post every two months.
2. The Mechanic will fix the water supply system promptly. The User-Group will call him when repairs are required, and the Mechanic must respond quickly.

Each family within the User-Group agrees to pay to the Mechanic the sum of ____ seer wheat per year. (1 seer = 7 kg.) The User-Group is also responsible for the payment of spare parts.

4.4.9 Waqf / Selling Agreement

If the land for the well or stand post is private, it must be donated or sold to the User-Group through a Waqf/Selling Agreement.

Agreement:
I _____, son of _____, resident of _____ village do hereby agree that I have sold/waqf my property of ____ square meters (m^2) located in _____ village to the User-Group listed below, and who is represented by the caretaker _____. The User-Group will use this land for the installation of a public well or stand post.

Dat

ed: _____

Village: _____

District: _____

Province: _____

Land Owner _____ _____
name *signature*

User-Group Caretaker_____ _____
name *signature*

Field Engineer _____ _____
name signature

4.4.10 Disclaimer

All projects are to be implemented according to SO's guidelines and strategy. No group or individual can force SO to implement projects against SO's guidelines or strategy. If such force is applied, SO will stop the project and shift all equipment and personnel to another area.

4.4.11 Distribution of Signed Agreements

This agreement is to be signed at the time of the Site Selection process. Copies of the full agreement will be kept by the Field Engineer, the User-Group, Caretaker and the mechanic.

4.4.12 SignaturesDated: _____

Village: _____

District: _____

Province: _____

Project number: _____

User-Group Caretaker_____ _____
Name *signature*

Mechanic _____ _____
name *signature*

Field Engineer _____ _____
name *signature*

Heads of Families

_____ _____
name *signature*

_____ _____
name *signature*

_____ _____

name	*signature*
_____	_____
name	*signature*
_____	_____
name	*signature*
_____	_____
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name	*signature*
_____	_____

ANNEX 4

DACAAR Agreement with District authority and District assembly

Agreement between DACAAR /District authorities/District assembly

The aim of DACAAR's Water and Sanitation Programme projects is to reduce the water born diseases by providing safe drinking water to communities and improve the personal and environmental hygiene education. DACAAR is hopeful by improving and exhibit of bath and latrine persuade the community for adopting them.

DACAAR and District authorities are agree about the following items:

1. DACAAR improves and completes only public water resources (wells and stand posts). The water resources which have been enclosed within a private space will not be selected for improving and completion.
2. Each stand post or ordinary well should be used at least by 15 families and each borehole should be used at least by 20 families.
3. All user families should be agree about the selection of the well location, women and children should have access to it without raising any objection.
4. The field engineer in cooperation with the user group selects the location of the water point, bath and latrine.
   DACAAR employs a couple for the performing of hygiene education.

DACAAR Responsibility:

1. DACAAR provides all concrete elements which are needed for the well or the stand post, bath and latrine.
2. DACAAR trains skilled laborers for the project.
3. DACAAR team improves the apron and drainage of well for safety and to prevent contamination.
4. DACAAR provides the hand pump and its apparatus (rising main, cylinder and hand pump's rods).
5. DACAAR drills the well, installs the PVC casing and filters and equip them with hand pump (in case of a tube well).
6. DACAAR provides the pipe, the cement and the iron bars for the construction of the Pipe Scheme.
7. DACAAR builds baths and latrines to some of the user group families.
8. DACAAR trains the mechanic or plumber in the field to keep the water supply system functional.
9. DACAAR helps people to form administration for water supply system.
10. DACCAR employs a man and a woman which are intimated together from the area, to perform the hygiene education in the mentioned district. DACAAR provides the literature of hygiene education and gives advices and support, and they will perform the hygiene education for the people of project area.
11. The hand pump inspection team will inspect the area regularly. The administration is agreed that the hand pump inspection team removes the hand pump if there is no good use and maintenance.

Responsibility of District Authorities:

1. District authorities insure the security of DACAAR staff with their equipments.
2. District authorities make strong the good relation between DACAAR and community.
3. District authorities encourage the community to perform in project works.
4. District authorities are agree to prepare the local construction material and casual labor from the community.
5. The local authorities are agree to pay for mechanic and spare parts when require through the community.
6. The local authorities are agreeing to allow the couple which is trained for hygiene educations (they are intimated together) for working to enrich the hygiene knowledge of community and applying the hygiene educations.

Termination:

All projects are implementing according DACAAR rules. Neither groups nor any one can force DACAAR to implement against wants and policy. If such force is used in this way, DACAAR will stop activities and remove their equipments to another place.

Province_____ District_____ Village _____

	Name	**Signature**
District administrator_____ _____		
Field engineer _____ _____		

Assembly member_____ Project No. _____ Date:

ANNEX 5

DACAAR Agreement between DACAAR, User-group, and HP Mechanic

Agreement between DACAAR, User-Group and the Mechanic

On Project implementation and Maintenance

The objective of DACAAR Water supply Project is to reduce water-borne diseases through the provision of safe drinking water, improving personal and community hygiene with a Hygiene education Programme, and provision of a demonstration bath and latrine to community. DACAAR hopes that the community will replicate the model bath and latrine on their own.

DACAAR, the User Group and the Mechanic agree to the following:

1. DACAAR will only improve public water sources (wells or stand posts). The water sources inside private houses will not be selected for improvement. All members of the user group agree that the water-source will remain for the public.
2. Each dug-well or stand post must have at least 15 families. Each tube well must have at least 20 families.
3. All families in the user group should agree on the site-selection of the well or stand post. Women and children must have free access to the well or stand post.
4. The Field Engineer works with the user group to decide the location of water sources, bath and latrines.
5. DACAAR will employ a couple (related man and woman) to teach Hygiene Education in the district.

DACAAR Responsibility:

12. DACAAR provides all concrete elements which are needed for the well or the stand post, bath and latrine.
13. DACAAR trains skilled laborers for the project.
14. DACAAR team improves the apron and drainage of well for safety and to prevent contamination.
15. DACAAR provides the hand pump and its apparatus (rising main, cylinder and hand pump's rods).
16. DACAAR drills the well, installs the PVC casing and filters and equip them with hand pump (in case of a tube well).
17. DACAAR provides the pipe, the cement and the iron bars for the construction of the Pipe Scheme.
18. DACAAR builds baths and latrines to some of the user group families.
19. DACAAR trains the mechanic or plumber in the field to keep the water supply system functional.
20. DACAAR helps people to form administration for water supply system.
21. DACCAR employs a man and a woman which are intimated together from the area, to perform the hygiene education in the mentioned district. DACAAR provides the literature of hygiene education and gives advices and support, and they will perform the hygiene education for the people of project area.
22. The hand pump inspection team will inspect the area regularly. The administration is agreed that the hand pump inspection team removes the hand pump if there is no good use and maintenance.

Responsibility of User-Groups:

1. The user-group will work with the Field Engineer on the site-selection for wells and stand posts. The site must fit DACAAR strategy. Woman and children must have free access to water source. The site must also be a suitable distance from all sources of contamination.
2. The user-group agrees to the following during implementation:
   - Work with the Field Engineer in site-selection for wells and stand posts, and in selecting the proper layout for pipes in pipe-schemes;
   - Dig the wells at the selected site (for dug well projects only).
   - Provide local construction materials (gravel and stone) for the concrete elements;
   - Provide unskilled labor as required, including the following:
   - Installation of the hand pumps on well;
   - Construction of apron and curing of apron;
   - Carrying equipment and materials for all project types, including transport of the drilling rig and casing for tube well projects;
   - Transport the required concrete elements from the production site to the location of implementation;
   - Two laborers at the time of boring tube wells;
   - Dig trenches and back filling trenches for pipe-schemes.

3. For pipe-schemes, the User Group must agree that the source is public property. If the source is used for irrigation, all residents and villagers must agree on the use of the source for implementation of the pipe scheme project.
4. The user group must select a care taker. The care taker will act for the use group when dealing with the mechanic or DACAAR staff.
5. The user group must keep the area around the water source clean form the contamination, including fasces and garbage. The user group must keep the drainage clear of obstruction.
6. The user group must agree to pay for the mechanic's wages and for spare parts required for the repair or maintenance of the water supply system.
7. The user group will work with field engineer to decide the location of the demonstration baths and latrines. Families with bath and latrines have these additional responsibilities:
   - Select a location for the bath and latrine according to the following criteria:
     Accessible for all residents in the family
     Located in an area with good ventilation
     Be at least 10m from wells and other water sources and from the kitchen
   - Provide local material (sand and gravels) and build the super structure for the bath and latrine.
   - Use the bath and latrine only for the intended purposes

Responsibilities of Mechanic (hand pump mechanic or valve man)

1. the mechanic agrees to maintain the water supply system, he will visit every well and stand post every two months
2. The mechanic will fix the water supply system promptly. The user group will call him when repairs are required and the mechanic must respond quickly.

Each family within the user group aggress to pay to the mechanic the sum of _____ seer wheat per year.(one seer =7kg). The user group is also responsible for the payment of spare parts.

Waqf /Selling Agreement

If the land for the well or stand post is private, it must be donated or sold to the User-Group through a Waqf/Selling Agreement.

Agreement

I_____, son of _____, resident of _____ village do hereby agrees that I have sold/waqf my property of _____ square meters (m^2) located in _____ village to the user group listed below, and who is represented by the caretaker_____. The user-group will use this land for the installation of a public well or stand post.

Dated: _____ Land Owner _____ _____
Name Signature

Village: _____ User group caretaker _____ _____
Name Signature

District: _____

Province: _____ Field Engineer _____ _____
Name Signature

Disclaimer
All projects are to implemented according to DACAAR's guidelines and strategy. No group or individual can force DACAAR to implement projects against DACAAR strategy. If such force is applied, DACAAR will stop the project and shift the equipment and personnel to another area.

Distribution of signed agreements
The agreement is to be signed at the time of site selection process. Copies of full agreements will be kept by the field engineer, the user group caretaker and the mechanic.

Signatures
Dated _____ User group care taker _____ _____
Name Signature

Village _____ Mechanic _____ _____
Name Signature

District _____

Province _____ Field Engineer _____ _____
Name Signature

Project number:_____

Heads of families

_____	_____	_____	_____
name	signature	name	signature
_____	_____	_____	_____
name	signature	name	signature
_____	_____	_____	_____

name	signature	name	signature
name	signature	name	signature
name	signature	name	signature
name	signature	name	signature
name	signature	name	signature
name	signature	name	signature
name	signature	name	signature
name	signature	name	signature
name	signature	name	signature

ANNEX 6

DACAAR Agreement between DACAAR and HP Mechanic

Agreement: DACAAR and Hand Pump Mechanic

I _____ S/o _____ Residence of _____ village accept the responsibility as a Pump Mechanic that is given by DACAAR.

DACAAR Commitment:

1. DACAAR prepares the maintenance training for the wells, repairing of the hand pump, making of concrete elements and well apron.
2. DACAAR starts the maintenance system with the user group and supports the maintenance system through the HIT (Hand Pump Inspection Team).
3. DACAAR provides the repairing equipments for well and hand pump to maintain the wells:

- Saw
- Saw blade
- Rope
- Pliers
- Gantry
- Helmet
- Safety gloves
- File
- Spanner
- Screwdriver
- Hammer
- Fishing tools
- Socket maker

4. DACAAR also provides a bicycle for the mechanic.

Hand Pump Mechanic's Commitment:

1. The mechanic takes care about the well and he has to check each well once every two months.
2. The mechanic repairs the pump and well when required - after the information of HIT and user's group he has to see the well urgent.
3. The mechanic supports the HITs.
4. The mechanic informs the HITs about serious problems.
5. The mechanic repairs or changes the parts of hand pump when required.
6. The mechanic of hand pump repairs or changes the bicycle.

Resignation:

The hand pump mechanic can't resign without main reason. If the hand pump mechanic wants to resign he has to inform the HIT at least one month in advance. He has to agree to transfer the above mentioned equipments containing the bicycle to the new hand pump mechanic. The new hand pump mechanic is agreeing about receiving the equipment and the bicycle.

Name:	_____	_____	_____
Signature:	_____	_____	_____
	Mechanic	*Field engineer*	*District Authorities*

Date: _____
Province: _____
District: _____
Signed in village: _____
Project No.: _____
Specified No. of bicycle: _____

ANNEX 7

DACAAR Agreement between DACAAR and Pipe Scheme Valveman

Agreement: DACAAR and Pipe-Scheme Valveman

I _____ , son of _____ , resident of _____ village accept the responsibilities that DACAAR has assigned to me as Pipe-Scheme Valveman for DACAAR pipe-scheme.

DACAAR's Commitment:

1. DACAAR provides training in the maintenance of the pipe-scheme pipe-work and concrete.
2. DACAAR will start the maintenance system with the user-groups, and to support the maintenance system through the Handpump Inspection Teams.
3. DACAAR provides tools required for maintenance of the pipe-scheme:
   - threading machine (dyee)
   - threading machine tripod with vice and blades
   - pipe cutter
   - pipe wrench
   - chain wrench
   - screw wrench
   - file
   - pliers
   - screw driver
   - hacksaw
   - hacksaw blades
   - lever arm
   - socket fusion machine for PE pipes
   - but fusion machine for PE pipes
4. DACAAR provides a bicycle to the mechanic.

Pipe-Scheme Valveman's Commitment

1. The Valveman will maintain the pipe-scheme. He must visit each standpost every two months.
2. The Valveman will fix the pipe-scheme when necessary. The Valveman will visit the standpost or pipe-scheme quickly when contacted by the user-group, Water Management Committee, or the Handpump Inspection Team.
3. The Valveman will assist the Handpump Inspection Team with their work.
4. The Valveman will tell the Handpump Inspection Team when there are difficult problems.
5. The Valveman will repair and replace the tools as required.
6. The Valveman will repair and replace the bicycle as required.

Termination

The

Valveman should not quit his duties without a valid reason. If the Valveman does need to quit, he should tell the Handpump Inspection Team at least one month in advance, and he agrees to give the tools listed above (including the bicycle) to the new Valveman.

The Valveman agrees that he has received the tools and bicycle.

Name: _____ _____ _____

Signature: _____ _____ _____

Valveman *Field Engineer* *District Authority*

Dated: _____ Signed in village: _____

Province: _____ Project number: _____

District: _____ Bicycle ID *#:* _____

ANNEX 8

Provision of Tools to HP Mechanic

Provision of tools

Following tools are recommended to be supplied for the mechanic:

	Quantity
Fishing tool	1
500 gm Hammer	1
Gantry	1
Spanner for M16 bolts	2
Flat spanner for M12 fastener	2
Plier	1
Jute rope	50 m
Socket maker	1
Helmet	1
Hack saw frame	1
File	1

To perform the repair of the community handpump on time it is better to issue one bicycle to each community mechanic.

ANNEX 9

Recommended list of spare parts (for 5-year operation)

Recommended list of spare parts (for 5-year operation)

Description	Recommended Qty. for100 pumps
Flapper	100
Plunger with pump rod fitting bottom	10
Nylon rope	300
Foot valve with fitting	20
Pipe centralizers	50
Pump rod-Mild Steel	300
Stainless Steel	50
Rising main	50
Cylinders without Plunger/foot valve	10
Pump head	2
Stand (Goo or Goob)	2
Handle	3
Fulcrum Pin	50
Rod hunger pin	20
uPVC riser pipe(530mm long)	100
M16x30 hex Screw	100
M12x35 Hex Bolt	100
M12 Hex Nuts	100
M16x30 Hex Bolt	40
"O"Ring	200

ANNEX 10

Hand Pump Trouble Shooting

Trouble Shooting

Problem	Operation	Cause	Remedy
No water	- Handle easy to operate - Difficult to operate - Handle normal operation	- Rods disconnected - Pipes disconnected - Plunger seal defect - Water level gone below the cylinder	- Pull out all rods and replace broken rods - Join the pipes - Replace seal - Add pipes and rods
Delayed Flow	Normal operation	- Leaky valves - Complete stroke not available - Leakage in pipe joints - Leaking foot valve "0" ring	- Replace the valve bobbins. - Adjust the length of the top rod. - Take out the riser mains and replace. - Replace "0" ring
Reduced Discharge	- Difficult to operate - Operation normal	- U seal tight - Complete stroke not available - U-seal completely worn out - Valve bobbins worn out - Pump cylinder cracked	- Replace U-seal with new one - Correct the stroke by using required length of rod - Replace the worn U-seal - Replace the bobbins - Replace the cylinder
Abnormal noise during Operation	- Operation normal. - Operation inconvenient.	- Rods rubbing - Worn out centralizer - Rods bent and rubbing - Worn out bearings - Handle fork touches pump head	- Straighten bent rods - Replace centralizer - Replace rods by good ones - Replace bearings
Pump handle shaking.	Stand assembly shaking.	- Cracked platform - Loose flanges - Worn out bearings - Hanger pin loose - Fulcrum pin loose	- Repair platform - Tighten flange bolts and nuts - Replace bearings - Tighten fully both nuts - Tighten fully both nuts

ANNEX 11
Recommended List of Masonry Tools, Materials and Consumables for Platform Construction

RECOMMENDED LIST OF MASONRY TOOLS, MATERIALS AND CONSUMABLES FOR PLATFORM CONSTRUCTION

Masonry Tools

Item	Qty
Metal Scoop	3 Nos
Metal Pan	4 Nos
Spade	3 Nos
Crowbar	2 Nos
Wooden levelling blocks (small and large)	1 Each
20 liter bucket	2 Nos
2 liter mug	2 Nos
3 meter metal measuring tape	1 Nos
Platform shuttering	1 No
Spirit level	1 No
Stand selected from option	1 No

Materials and Consumables for the Construction of the Platform

Hessian cloth	6 bags x 50 kgs (for layout as per sketch No 3 on page No 8)
Cement	
Sand	1.5 Cubic Meters
Gravel 20 mm	3.0 Cubic Meters
Temporary cover for pump stand (Wooden board bolted to stand flange)	
Brick 9" x 6" x 18"	65 Nos
Wire mesh 50 x 50 x 10 gauge for stand G00	600 x 1200 mm
Binding wire (18 gauge)	2 meters
Used motor oil	1/4 liter

Note: Quantity of materials required will vary with platform layout.

Consumable for Soak Pit

Bamboo mat, sand, gunny bag, tar to apply on bamboo mat, bricks, stones, pebbles, broken bricks.

ANNEX 12: LIST OF MATERIALS REQUIRED FOR INSTALLING THE AFRIDEV HANDPUMP WITH CYLINDER SET SETTING OF 30 METERS

	Description	Qty for one pump 30 mts cylinder setting
A)	**Pump head and Handle Assembly**	
1)	Pump body	1 No
2)	Fork handle with locking bolt	1 No
3)	T-bar	1 No
4)	Rod hanger with pump rod locking bolt	1 No
5)	Fulcrum pin	1 No
6)	Hanger pin	1 No
7)	Plastic bearings (one set consisting one inner and one outer bearing)	4 sets
B)	**Stand Assembly**	
1)	Stand assembly	1 No
2)	Stand bolts & nuts	4 sets
3)	Steel cone	1 No
4)	Rubber cone	1 No
5)	Foundation bolts & nuts	
6)	(Required only for stand	
7)	with bottom flange)	4 sets
C)	**Rising Main**	
1)	Rising main (2.9 meters) pipe (3 meters long)	10 Nos
2)	Rubber RM centralizer	11 Nos
D)	**Pumprods**	
1)	Pumprods (hook & eye, MS,SS, etc)	(10 Nos)
2)	Pumprod fitting: top	1 No
3)	Rubber pumprod centralizer	10 Nos
E)	**Cylinder Assembly**	
1)	Cylinder with liner	1 No
2)	Suction pipe	1 No
3)	Plunger with fittings, bobbin and u-seal	1 No
4)	Foot valve with fittings, bobbin and 0-ring	1 No
F)	**Miscellaneous Items**	
1)	Rope	70 meters
2)	Solvent cement	1 tin of 200 ml
3)	Cleaning fluid Carbon **Tetra Chloride (CCl_4)**	1 tin of 100 ml
4)	Top sleeve	1 No
5)	Rubber flapper	1 No
6)	Foldable spanner	1 No
7)	Fishing tool	1 No

ANNEX 13

List of Tools and Consumables for Handpump Installation

LIST OF TOOLS AND CONSUMABLES FOR HANDPUMP INSTALLATION

Tools	Quantity
Spanner for M16 bolts (N00 or N-00a)	2
Flat spanner for m12 fasteners	2
Hacksaw with blade	1
Knife (for cutting extra length of nylon rope)	1
Fishing tool	1
Half-round file	1
Flat file	1
Round file	1
Steel wire brush	1
Ball pean hammer	1
Hammer 500 gm	1
Pliers	1
Calibrated bucket (20 Liters)	1

Consumables

Bleaching powder	300 gm
Solvent cement for joining uPVC pipes	200 ml
Cleaning liquid	100 ml
Cotton Waste	
Emery paper (roughness 60 grit)	300 cm x 200 cm sheet
Brush for applying solvent cement	1

ANNEX 14

Guidelines for Joining of uPVC Pipes

GUIDELINES FOR JOINING OF uPVC PIPES

1. Mark the depth of the socket (115 mm) on the plain end of the riser pipe.

2. A small chamber at an angle of 15° to 20° should be made on the outer edge of the plain end if not already done in the factory.

3. Clean the pipe (bell end inside and plain end outside up to 115 mm) with the cloth, using cleaning fluid (Carbon tetra chloride).

4. Roughen the surface using emery paper.

5. Clean the pipe once again with cleaning fluid.

6. Mix solvent cement thoroughly.

7. Apply the solvent cement up to the mark on clean surface of outside of the plain end and inside of bell mouth socket of riser main with a brush. Replace bottle closure on cleaning fluid and solvent cement after each use.

8. Insert the pipe plain end into the socket of the other pipe as quickly as possible. Do not twist or rotate the pipe during insertion. Push hard to make sure the joint entered the full length.

9. Wide out the excessive solvent cement with a cloth.

10. Care should be taken to avoid the application of an excessive amount of solvent cement, which could lead to weakening of the pipe wall by solvent action.

11. Allow it to set for at least five minutes. Nylon rope should be anchored during these five minutes.

12. Lower the pipe using nylon rope.

13. Allow the pipes to cure for about 24 hours before applying pressure. The pipes should be supported with the help of nylon rope to eliminate the risk of joint failure.

ANNEX 15

List of Spare Parts with Recommended Time Interval for Replacement:

LIST OF SPARE PARTS WITH RECOMMENDED TIME INTERVAL FOR REPLACEMENT:

Description	SKAT Drg/Part No	Quantity Pump	Time interval* for replacement
Rod centralizers	504	10 Nos	Two Years
Bobbin	555	2 Nos	Two Years
Bearings (inner and outer)	100 & 101	4 Nos	One Year
Plunger seal	566	1 No	One Year

* For heavily used pumps, the time interval can be shorter than indicated.

ANNEX 16

Mechanic Registration and Spare Part Information Report

Mechanic Registration and Spare Part Information Report

Mechanic Registration Information Report	**Part 5**		
Mechanic Name			Fathers Name
Village of Residence			
Districts of Work			
	---	---	
	---	---	
	---	---	
Spare Part Shop Details			
Owner's Name --- Village Name ---			
Given Tools? [ ]Y Date [ ] N	Given Bicycle? [ ] Y Date [ ] N		Training date

Spare Part Shop Information Report				**Part 6.**
Province		District		Village
Lat		Lon		Shopkeeper Name
Source of Spares (Village Name)				Distance(Time)

Part	Given Quantity
1. U Seal washer	
2. Plastic bearing	
3. Nut and bolt	
4. Body flanger and foot valve	
5. Valve bobbin	
6. O-ring	
7. Solution 250 mg.	
8. Rod	
9. Rising mains	

ANNEX 17 (DACAAR) Operation and Maintenance report Form

Water and Sanitation Program Operation and Maintenance Report

Implementing Agency (Previous)		Donor Name (For rehabilitation)		Date repaired:	
Province:		District:		Village	
LAT:		LON:		WP Code / Year Impl.	
EC (S) pH:		T (C) :		Beneficiaries (HH):	
Well Depth (m)		Well Diameter:		Static Wtr Lvl (m):	
WP Repairing		WP TYPE	MAINTENANCE SYSTEM	ORIGINAL HP replaced and handed over to:	
Repaired [ ] Yes [ ] No		[ ] DW	[ ] newly Included in DACAAR Maintenance System	Name	
[ ] HP part changed: 1- 3- 2- 4- [ ] Tap replace [ ] Pipe line replace		[ ] TW	[ ] Already included in DACAAR Maintenance system	Designation	
		[ ] DE	Mechanic Name:	ID No	
[ ] HP replaced [ ] Yes [ ] No		[ ] SP	Elder Name:	Signature	
[ ] Concrete repaired (M^2)		[ ] PR	Spare Part Shop Location:	PO Manager Name	
[ ] Raising Main (M)			Spare Part Shopkeeper Name:	PO Manager Signature	
Old Pump Mfr.	Old pump code:		New pump Mfr:	New pump code:	
OLD PUMP TYPE : NEW PUMP TYPE	[ ] PAMIR [ ] PAMIR	[ ] KABUL [ ] KABUL	[ ] INDUS [ ] INDUS	[ ] Other [ ] Other	

ANNEX 18(DACAAR): Water Point Survey / Data Collection

Water Point Survey / Data Collection

Implementing Agency	Donor Name	Date visited:
Province	District	Village
LAT	LON	WP Code / Year Impl.
EC (S) / PH	T (C)	Beneficiaries (HH):
Well Depth (m):	Well Diameter (Inch)	Static Wtr Lvl

WP STATUS (max 3)		WP TYPE	MAINTENANCE SYSTEM PROBLEMS	ORIGINAL HP PRESENT	PUMP CONDATIONS (max 2)
[ ] Working	[ ] Enclosed	[ ] DW	[ ] No Maintenance Problem	[ ] Y [ ] N	
[ ] Working with Bucket	[ ] Concrete Problem	[ ] TW	(max 3)	NEW HP	[ ] Pump problem FIXABLE
[ ] Dry / Drawdown	[ ] Pump Problem	[ ] DE	[ ] Commnuity	[ ] NO new HP / Removed	[ ] Pump problem NOT FIXABLE
[ ] Collapsed / Destroyed	[ ] Tap problem	[ ] SP	[ ] Mechanic	[ ] New HP from Community	[ ] Raising Main Problem
[ ] Plugged & abandoned	[ ] Pipe problem	[ ] PR	[ ] Spare Part Shop	[ ] New HP from NGO / Gov	[ ] Removed / Main Problem

Pump Mfr.	Pump Code

PUMP TYPE	[ ] PAMIR	[ ] KABUL	[ ] INDUS	[ ] Other

Name of Engineer: Signature:

HANDOUTS

Handout 1.1

Definitions

Sustainability

A service is sustainable when:

- it functions and is being used
- it is able to deliver an appropriate level of benefits (quality, quantity, convenience, comfort, continuity, affordability, efficiency, equity, reliability, health)
- it continues over a prolonged period of time (which goes beyond the life-cycle of the equipment)
- its management is institutionalized (community management, gender perspective, partnership with local authorities, involvement of formal/ informal private sector)
- its operation, maintenance, administrative and replacement costs are covered at local level (through user fees, or alternative financial mechanisms)
- it can be operated and maintained at local level with limited but feasible external support (technical assistance, training, monitoring)
- it does not affect the environment negatively.

Handout 1.2

Processes which influence sustainability

- Demand from the community
- Responsiveness from the supporting institutions
- Participation of the community throughout the project phases
- Linking technology choice with operation and maintenance
- Integrated planning (sanitation, water, hygiene, environment)
- Planning with a gender perspective
- Decentralization and transfer of responsibilities and resources
- Capacity-building at all levels
- Communication among stakeholders
- Public-private partnership
- Co-responsibility between communities and municipalities

Handout 1.3

Spare parts provision in general

- Spare parts are principal items on a check-list for sustainability,
- Spare parts are often considered long after the technical and operational designs
- Spare parts provision should therefore be one of the deciding factors in technology selection
- Spare parts can be defined as all the materials and items needed for the efficient and sustainable operation and maintenance of a water supply or sanitation system

Sustainable provision of spare parts depends on:

1. The demand for spare parts

- Spare parts needs
- Spare parts costs
- Spare parts accessibility

2. The supply of spare parts

- Use of local materials and manufacture
- Marketing and sales points
- Perspective on profits

3. Strategic issues

- Efficient planning
- Quality of spare parts
- Whether to standardize
- Approaches to reduction of spare parts needs
- Appropriate pricing policy
- Private sector involvement
- Capacity-building

Handout 2.1

MRRD Operation and Maintenance System

O&M System should be established to address the sustainability concerns

1. Core Guiding Principles

- O&M cost should be borne by the community beneficiaries.
- The stress shall be on preventive maintenance system to minimize sudden breakdowns of handpump/ water points.
- Community should make its own decisions and manage the scheme.
- Beneficiary communities should have strong sense of ownership.

2. Institutional Arrangement

2.1 CDC/WSUG

2.2 Hand Pump Caretaker

2.3 Hand Pump Mechanic

2.4 Valve Man

2.5 Spare Parts Shop

2.6 Regional Technical Support Unit (RTSU)

2.7 MRRD / RRD Role

2. 1 CDC/WSUG

- Appointing handpump caretakers for each handpump.
- Sign a contract with the Hand Pump Mechanic
- Fixing user charges and establish O&M Fund.
- Stocking of fast moving spare parts.
- Maintain accounts and other ledgers as required.
- Periodically, inform the community about progress and expenditure details.
- Managing O&M of all water facilities in the village including schools within the village through a pump mechanic trained by the project.

2. 2 Hand Pump Caretaker

Responsibility:

- Undertake the preventative maintenance of the pump
- Ensure that user groups keep the platform clean
- Inform the community representatives and the mechanic regarding repairing needs of the hand pump.
- Assist the hand pump when repairing the pump
- Assist collect the grain/money for the cost of spare parts as well as wages of hand pump mechanic.
- Act as a motivator to promote health and hygiene practices, proper use of hand pump and sanitation in villages

Criteria for Selection:

- Should serve the community voluntarily.
- Be a representative (Male/female) of the user groups.
- Should have leadership capabilities.
- Should have ability to read and write.
- Should be accessible, via greed linkages, to female users.

2.3 Hand Pump Mechanic

Trainings & Tools:

- He will be trained by the project and will look after 100-150 handpumps.
- He will be provided with a set of tools.
- CDC/WSUG/ will enter into a contract with the handpump mechanic for maintenance HPs.

The payment for labour charges and spare parts costs will be made by CDC/WSUG

Functions:

- Visit each handpump at least once every quarter.
- Cary out preventive maintenance to avoid breakdown.
- Repair pump with help from caretaker.
- Purchase spare parts from an approved spare parts shop if CDC/WSUG so desire on actual payment basis.

- Get the signature of the pump caretaker in his/her logbook during the visits of the water source

Selection Criteria:

- Preferably to be introduced by the representatives of the user groups.
- Be a permanent resident of the area
- Committed to serve that community.
- Should have the confidence of the community.
- Preferably be literate.
- The hand pump mechanic preferably should have a relevant background such as a blacksmith or bicycle mechanic
- Should have mechanical knowledge, ability and interest.

2.4 Valve Man

- Selection of one or more Valvemen to maintain O&M in the same manner as handpump mechanics
- Should be paid as skilled labor during project
- Will receive on-the job training
- Be equipped with the necessary tools for his work.

2.5 Spare Parts Shop

- The spare parts shop will provide quality spare parts to CDC/WSUG on payment basis.
- The project will train some mechanics attached to the shop who could also offer installation and maintenance services to CDC/WSUG and private households (HHs).
- DACAAR / RRD will work with spare parts shop to ensure that spare parts are of good quality and prices are reasonable.

2.6 Regional Technical Support Unit (RTSU)

- RTSU with assistance of Provincial RRD will monitor hand pump maintenance.
- They visit each Handpump Mechanic every three months to discuss and assist in resolving problems at individual water points.
- They also inspect the water points on a routine basis.

2.6 Regional Technical Support Unit (RTSU)

Their role:

- RTSU form as its backbone for both monitoring of O&M and health and hygiene awareness creation
- Assess the functioning of the maintenance arrangement and performance
- Assist on conflict resolution between different actors at the village level
- Monitor the performance of the hand pump and well for technical weaknesses.
- Collect the information recorded by the hand pump mechanic on repairs, maintenance and spare parts used.
- Chlorinate wells when necessary.
- Help select and train a new mechanic when required.
- Supply chlorine the hand pump mechanics and the construction teams
- Hold group discussions separately with men and women on issues related to health and hygiene.
- Brief RRD officials on issues needing their attention.
- Record relevant data in a computer based data sheet.

Structure:

- A mobile team provided with a four-wheel motorized transport
- Cover 1500-2000 handpumps
- Comprise of driver-cum-handpump mechanic, a male sociologist and a female sociologist.

2.7 MRRD / RRD Role

- Lead the program at the national and provincial level.
- Develop policy framework for water facilities.
- Keep database on water supply facilities and their status.
- Analysis of data and identify priority areas.
- Do need and resource-based planning.
- Share data base with donors/NGOs
- Fund RTSU teams and supervise their function.
- Intervene when a repair is beyond community’s reach.
- Build capacity at different levels
- Coordinate implementation activities among agencies in provinces.
- MRRD/RRD role will be that of policy maker, coordinator and facilitator

Handout 2.2

DACAAR Operation and Maintenance System

- DACAAR supports a community based maintenance system for its Safe Water program to ensure sustainability
- (HIT) O&M System should be established to address the sustainability concerns.

Maintenance System

- Waterpoint Caretaker
- Community Hand-pump Mechanic
- Spare parts Shopkeeper

Caretaker

- Usergroup and Field Engineer identify an active and committed person who will act as caretaker.
- Should be selected by the entire Usergroup
- Should be a permanent resident of the area
- Responsible for collection of the wheat and payment to the mechanic
- Calls the mechanic if repairs are needed
- Mobile Handpump Inspection Teams (HIT)
- Solves any conflicts occurring between the Usergroup and the Hand-pump mechanic.

Hand-pump Mechanic

- DACAAR trains one HP mechanic for every 50 to 120 hand pumps, and one or more valvemen for each pipe scheme.
- A HP mechanic (equipped with a bicycle) is expected to be able to service pumps within a 25km radius from the village where he lives.
- Mechanics are selected by the Field Engineer with agreement from the local shura certified by the local authority (woliswali).
- HP mechanics are supported by the project with training in all aspects of hand pump installation, well improvement, production of concrete components, sanitation, hygiene education and well maintenance and repair.
- Field Engineer supply the mechanic with a bicycle and necessary tools (hacksaw and blades, jute rope, gentry, helmet, gloves, spanner, screwdriver, file, well fishing tools, socket maker, hammer and pliers) for handpump repairs.

- The supply of new tools/new bicycle is a one-time grant from DACAAR and will not be repeated for the same mechanic.

- The type and amount of wages to be paid to the mechanic by the Usergroup is discussed and agreed upon by the mechanic and the Usergroups involved.

- The Usergroup pays the mechanic an annual wages of wheat for each well or standpost (approx. 28kg of wheat per handpump per year). The first wages must be paid before the installation of the handpump is finalized.

Spare Parts Shopkeeper

- Shopkeepers who are willing to stock and sell hand pump spare-parts are identified in the main bazaars that serve the project area.

- Each district should have a sub-supplier of spare parts.

- The selected shopkeeper is supplied with an initial stock of spare-parts at cost, and letter of introduction to the hand pump factory or provincial suppliers to facilitate the procurement of additional spare-parts.

Hand-pump Inspection Team

- Mobile Handpump Inspection Teams (HIT teams) visits all DACAAR waterpoints on regular basis to ensure that the maintenance systems are functioning effectively.

- They assess the functioning of the maintenance arrangements including the payment and performance of hand pump mechanics and the effectiveness of spare part distribution.

- They visit each Handpump Mechanic every three months to discuss and assist in resolving problems at individual waterpoints.

- They Identify new shopkeepers as required and select and train new hand pump mechanics if anyone leaves the job or is replaced.

- In areas where a commercial spares system is not yet operational they also supply spare parts to shopkeepers or mechanics.

- They also chlorinate wells when needed and

- They collect data on the availability of safe water from each waterpoint and identify and record any waterpoint problems.

Handout 3.1

What is a community?

- Is a community a group of people sharing common values and interests?
- A community can be heterogeneous in various aspects
- A community does not necessarily live in one contiguous geographic area
- People can be a member of a number of communities
- A 'community' can also consist of groups of people with divergent values and interests:

  rich/poor

  peasants/cattle-raisers

  women/men

  people using water for different purposes

  polluters/non polluters

  people living in the centre/in the periphery

  highly educated/low educated

Handout 3.2

What is community Management?

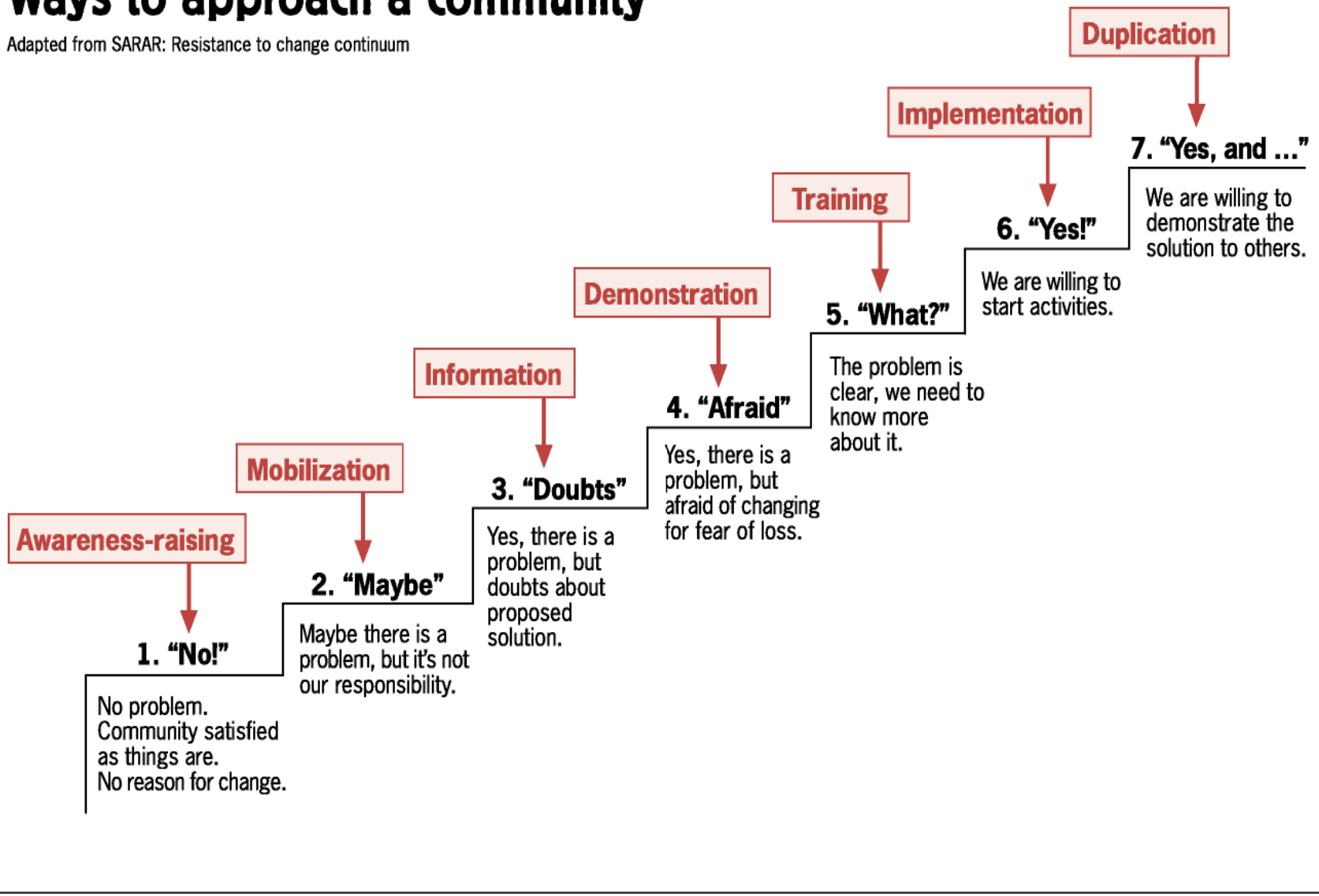
Social management
(all aspects linked to the organization of the community)

Technical management
(all aspects linked to O&M technical activities)

Financial management
(accounting, tariff setting and all aspects of O&M cost recovery)

Ways to approach a community

Adapted from SARAR: Resistance to change continuum



Handout 3.4

Why involve communities in the management, operation and maintenance of RWSS?

- Building on existing local knowledge and management capacities
- All social groups feel concerned and can participate
- Addressing the true needs of community members
- Solutions acceptable to community members
- Solutions adapted to community capacities
- Increased community commitment to improve the situation
- Better understanding of the causes and effects of problems
- Empowering the community and reducing dependency
- Increased sense of ownership and responsibility
- Increased self-consciousness and confidence in own capacities
- Direct interest to have a system well maintained
- Possible improvement of willingness to pay
- Reduced overall and government costs
- Improved reliability and sustainability of systems

Handout 3.5

Goal of community Management

- Improved reliability and sustainability of the system
- More appropriate choice of technology and service levels
- Reducing investment and operation costs for both the support agencies (government) and the communities
- Increased confidence and problem-solving capacities for further development activities
- Promoting gender-sensitive solutions
- Contributing to democratization and equity in the development process
- Increased health and socioeconomic well-being

Handout 3.6

Characteristics of community management

Community is responsible for:

- Maintenance and repair
- Local management and organization
- Financing

Community decides on:

- Technology choice
- Service level
- Form of local organization

- Local rules and regulations on use
- Financing mechanisms
- Sanctions

Community controls:

- Ownership of the system
- Outcome of decisions
- Quality of work done and functioning of the system

Handout 3.7

Forms of community management

The forms of community management vary according to the size of the community, the technology used, the local context, and national legislation. Basically, community management operates through a Committee whose members are elected by a General Assembly of users. The following forms can be found:

Tap or Neighbourhood Committee
Responsible for operating and maintaining a specific water point.

Water Committee
Responsible for all activities (managerial, operational, technical and financial) of a particular scheme, which covers a larger area than a neighborhood and possibly the whole community.

Village Association
Responsible for all development activities concerning the village, and includes overseeing water and sanitation.

"Coordinating" Water Committee
Responsible for managerial and financial matters and coordination of several smaller committees (tap/standpost or neighbourhood committees), which retain responsibility for operation, maintenance and collection of fees.

Water Committee contracting a private body
Responsible for general management and control, but contracts a private body (an individual, a mechanic, a group of artisans, or a firm) to operate and maintain the system.

Delegated responsibility by local authority
Ownership and decision-making are held by the local authority, while the water committee operates and manages the system.

Inter-community Federation of Committees
When several communities share the same pipe source or water source, each community has a water committee to operate and maintain its own water point and collect fees, part of which goes to an Association or Federation of Committees for maintenance of the whole system (pipes, source)

Handout 3.8

Typical tasks of a Water Committee

1. Represents the community in contacts with support agencies
2. Coordinates with other community institutions and decision-making bodies
3. Ensures efficient and effective overall management of systems:
    - takes up assigned roles and tasks
    - ensures equity
    - organizes contributions
    - organizes effective O&M
    - ensures accurate financial management
    - promotes hygienic and effective use of facilities
    - holds regular committee meetings
    - ensures good communication at all levels
    - provides information and feedback
    - collects information.

Handout 3.9

Composition and legal status of

The composition of a Water Committee will vary according to its management and operational mandate.

Generally it is composed of a President, Vice-President, Treasurer and several representatives of the users, with a balance between posts occupied by men and by women. If the community is directly responsible for the technical operation and maintenance of the system, the Committee also includes the operator and/or caretaker.

In many countries, the Water Committee does not have proper legal status. This makes it vulnerable in situations with material, financial, contractual or legal problems. The following types of legal status are found:

- **The Municipality officially registers the Water Committee** If it has been elected by a General Assembly of users, a "constituting" Act must be produced by the Assembly

- **The Water Committee is registered with the Chamber of Commerce as a non-profit-making Association**

- **The Water Committee is registered with the Chamber of Commerce as an Association with an economic interest** It can then operate as a concession or under contractual arrangements with local authorities

- **The Water Committee operates under the legal mandate of a Development Association a Water Committee**

Handout 3.10

Prerequisites for community management

- Demand to improve the system
- Policy and legal framework for promoting community management
- Effective external support, if required
- Information on system options, as well as on cost and technical implications of each system, must be available to the community
- Technology options must be selected with the communities, and adapted to the community's capacities and needs
- The community understands the implications of choice in terms of responsibilities and tasks
- The community is willing to pay
- The community has decision-making power
- The community has access to required capacity-building support
- There should be a policy framework to permit and support community management

Handout 4.1

Seven key principles to sustainable cost recovery

1. Identifying the cost implications of the project's characteristics and the environment
2. Maximizing the willingness to pay
3. Clarifying financial responsibilities
4. Optimizing operation and maintenance costs
5. Setting an appropriate and equitable tariff structure
6. Developing an effective financial management system
7. Organizing access to alternative financial sources.

Handout 4.2

Factors influencing willingness to pay

- Demand and participation from communities
- Service level
- Service standard
- Perceived benefits
- Relationship to production
- Level of income
- Price of water
- Relative costs
- Opportunity cost of time
- Characteristics of existing sources
- Reputation of service agency
- Community cohesion
- Policy environment
- Sociocultural factors
- Perception of ownership and responsibility
- Transparency of financial management
- Institutional support.

Handout 4.3 (exercise)

Sound financial management

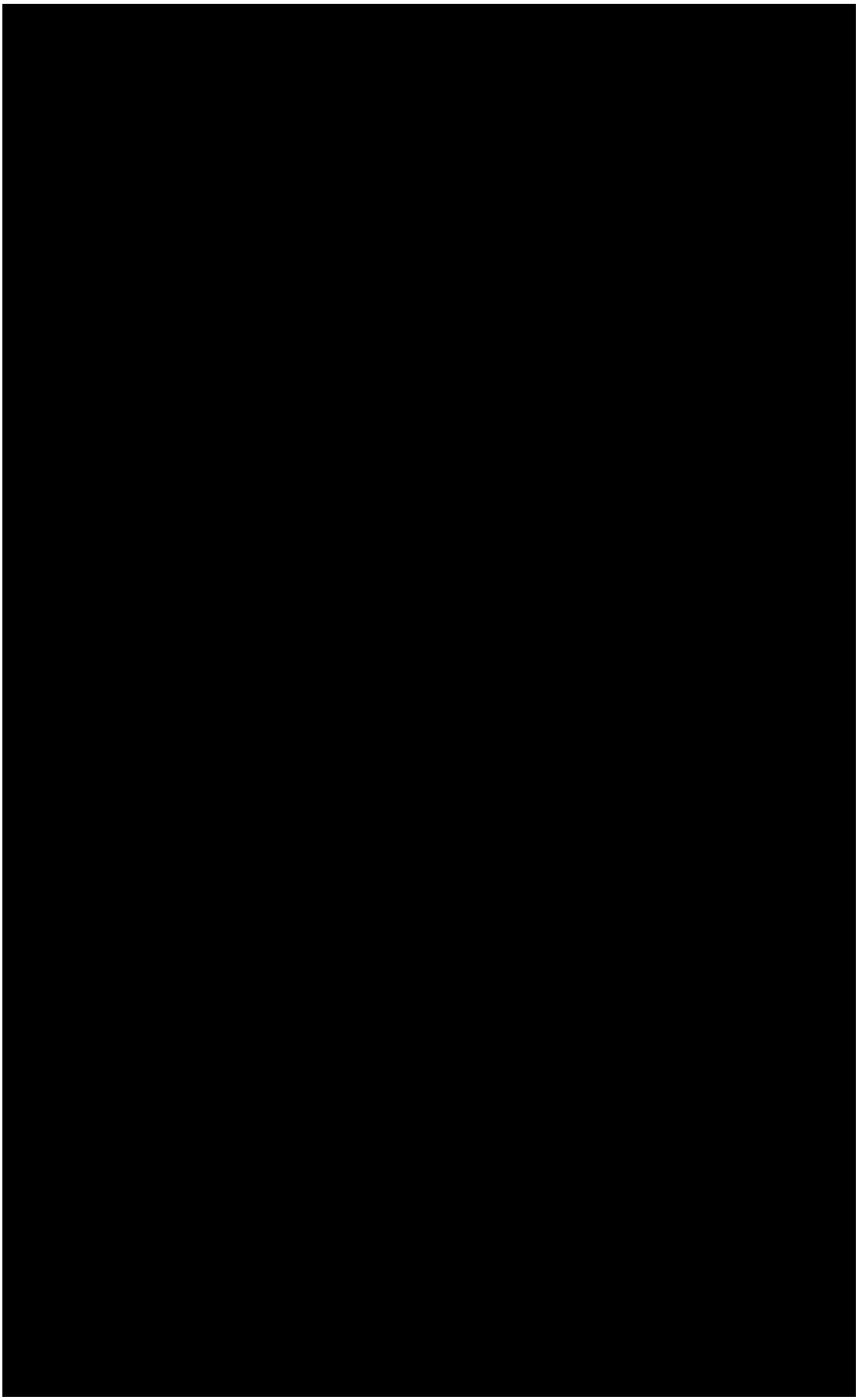
Financial management issues	Possible options
What costs to budget for?	
What sources of income to use?	
How to collect the money?	
When to collect the money?	
Who collects the money?	
Where to keep the money?	
How to register movements of expenditures and incomes?	
How to pay the mechanic or caretaker?	
Who administers the funds?	
What are the funds used for?	
Who orders payments?	
What type of financial control?	
How to monitor?	
What to do with bad payers? This question should also be asked when public administrations do not pay.	

Handout 5.1

Key principles of monitoring

- Monitoring should be based and planned on a solid knowledge of objectives and activities
- Information should be used (solve a problem, answer a question, improve the project, adapt activities)
- Monitoring information should be collected and acted upon at the lowest level possible
- Monitoring should be focused and simple (limit number of indicators, length and cost of data collection)
- Monitoring should be based on a careful definition of indicators (they should really be adapted to the project)
- Monitoring should combine qualitative and quantitative information
- Monitoring should ensure checks and balances, (validity and reliability of information)
- Monitoring should become an in-built integrated activity and not a separate activity

Handout 5.2



Handout 5.3

Seven steps for planning a monitoring system

1. Identify key issues, concerns, questions or demands which will become the focus of monitoring
2. Determine indicators
3. Determine strategies for collecting, analysing and reporting data
4. Determine the use of the information and how action will be taken
5. Determine information flow, checks and verification of information
6. Test monitoring system
7. Provide training or orientation to groups involved

Handout 6.1

Introduction to O&M of Rural Water Supply Systems

- Problems with the O&M of water supply are key constraints to the sustainability of these services.
- This module explains O&M system and its all aspects.
- The aim is to improve the efficiency, effectiveness and sustainability of water supply services.
- O&M activities encompass not only technical issues, but also managerial, social, financial and institutional issues, must be directed towards the elimination or reduction of the major constraints which prevent the achievement of sustainability.
- This document and the training activities described in it are intended for managers, planners, project implementers, engineers.

Course Goal
To contribute to the sustainability of water supply programme and projects in rural areas

Course objectives
- To understand the MRRD and other NGOs O&M system
- To update knowledge on O&M issues
- To reinforce management skills on sustainable O&M
- To create specific approaches for better work and planning with communities
- To develop individual assignments based on the lessons learnt and each participant's workplace
- To understand the importance of community participation
- To implement effective O&M of rural water supply and sanitation services

The importance of O&M for water supply technology

- O&M of small community water supply systems has been neglected
- 30%–60% of existing rural water-supply systems inoperative at any given time
- The lack of such services is degrading for the affected people and has a serious impact on their health and well-being.
- All recognizing the importance of integrating O&M components in all development phases of projects.
- Project staff and communities should be made aware of the O&M implications, as the communities themselves have responsibilities in the management and O&M of their water supply systems.
- Many local government departments have insufficient resources and are unable to provide effective support.
- Appropriate and sustainable technologies can be adapted to local conditions and be maintained by the communities them-selves.
- O&M should be integrated into project development from the beginning.
- Often, critical aspects of O&M development have been neglected in short-term, agency-managed projects.
- Effective O&M brings about important health benefits by sustaining accessible water supplies in adequate quantity and quality; by reducing the time and effort spent on water collection
- The selection of a particular technology and users participation can have far-reaching consequences for the sustainability of the services.
- Although these aspects are important, the roles of financial, institutional, social and environmental factors are also germane for ensuring the sustainability of services.
- Roles and responsibilities of the actors involved in O&M need to be well defined
- Tendency to decentralize O&M activities and to encourage the private sector to get involved which reduce cost and increase flexibility
- Private sector involvement may be limited by the low profit margins, particularly in areas where rural communities are scattered.
- Private-sector accountability is also a concern when there are no controls or regulations.
- Communities that contract services from the private sector need to ensure that the job is well done at a fair price and initially require assistance from the central government
- Regulation, control and monitoring require extensive efforts and commitment by governments, and considerable human and financial resources.

Definitions

Operation: operation deals with the actual running of a service (e.g. provision of fuel, starting or handling of pumps, control of water collection points, general mechanical or water treatment procedures, hygienic handling, etc.).

Maintenance: maintenance deals with the activities that keep the system in proper working condition, including management, cost recovery, repairs and preventive maintenance.

Crisis maintenance: maintenance under-taken only in response to breakdowns and/ or public complaints, leading to poor service level, high O&M costs, faster wear and tear of equipment, and user's dissatisfaction.

Preventive maintenance: maintenance activities undertaken in response to pre-scheduled systematic inspection, repair and replacement, leading to continuity in service level, O&M costs spread over time, extension of life-span of equipment, user's satisfaction and willingness to pay

Water-lifting technologies

- Rope and bucket: loose, through a pulley, or on a windlass
- Bucket pump
- Rope pump
- Suction plunger handpump
- Direct action pump
- Deep-well piston pump
- Deep-well diaphragm pump
- Centrifugal pump
- Electrical submersible pump
- Axial flow pump
- Hydraulic ram

Water sources for low-cost water supply technologies

Rain water
- Rooftop water harvesting
- Catchment and storage dams

Groundwater
- Spring water captation
- Dug well
- Drilled well Subsurface harvesting

Surface water
- Protected side intake
- Bottom river intake
- Floating intake
- Sump intake

Power systems

- Human power
- Animal traction
- Windmill
- Photovoltaic systems Electric engines
- Diesel engines

Water treatment devices

At the household level

- Heating
- Solar disinfection
- Household slow sand filter Domestic chlorination

At the community level

- Pot chlorination in well
- Storage and sedimentation
- Upflow roughing filters
- Slow sand filtration
- Chlorination in piped water supply systems

Handout 6.2

Technology Selection and its O&M Requirements

Spring water captation

Operation

- Water should be permitted to flow out freely all the time so that it will not find another way out of the aquifer.
- Operation may include activities such as opening or closing valves to divert the water to a reservoir, a conduit or a drain.
- The spring and surroundings must be kept clean.

Maintenance

- Prevent contamination in infiltration area and in the immediate surroundings of the spring.
- Check the surface drains, the animal-proof fence and gate, and repair if necessary.
- Protect from vegetative growth in infiltration and in the immediate surroundings of the spring (prevent clogging of the aquifer by growth of roots).
- Check the water flow from the spring box. If there is an increase in turbidity or flow after a rain storm, surface run-off has to be identified and the protection of the spring improved.
- If the water flow decreases, it has to be suspected that the collection system is clogged. It may then be necessary to take out the gravel and replace with new gravel or, in case a seep collection system is used, to clean the collection pipes.
- Regular water samples must be taken and analyzed to check for evidence of faecal contamination.
- Annually, open the washout and remove all accumulated silt. Check all screens; if damaged or blocked, replace with non-rusting materials, e.g. copper or plastic screening, and clean if dirty.
- After cleaning, make sure to close the washout valve thoroughly and replace and seal the manhole cover.
- Disinfect the spring box every time a person enters to clean or repair it, or when there is bacteriological contamination.
- Leaks in the protective seal, undermining of the headwall, and damage caused by erosion or settlement of soil must be repaired.

O&M requirements

Activity	Frequency	Human resources	Materials and spare parts	Tools and equipment
Clean spring surrounding	Weekly	Local		Broom, bucket, hoe, machete
Check turbidity	After each flood	Local		
Check water quality	Occasionally	Local		Bucket, watch
Repair fence and clean surface	Occasionally	Local	Wood, rope, wire	Machete, axe, knife, hoe, spade, pickaxe
Check water quantity	Regularly	Area	Laboratory reagents	Laboratory equipment
Wash and disinfect the spring	Annually	Local	Chlorine	Bucket, wrench, brush
Repair piping and valves	Occasionally	Local or area	Spare pipes and valves, cement, sand, gravel	Bucket, trowel, wrench, flat spanners
Repair cracks	Annually	Local	Cement, sand, gravel, clay	Bucket, trowel, hoe, spade, wheelbarrow

Actors implied and skills required in O&M

Actor	Role	Skills
User	Use water, report malfunctioning, keep site clean, assist in major repairs	No special skills
Caretaker	Keep site clean, check for damage, perform small repairs	Basic skills
Water committee	Organize bigger repairs, control caretaker's work	Organizational skills
Valveman	Repair masonry or concrete	Masonry
External support	Check water quality, guide and stimulate local organization	Microbial analysis, extension work

Frequent problems

- Erosion or collapse of the spring box due to wrong design, construction errors, large surface runoff flows, and damage caused by people or animals.
- Leaks in the box or leaking taps and valves.
- Contamination of the spring water due to cracks in the seal or to people's behaviour.
- Damaged piping because of faulty construction, abuse or corrosion.
- Improper drainage of surface runoff, outflow and wastewater.

- Clogged pipes because of siltation or plant roots.
- Poor accessibility for water users.

Limitations

- Springs may not deliver enough water or become dry during certain seasons of the year.
- Not all springs produce clean water of acceptable taste.
- Springs may be sited too far from households or on privately owned land.
- In some cases, the cost of construction, large repairs or replacements may be beyond the capacity of communities.
- Some spring water is very corrosive.

Remarks

- Usually spring water is of good quality but this should be checked; examples exist where the water was fed from a polluted stream which had gone underground or where the catchment area was contaminated.
- Unprotected springs are almost always contaminated at the outlet.

Handout 6.3

Reinforced concrete reservoir

Operation

- Consists of opening and closing the valves, and managing a chlorinator, if provided.
- If the reservoir does not deliver directly to a tap, water distribution is usually carried out by a caretaker/valveman/operator.

Maintenance

- A well-designed and well-built reservoir needs very little maintenance.
- The surroundings must be kept clean on a regular basis; every two months the valves must be closed and opened to prevent them from sticking, and the screens must be checked.
- Occasionally, a screen or tap may need to be repaired.
- Once a year, or sooner if contamination is suspected, the reservoir must be drained, de-silted, cleaned with a brush and disinfected with chlorine.
- Any leaks or cracks in the concrete have to be repaired as soon as possible.
- If needed, a caretaker can be appointed to regulate the inflow and outflow.
- A concrete reservoir has few other organizational requirements.

O&M technical

Activity and frequency	Materials and spare parts	Tools and equipment
Regularly		
clean the surrounding area.	Broom, machete, hoe, etc.	
At least monthly		
open and close the valves.		
Occasionally		
repair the valve;	Washer, spare valve.	Wrench, spanner, screwdriver
repair the screen;	Plastic or copper screen, wire	Pliers, wrench, tin cutter.
repair the concrete lining.	Cement, sand, gravel, additives	Trowel, spade, bucket, wheelbarrow, ladder, rope.
Annually		
clean and disinfect the reservoir	Chlorine	Brush, broom, bucket, ladder.

Actors and their roles

Actors	Roles	Skill required
Water user	Assist in reservoir cleaning	Simple
Caretaker/ valveman/ operator	Regulate water inflow and outflow, organize cleaning, and warn if repairs are needed	Basic skills
Water committee	Supervise the caretaker, organize repairs	Basic skills

Mason /valveman	Perform repairs.	Technical skills
External support	Check water quality, motivate and guide local organization	Highly qualified

Potential problems

- cracks and leaks form owing to a poor foundation, design or construction;
- exposed metallic components become corroded;
- the water becomes contaminated owing to a poorly-covered manhole or broken screens;
- reinforced concrete is expensive;
- reinforced concrete is also heavy, and the soil beneath the reservoir may settle if the foundation is inadequate.

Handout 6.4

Drilled well

Operation

- Operation of the well itself is usually not required.
- When the production capacity of the well is lower than the demand, daily monitoring of the water level may be necessary.
- Abstraction of the water from the well is usually done by the users, often women and children, or by a caretaker.

Organizational aspects

- Users may need to establish an organization that can effectively deal with issues such as the control or supervision of water use, prevention of water contamination, execution of O&M activities, financing of O&M, and monitoring of water quality.
- Although the number of O&M activities required is limited and they usually cost very little, they should be given ample attention, as many wells have been abandoned because they were contaminated or had collapsed as a result of lack of

Maintenance

- Apart from cleaning the apron daily and occasionally cleaning the drain and repairing the fence, if there is one, there are hardly any maintenance activities.
- Rarely, when a well has to be desilted or rehabilitated, all appliances have to be removed and a specialized company will have to come and do the job.
- There are various rehabilitation techniques such as forced air and water pumping, brushing, and treatment with chemicals.
- It is very difficult to deepen an existing drilled well.

O&M requirements

Activity	Frequency	Human resources	Materials and spare parts	Tools and equipment
Clean well site	Daily	Local		Broom, bucket
Clean drain	Occasionally	Local		Hoe, spade, wheel-barrow
Repair fence	Occasionally	Local	Wood, nails, wire etc.	Saw, machete, axe, hammer, pliers, etc.
Repair apron	Annually	Local	Cement, sand, gravel	Trowel, bucket
Rehabilitate well	Very rarely	National	Gravel, pipe material etc.	Various special equipment

Actors implied and skills required in O&M

Actor	Role	Skills
Water user	Use water, keep site clean, assist with major maintenance tasks	No special skills
Caretaker	Monitor water use, keep site clean	Basic skills for cleaning and disinfection
Water committee	Supervise caretaker, organize major maintenance, collect fees	Organizational skills
Specialized well company	Rehabilitate the well	Very special skills
External support	Check water quality, stimulate and guide users' organization	Microbial analysis, extension work

Frequent problems

- Bad water quality or collapse due to corrosion of the galvanized iron/PVC lining
- Poor water inflow because of inadequately developed well,
- Entrance of ground particles in the well because of wrong screens or wrong development,
- Contamination due to wrong apron design or construction or neglect of maintenance,
- Collapsing of borehole where no lining is applied or where the lining is not strong enough.

Limitations

- Well construction depends on hydro-geological conditions.
- If wells locations are too far from the users' households, or which are too difficult to reach, will not be sufficiently used or maintained.
- Wells should not be drilled near latrines or where cattle gather.
- Recommended min. distance is 30 m, although this is no guarantee that contamination will not occur.
- Construction of an improved drilled well may be beyond the capacity of the community. It may be impossible to transport the heavy equipment and materials needed to the drilling site.

Handout 6.5

Chlorination in piped water supply systems

Operation

- The chlorine tank has to be refilled with a freshly prepared solution once or twice a week.
- The flow rate has to be checked and adjusted if necessary.
- Operators must be very careful to avoid contact of chlorine compounds or solutions with eyes or clothes.
- In some cases, a logbook is kept with data on the amounts of chlorine applied and residual chlorine levels measured.
- Chlorination can easily be learnt.

Maintenance

- Chlorinators regularly have to be adjusted and cleaned of chlorine salts.
- When hoses get affected by chlorine they have to be replaced.
- If a steel chlorine tank is used, it must be painted and checked for corrosion annually.
- Protective gloves and utensils used for the preparation of the chlorine solution occasionally need replacement, and the shelter of the chlorine solution tank needs maintenance.

Organizational aspects

- Usually the water committee appoints a caretaker who is trained for the job.
- The chlorine compound has to be obtained through a merchant or the health department and an adequate supply of chlorine compound must be kept in stock.
- An external organization like a governmental health or water department will have to provide training for caretakers and monitoring

O&M requirements

Activity	Frequency	Human resources	Materials and spare parts	Tools and equipment
Refill chlorine tank	Once or twice a week	Local	Chlorine compound, water	Spoon, scale, bucket, stirring rod

Adjust and clean chlorinator	Regularly	Local	Water	Measuring cup, stopwatch
Replace hose or chlorinator	Occasionally	Local	Hose, small tubes of plastic, glass etc., plug, bowl	Knife, nail
Paint steel tank	Annually	Local	Latex paint	Steel brush, paint, brush
Check and adjust doses	Regularly	Area	Test medium, water sample	Test kit

Actors implied and skills required in O&M

Actor	Role	Skills
Caretaker	Refill chlorine tank and prepare solution, clean and adjust chlorinator, perform small repairs	Basic skills
Water committee	Supervise caretaker, collect fees	Organizational skills
Local health worker, shopkeeper or merchant	Provide or sell chlorine compound	No special skills
External support	Check residual chlorine in water and adjust doses, train caretaker	Basic testing and calculation, training skills

Frequent problems

- Bad quality hoses wear quickly.
- Some chlorine compounds are very sensitive to storage conditions and rapidly lose strength.
- If the chlorinator gets clogged or residual chlorine is not monitored, disinfection may not be sufficient.

Limitations

- Chlorination does not kill all pathogenic organisms but is generally very effective.
- In alkaline water, pH above 8, chlorination is less effective.
- When the water contains a lot of organic matter or suspended material, pretreatment will be needed.
- High cost and unavailability of the chlorine compound can be serious limitations.

Remarks

- Chlorination affects the taste of water and for that reason may be rejected by consumers.
- On the other hand, sometimes a chlorine taste is appreciated.
- The taste of chlorine in water is no proof of proper disinfection.
- Often a chlorine taste is caused by the application of too little chlorine.

Handout 6.6

Deep-well piston handpump

Operation

- Operation of the pump is done by moving a handle up and down or by rotating the handle of a flywheel.
- This can be done by adults and even children.
- Handle forces are usually kept within acceptable limits (depending on brand and lifting heights).
- Pump and site must be kept clean.

Maintenance

- Preventive maintenance usually consists in checking pump functioning and cleaning the pump and site daily, greasing weekly, checking all parts of the pump stand monthly, and taking the whole pump apart for a check, cleaning the parts with clean water and painting the pump stand annually.
- Pump rods that show bad corrosion must be replaced. Under normal conditions, a galvanized steel pump rod needs replacement every five to six years.
- Rising mains consisting of galvanized iron have to be removed and checked and pipes with badly corroded threads must be replaced.
- Small repairs are the replacement of bearings, cupseals and washers, straightening bent pumping rods, etc.
- Major repairs may involve the replacement of the plunger, footvalve, cylinder, pump rods, rising main, pump handle, fulcrum, etc.
- With open-top cylinder pumps, all preventive maintenance activities can normally be executed by a village pump caretaker. For major repairs and problems, external support may be needed.
- Closed-top cylinder pumps often need special lifting equipment to pull up the rising main and cylinder for maintenance of parts down in the hole.

Organizational aspects

- Most deep well pumps are too expensive for family use and will have to be used at communal level.
- The price of these pumps also means extra effort in fund-raising. Communities have to organize themselves in order to maintain the pump in good working condition.
- Often a caretaker is appointed and a pump committee coordinates activities.
- External support is often provided by state or nongovernmental organizations but becomes costly.

- In some cases small private enterprises, paid directly by the communities, are now doing this job very satisfactorily.

O&M requirements

Activity	Frequency	Human resources	Materials and spare parts	Tools and equipment
Clean pump and site	Daily	Local		Broom, brush
Grease bearings	Weekly	Local	Grease or oil	Lubricator
Check pump stand parts	Monthly	Local		Spanner
Replace pump stand parts	Occasionally	Local	Nuts and bolts, bearings, pump handle	Spanners, screw-driver
Replace cupseals	Annually or less	Local or area	Cupseals	Spanners, wrench, knife, screwdriver etc.
Redo threads in pump rod or main	Occasionally	Local or area	Oil	Pipe threader, tackle
Replace footvalve, plunger or cylinder	Occasionally	Area	Footvalve, plunger or cylinder	Spanners, wrench
Replace pump rod or main	Occasionally	Area	Pump rods or main tubing	Spanners, wrench, pipe threader
Repair platform	Annually	Local	Gravel sand, cement	Bucket, trowel

Actors implied and skills required in O&M

Actor	Role	Skills
User	Pump water, Keep site clean Warn in case of malfunctioning	No special skills
Caretaker	Keep site clean, Regularly check pump Do small repairs	Basic maintenance
Water committee	Supervise caretaker, Collect fees	Organizing skills
Area mechanic	Perform more major repairs	Some special skills, depending on brand
External support	Check water quality, stimulate and guide local organization	Microbial analysis, extension work

Frequent problems

- Replacement of plunger seals is the most common repair needed.
- Problems with local manufacture, about quality control
- Hook and eye connections of pump rods tend to break more often than conventional connections.

- Rods also reportedly get disconnected or bend spontaneously sometimes.
- Especially where groundwater is corrosive, corrosion has been reported to affect the pump rods (if not made of stainless steel), and other pump stand parts.
- Broken or shaky handles, mainly due to worn-out or otherwise affected bearings.

Limitations

- The maximum lift differs by brand, varying between about 45 and 60 metres.
- The forces required to turn the handle of the pump may be high in certain cases, depending on the brand and on the depth of the well.

Remarks

- The quality of the material used for the rising main should be as high as possible to reduce the number of repairs needed on this part.
- Many of these pumps can be produced in developing countries. Rigorous quality control is needed.
- Piston pumps may be driven by a windmill but often rotary pumps are preferred because of their lower starting torque.

Handout 6.7

Public standpost

Operation

- Users clean and fill their containers at the tap.
- Bathing and washing of clothes is usually not permitted at the standpost itself.
- The tap site has to be cleaned daily and the drain inspected

Maintenance

- Drain must be cleaned at least once a month.
- Formation of pools must be prevented at all times.
- Occasionally, a rubber washer or other part of a tap may have to be replaced.
- The fence may need repair too.
- Serious cracks in the structure must also be repaired, and when wood rots it must be treated or replaced.
- Occasionally the tubing may leak or need replacement.

Organizational aspects

- A caretaker or tap committee may be appointed to keep the tap functioning and the surroundings clean, and to regulate the amounts of water used.
- The committee may also collect the fees for water use.
- Sometimes water vendors fill their tanks at public tapstands at special rates for resale to people living far away

O&M requirements

Activity	Frequency	Human resources	Materials and spare parts	Tools and equipment
Tap water	Daily	Local		Jar, bucket, can, etc.
Clean site	Daily	Local		Broom or brush
Inspect and clean drain	Daily	Local		Hoe, spade
Repair or replace valve	Occasionally	Local	Rubber or leather washer, Spanners, screw-gland seal, Teflon, flax, spare valve	Spanners, screwdriver pipe wrench
Repair fence	Occasionally	Local	Wood, steel wire,	Machete, pliers, hammer

			nails	
Repair valve stand, apron or drain	Occasionally	Local	Wood, nails, cement, sand, water, etc	Hammer, saw, trowel, bucket, etc.
Repair piping	Occasionally	Local	Pipe nipples, connectors, Pipe wrench, pipe elbows etc., oil, Teflon, cutter, saw, file, pipe flax or plumbing putty	Pipe wrench, pipe cutter, saw, file, pipe threader

Actors implied and skills required in O&M

Actor	**Role**	**Skills**
User	Tap water, keep site clean	No special skills
Caretaker or tap committee	Clean site, perform small repairs, collect fees	Basic skills
Communal water committee	Organize more major repairs, collect fees	Organizing and bookkeeping skills
Mason	Repair tapstand and apron	Masonry
Plumber	Repair piping and taps	Basic plumbing
External support	Monitor hygiene, train committee members	Training skills and microbial testing

Frequent problems

- Tampering, insufficient maintenance, and conflicts over use due to bad location of tapstand or unsolved social problems.
- Poor drainage.
- Often taps are not closed after use and even left open on purpose to irrigate a nearby plot.
- Tapstands at the tail end of a piped system often have insufficient water pressure.

Limitations

- If people are willing to organize communal use and maintenance, the only limitation is the cost.

Remarks

- Special attention should be given to how the water is handled after collection at the tapstand in order to prevent subsequent contamination

Handout 6.8

Slow sand filtration

Operation

- Operation of a slow sand filter is crucial to its effectiveness.
- The flow of water must be maintained in the range of 0.1– 0.3 m per hour to provide the organisms in the filter with a stable flow of nutrients and oxygen and give them time to purify the water.
- After several weeks to a few months the population of micro-organisms gets too dense and starts to clog the filter.
- Depending on the filter design, flow rates may have to be adjusted accordingly or the layer of supernatant water on the filter will get too high.
- The caretaker of a slow sand filter keeps a logbook with flow rates and operation and maintenance activities.
- Slow sand filters can be operated and even monitored by communities, provided caretakers are trained well.
- It takes less than one hour a day for a caretaker to check the functioning and adjust the flow rates.
- Cleaning the site and other activities may take more time.

Maintenance

- When flow velocities get too low the filter is drained and the top layer of the sand is scraped off, washed, dried in the sun and stored.
- After several scrapings the sand is restored, together with new sand to make up for losses during washing.
- It takes one day for several people to clean a filter unit.
- Hygienic measures must be taken every time someone enters a filter unit for maintenance or inspection.
- Valves must be opened and closed every two months to keep them from getting stuck.
- Any leaks must be repaired immediately.
- If well-designed and constructed, hardly any repairs of the filter tanks and drainage system will be needed, although valves and metal tubing may need occasional attention.

- Test kits are available which only require some basic training to monitor water quality.

Organizational aspects

- A slow sand filter for community use requires some organization in order to have enough workers for scraping and resanding the filter units.
- A local caretaker will have to be trained and some other people may need training for water quality testing and to be able to replace the caretaker.
- It may take some time for people to get to trust that a green and slimy filter is capable of producing safe water.
- Apart from extra sand, some chlorine and test materials very few external inputs are needed.
- With proper external assistance, water organizations can become very independent in managing their water treatment.

Actors implied and skills required in O&M

Actor	Role	Skills
Local caretaker	Regulate flow, keep site clean, scraping and resanding	Fair understanding of filter process and hygiene, organizational skills
Water user or paid worker	Assist in scraping and resanding of filter units	No special skills
Water committee	Supervise caretaker, monitor water quality, collect fees, organize scraping and resanding	Organizational skills, basic water quality testing
Local plumber	Repair valves and piping	Basic plumbing
External support	Train caretaker, monitor water quality	Training and microbial testing skills

O&M requirements

Activity	Frequency	Human resources	Materials and spare parts	Tools and equipment
Check inflow	Daily	Local		
Regulate flow	Daily	Local		
Keep logbook	Daily	Local	Logbook, pen	
Clean site	Daily	Local	Broom	
Scrape off sand, wash, dry and store	About every six weeks	Local	Water, disinfectant for tools, boots or feet	Wheelbarrow, hoe, rake, spade, rope, bucket, ladder, planks, broom, wash basin
Resand filter	About every 18 months	Local	Recycled and new sand, water, disinfectant for tools, boots or feet	Sieve, wheelbarrow, hoe, rake, spade, rope, bucket, ladder, planks
Repair valve	Occasionally	Local	Washers, spare valve	Spanners, screwdriver, wrench

Replace metal tubing	Occasionally	Local or area	Nipples and accessories, plumbing sealant or teflon, cement, sand	Steel saw, wrench, pipe threader, hammer, chisel, trowel, bucket
Disinfect filter outlets	Occasionally	Local	Chlorine	Bucket, brush
Analyse water quality	Regularly	Local or area	Water sample, test media	Test kit

Frequent problems

- If flow rates through the filter are too high, water quality drops.
- Excessive turbidity (>30 NTU) in the raw water can cause the filter to clog rapidly; in this case a prefilter may be needed.
- When water quality is very bad, harmful and badly tasting products like NH3 and H2NO3 may be formed in the lower layers of the filter.
- If water flow is interrupted for more than a few hours, beneficial micro-organisms in the filter may die and filter action is disturbed.
- Smooth vertical surfaces can cause short circuits in the water flow, producing poor quality water.

Limitations

- In some regions, sand is expensive or difficult to get. Slow sand filters require a substantial initial investment and dedicated operation and maintenance.

Remarks

- After re-sanding a filter it takes a few days to ripen; in this period water quality is lower.

Handout 6.9

Diesel engine

Operation

- The engine must be operated by a trained caretaker.
- Every engine has its own typical operating instructions.
- Before starting it, the levels of fuel, oil and cooling water (if not air-cooled) are checked. If these levels are low, extra fuel, oil or water has to be added.
- During operation, the fuel level, oil pressure, and engine speed are checked and also the functioning of the pump or generator.
- Some moving parts may need manual lubrication.
- When the engine is operated at very low speeds, its efficiency is low and carbon builds up rapidly in the engine, increasing the need for servicing.
- All data on liquid levels and running hours are written down in a log book.

Maintenance

- Every day the outside of the engine must be cleaned, and in dusty conditions the air filter must be checked and cleaned.
- Some parts may need manual lubrication.
- In moderately dusty conditions, oil-bath air filters are cleaned once a week, dry-paper air filters a little less frequently.
- The engine is serviced for preventive maintenance according to the number of hours it has run.
- Every 50 hours, the clutch (if present) must be greased.
- Every 250 hours, clean all filters (replace if necessary), change oil, check nuts and bolts and exhaust pipe.
- Every 1500 hours, major service overhaul with decarbonizing, adjusting valve clearance, etc.
- If the engine is connected to a pump or generator with a V-belt, this will regularly need replacement.
- Once a year the engine house must be painted and occasionally repaired.
- If a generator is present it will have its own maintenance needs. The Table below shows only the most important O&M activities.

Organizational aspects

- Diesel engines require a lot of simple maintenance and, if this is done well, they can have a long service life.
- Therefore training and supervision of the caretaker/operator are important.
- More complicated maintenance tasks and repairs have to be done by a well-trained mechanic with access to sufficient spare parts.

- Good organization will guarantee scheduled services at the right times and a quick response in case of breakdown.

O&M requirements

Activity	Frequency	Human resources	Materials and spare parts	Tools and equipment
Check liquid levels and add if necessary	Daily	Local	Fuel, engine oil, cooling liquid	Funnels, containers for liquids
Start and stop engine	Daily	Local		
Keep logbook	Daily	Local	Paper, pen	
Check air filter, clean or replace if necessary	Daily or weekly	Local	New dry paper filter, or kerosene and engine oil	Wrench
Check for oil and fuel leaks	Weekly	Local		
Tighten nuts and bolts	Weekly	Local		Spanners
Change engine oil	Every 250 hours	Local	Engine oil	Spanners
Clean or replace Filters	Regularly	Local	Oil filter, fuel filter	Spanners, special tools
Decarbonize, clean injector nozzles, adjust valves, etc.	Every 500 to 2000 hours	Specialist		Spanners, brass wire brush, special tools
Replace drive belt	Regularly	Local	Drive belt	Spanners
Replace engine parts	Occasionally	Specialist	Nozzles, injectors, gaskets, bearings, fuel pump, etc	Depending on part to be replaced
Repair engine mounting and housing	Occasionally	Local or area	Cement, sand, gravel, nuts and bolts, nails, galvanized corrugated iron sheets, wood, etc.	Trowel, bucket, hammer, chisel, saw, spanners, etc

Actors implied and skills required in O&M

Actor	Role	Skills
Caretaker	Operate engine, keep logbook, perform minor service, warn in case of irregularities	Special training is needed for basic diesel O&M
Water committee	Supervise caretaker, collect fees, organize major service and repairs	Organizational skills
Area mechanic	Perform major service and repairs	Special training needed
External support	Train caretaker and area mechanics	Training and technical skills

Frequent problems

- Excessive wear due to wrong O&M, neglect or misunderstanding.
- Rapid carbon buildup and low efficiency due to running the engine under full loading.
- Broken drive belts.

Limitations

- Frequent maintenance.
- High fuel costs and difficulty to get fuel.
- From time to time a specialist mechanic is needed for service and repairs.

Remarks

- Diesel engines are especially suited for high stationary power output.
- With good maintenance they are dependable energy sources.
- It is very important to select a brand of good reputation and locally available service and spare parts.

Handout: A

DACAAR/MRRD

O&M of Rural Water Supply Training course

For Water and Sanitation Engineers

Date: / / 2007

Participants' Profile

Name:

Designation:

Qualification:

Age:

Sex: M F

Work Experience with MRRD etc

Areas of Specialization (Program/ Project)

Major Training Courses Attended

Signature

Handout: B

DACAAR/MRRD
O&M of Rural Water Supply Training Course
For Water and Sanitation Engineers/staff of MRRD & PRRD

Date: / / 2007

Pre/Post Training Test

Name:

Father's Name:

Designation:

Please answer the following questions:

1. When development can be sustainable?

2. Why training of hand pump mechanic is important and explain hand pump mechanic responsibilities.

3. What are the probable dangers involved in maintenance and repair of wells and hand pumps?

4. Why involve community in management, operation and maintenance of rural water supply?

5. What is the operation and maintenance system of hand pumps/water points? Please explain.

Handout: C

Course Goal

To contribute to the sustainability of water supply programme and projects in rural areas

Course objectives

- To understand the MRRD and other NGOs O&M system
- To update knowledge on O&M issues
- To reinforce management skills on sustainable O&M
- To create specific approaches for better work and planning with communities
- To develop individual assignments based on the lessons learnt and each participant's workplace
- To understand the importance of community participation
- To implement effective O&M of rural water supply and sanitation services

Handout: D

DACAAR/MRRD
O&M of Rural Water Supply Training Course

For Water and Sanitation staff of MRRD/PRRD

Date: / / 2007

Date:
The following areas of course evaluation have been identified for getting your valuable opinion so that the course can be further improved.

1. The objectives of the course were achieved

1	2	3	4	5
Not Achieved				Fully Achieved

2. The contents are relevant to the job.

1	2	3	4	5
Not Relevant				Highly Relevant

3. The materials used in the training session were

1	2	3	4	5
Not Helpful				Very Helpful

4. The training methodologies used were

1	2	3	4	5
Non Participatory				Highly Participatory

5. The trainers involved were

1	2	3	4	5
Not Friendly				Very Friendly

6. Learning Environment was

1	2	3	4	5
Threatening and not open				Very open and Trustful

7. Food and Training Room was

1	2	3	4	5
Not Good				Very Good

8. Overall Organization of the Course

1	2	3	4	5
Not Good				Very Good

Comments (if any)

Handout: E

DACAAR/MRRD

O&M of Rural Water Supply Training Course

Date: From / / 2007 to / / 2007

S.No.	Name	Father's Name	Designation	Organisation	Province	Signature
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