[Workshop on village-level operation and maintenance of rural water supplies : papers]

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Existing Strategies for the Operations and Maintenance of Rural Groundwater Supplies in Malawi.

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Abstract

The majority of boreholes and some protected shallow wells (hand-dug) in Malawi are equipped with handpumps. Todate, there are an estimated 14,000 such handpumps of various types. In order to achieve the 74% target service ratio set for 1996, a further 16,000 handpumps would be required if the same technology for abstracting groundwater is employed.

At present, the handpump infrastructure is faced with severe problems of funding, inadequate and expensive logistics and spares procurement and distribution. Handpump maintenance is almost entirely done centrally. With the cited problems, 30% or more of the handpumps are at any one time out of order. Installation of more handpumps would be catastrophic if the maintenance system is not reviewed or other technologies are not explored.

Village or user - based maintenance systems whereby the handpump users themselves maintain their own pumps is a workable strategy as long as the handpumps used are simple to maintain, their spares are locally available at affordable prices and back stopping for major or expensive maintenance is available from Central Government. The Afridev Deep Well handpump is such one suitable pump in Malawi for such a system of maintenance.

Other strategies include contracting out maintenance responsibility at area or district-specific level or other suitable level, use of other technologies and standardization on handpump type used in Malawi. Meanwhile contracting work on handpump maintenance has not been effected by government.

There are 24 borehole maintenance units in the country effecting the central maintenance system and have average manpower force of 7 persons. Appendix 1.0 shows the maintenance units nation-wide and major intergrated groundwater projects.

Existing Strategies for the Operation and Maintenance of Rural Groundwater Supplies in Malawi

1. INTRODUCTION

Over 90% of the about 10,000 boreholes that have been drilled in the country are fitted with handpumps and serve the rural communities. The rest are fitted with powered pumps and serve small towns, institutions or are privately owned. Some of the protected hand-dug shallow wells (approximately 5,000 in number) have been fitted with handpumps. See appendix 2.0 showing the distribution of government owned hand pumps as per districts in Malawi.

1.2 The handpumps are targeted to serve 74% of the rural population by 1996. The 1987 population census showed that 89% of total population of 7,988,507 lived in rural areas. With the natural growth rate at 2.7 percent, the rural population for 1993 is projected at 8,342,154.

1.3 This rural population is served by the 9,000 boreholes and 5,000 protected shallow wells fitted with handpumps and by gravity water schemes.

As a handpump-equipped borehole is designated to serve 250 people and a protected hand-dug shallow wells fitted with a handpump is designated to serve 125 people, this infrastructure represents a coverage of 2,875,000 people or approximately 35% of the rural population. To achieve the targeted 74% coverage, slightly over 30,000 handpumps (ie over 16,000 more handpump-equipped water points) are required in the next three years (by 1996).

1.4 While the large shortfall in the handpump equipped water points is in itself a big problem, both the boreholes and shallow wells programme are faced with severe handpump maintenance problems.

1.5 There are more than ten different handpumps that have been used since the drilling of boreholes begun in the early 1930's. A lot of the pumps are heavy duty and require specialized tools and trucks to maintain them. A centralized maintenance system comprising of District/Unit Maintenance teams equipped with a truck and tools has been employed. Using this system, it costs approximately K1,000 per handpump per year.The use of mechanical or electrically driven winches no longer exists hence the use of manpower to physical perform the repair works, and implies extra costs as teams have to be large enough.

The handpump maintenance budget would thus be up to MK14m per year at present and MK30m at present costs in 1996 if the desired target service ratio is achieved. However, the

handpump maintenance effort is severely under funded. Current handpump (borehole) maintenance budgets have fallen below MK3m per year, while the number of handpumps has been increasing. The trucks are all old and expensive to operate.

1.6 Faced with these funding and logistical problem and the numerous types of pumps which require different spare parts nearly all of which have to be imported, the Ministry of Works has had to re-examine its strategies for handpump maintenance in the rural areas. A two point strategy is being adopted now:

(a) handpump standardization coupled with local manufacture of spare parts.

(b) village/community based (level) operation and maintenance of handpumps (VLOM) which is backed by monitoring assistants and the borehole maintenance teams.

Both these strategies are geared at reducing the recurrent budget for handpump maintenance. The departments staff structure is shown in Appendix 3.0 and a proposed new structure in appendix 4.0 delivery of services on maintenance of groundwater facilities is envisaged to improve under this structure.

2. CURRENT ACHIEVEMENT

2.1 The standardization on handpump types is necessary to limit the types of spare parts that have to be imported and also to enable the institution of a village based maintenance system. The ideal objective is to standardize on (a) deep well and shallow well handpump(s) that have inter-changeable spare parts.

While this is until now not foreseable, every effort should be made to use only those pumps whose spares are easy and affordable to buy at the user (village) level and which can be repaired and maintained by the user themselves with minimal technical assistance from the ministry. The use of special (expensive) tools and trucks should not be needed.

2.2 The Afridev Deep Well pump or equivalent with plastic downhole components has so far offered the best chance for achieving most of these objectives.

(a) It has now been established beyond reasonable doubt that villagers (women or men) can be trained to carry out maintenance on these pumps. This has been observed in four key projects in Malawi.

(a) Livulezi Valley Project
(b) Lilongwe North East Project
(c) Karonga Lakeshore Integrated Project and
(d) Community Based management of Rural Water Supplies Project.

(b) If a proper village based maintenance institution is built, villagers are able to step up their own maintenance system whereby they raise funds and buy spares they need for their own pumps. This has been under test in one project (Karonga) with overwhelming results. 95% and up to 97% of 295 Afridev handpumps have been kept operational every month (earliest pumps were installed in early 1988, the latest in early, 1991). The project uses one landrover pick up and 2 monitoring assistants on motor bikes supervised by 1 STA grade well maintenance assistant.

(c) Spare parts can be stocked and sold by private grocery owners provided a wholesaler is locally available. This is operating in the Karonga Project.

New projects including rehabilitation ones are using the Afridev deep well handpump with plastic downhole components.

2.3 The Afridev Deep Well Handpump has its own limits. Its optimum maximum lift is 45m. Other pump types are thus still necessary for specific purposes :

(a) Climax (English Specifications) for use where overhead tanks are required or for heavy duty use such as at schools and health centres, or for deep water table.

(b) Indian Mark II or Mark III for deep water table boreholes.

(c) Nira shallow wells in high population density areas.

2.4 On going rehabilitation projects will have replaced various 2,450 boreholes handpumps with the required Afridev handpump installed. See Appendix 5.0 showing the distribution of boreholes under IDA and UNDP/UNCDF rehabilitation projects currently underway. It is estimated that by 1996, more than 50% of the borehole for rural water supplies in Malawi will still have pumps other than Afridev handpumps. Coupled with the need for other handpumps for specific purposes (as explained in 2.3), this means that the system requiring maintenance trucks and units cannot be scrapped completely. Instead, the central maintenance system must only be streamlined to improve its efficiency. Also the village based maintenance system will need back stopping from the ministry (Water Department) for major or expensive maintenance works such as repair of rising mains or replacement of pumps heads.

2.5 The Central Maintenance System can be improved by :

(a) Contracting out some or all maintenance works at area-

specific level or other suitable level.

(b) Improving its fleet of vehicles.

(c) Pressing ahead with pump replacement programmes where the Afridev pump or equivalent are adopted as standard handpumps so that :

(d) the bulk of the maintenance can be left with the user-communities (reducing requirements for central system)

(e) limited types of spare parts need to be imported and stocked (reducing recurrent budget of Central System)

(f) local manufacturers be conduced to go into pumps spare parts manufacture as they would have a wide market if few (or one) type(s) of pump(s) are used in the country.

(g) adoption of other type of technology for abstracting groundwater such as use of solar powered water pumps.Much of the work in borehole rehabilitation works is instituting VLOM concept with an appropriate handpump installed. It is also a desire to have a VLOM component in the future groundwater development projects.

3.0 CONCLUSION

3.1 The current level of Central Government funding for handpump maintenance falls far below the required level to sustain the central system of handpump maintenance.

3.2 If an appropriate hand pump type is chosen and a proper institution is set up, user-communities are able to acquire enough skills to undertake a sustainable maintenance scheme for their own handpumps.

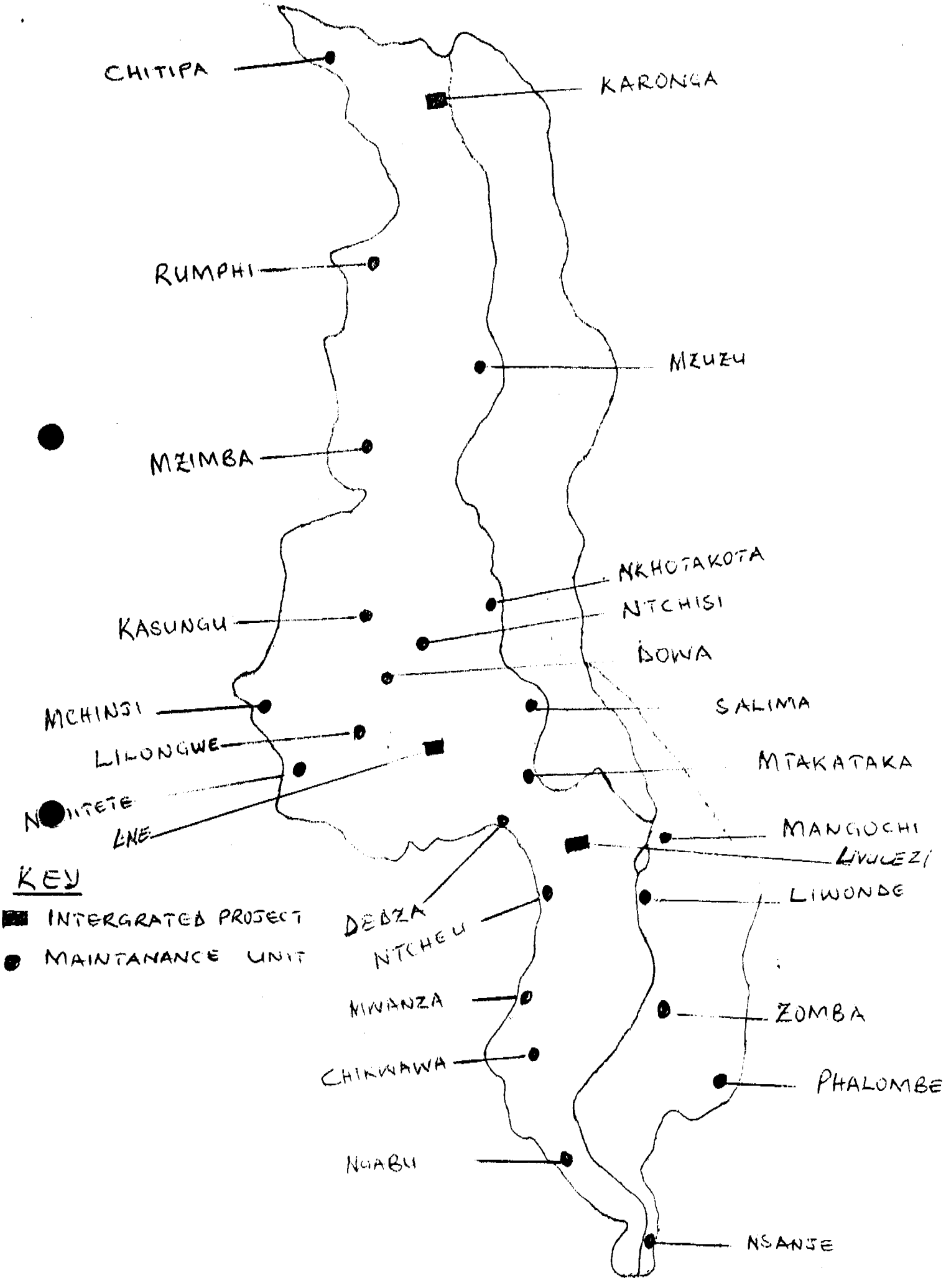
3.3 The Afridev Deep Well handpump with plastic downhole components has proven to be one of (if not) the pumps(s) to enable a village (user) based maintenance system in Malawi.

3.4 The Afridev handpump technology could well be supplemented by other groundwater abstraction technologies which would not have the maintenance problems faced with handpump technology.

3.5 Rehabilitation programmes on old wells must be looked as a tool to successful VLOM institution through the availability or placement of an appropriate handpump, and all major groundwater rural development projects must seriously consider concept of VLOM.

APPENDIX 10

MAP SHOWING BOREHOLE MAINTENANCE UNITS AND GROUNDWATER INTERGRATED PROJECTS



APPENDIX 2.0 BOREHOLE POPULATION DISTRIBUTION

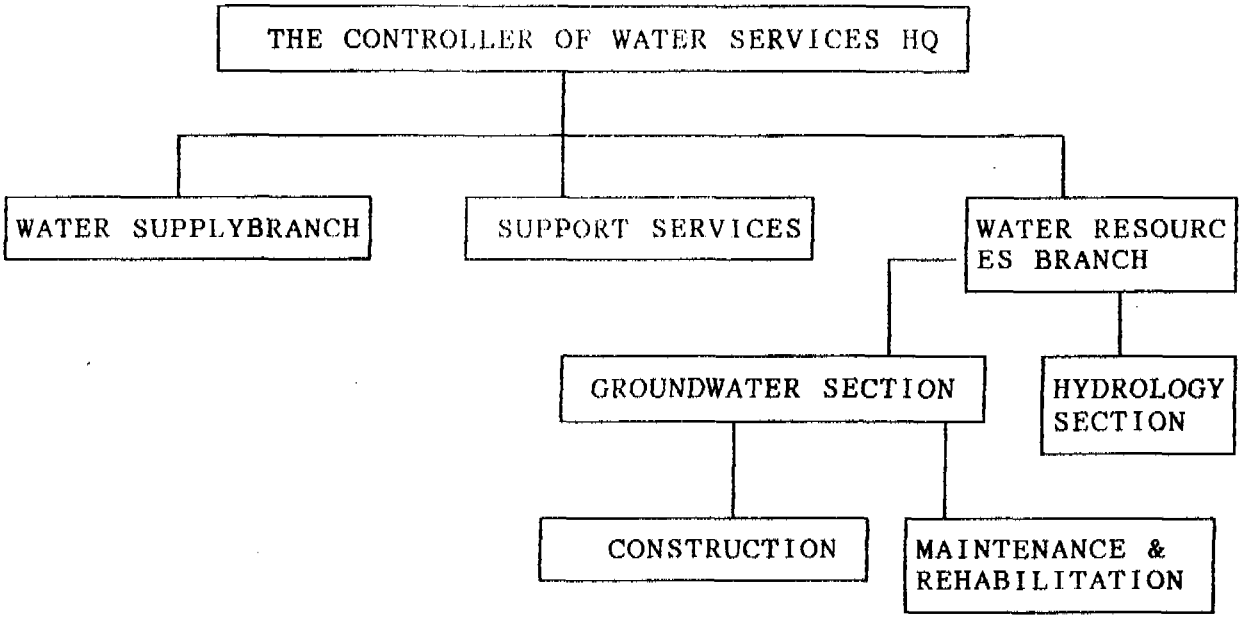
PER DISTRICT IN MALAWI (OWNED BY GOVERNMENT)

DISTRICT MAINTENANCE UNIT	TOTAL POPUALATION IN DISTRICT
CHITIPA	286
KARONGA	631
RUMPHI	304
MZIMBA	812
NKHATABAY	72
TOTAL	2,105
KASUNGU	323
LILONGWE	1399
DOWA	232
NTCHISI	135
MCHINJI	267
SALIMA	412
NKHOTAKOTA	221
NTCHEU	575
DEDZA	566
TOTAL	4,130
MACHINGA	329
MANGOCHI	455
ZOMBA	255
BLANTYRE	191
THYOLO	91
CHIRADZULU	74
MWANZA	128
MULANJE	174
NSANJE	362
CHIKWAWA	428
TOTAL	2,487
TOTAL	8,722

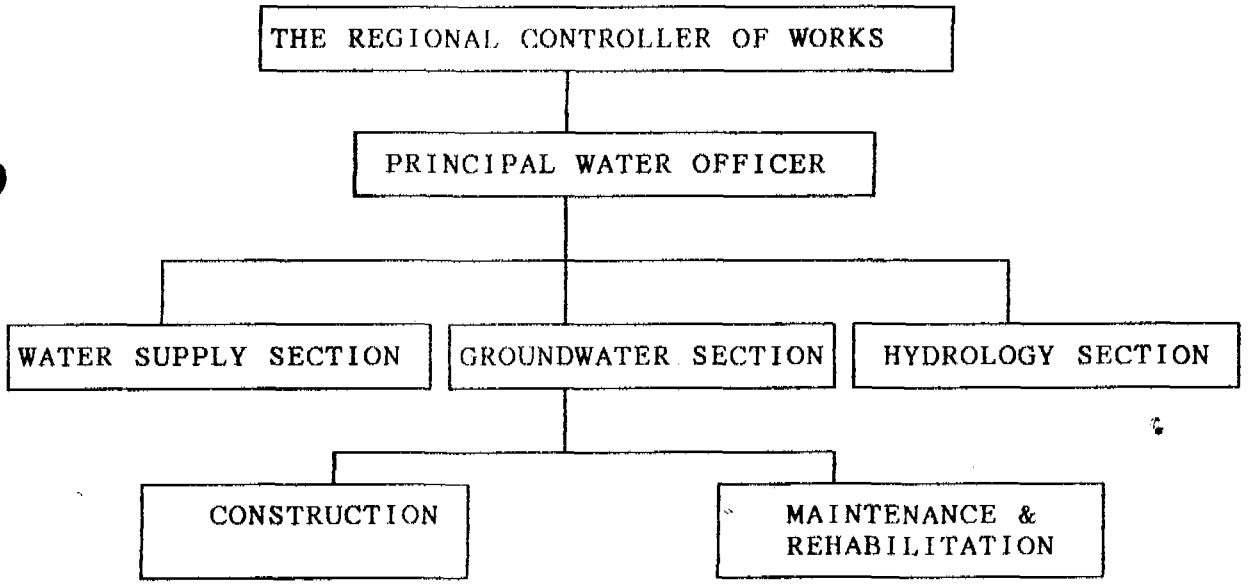
NOTE :- Some 1,011 boreholes are owned by UNHCR and other NGO'S in Malawi

APPPENDIX 3.0

EXISTING WORKING STRUCTURE (ON BOREHOLE MAINTENANCE)

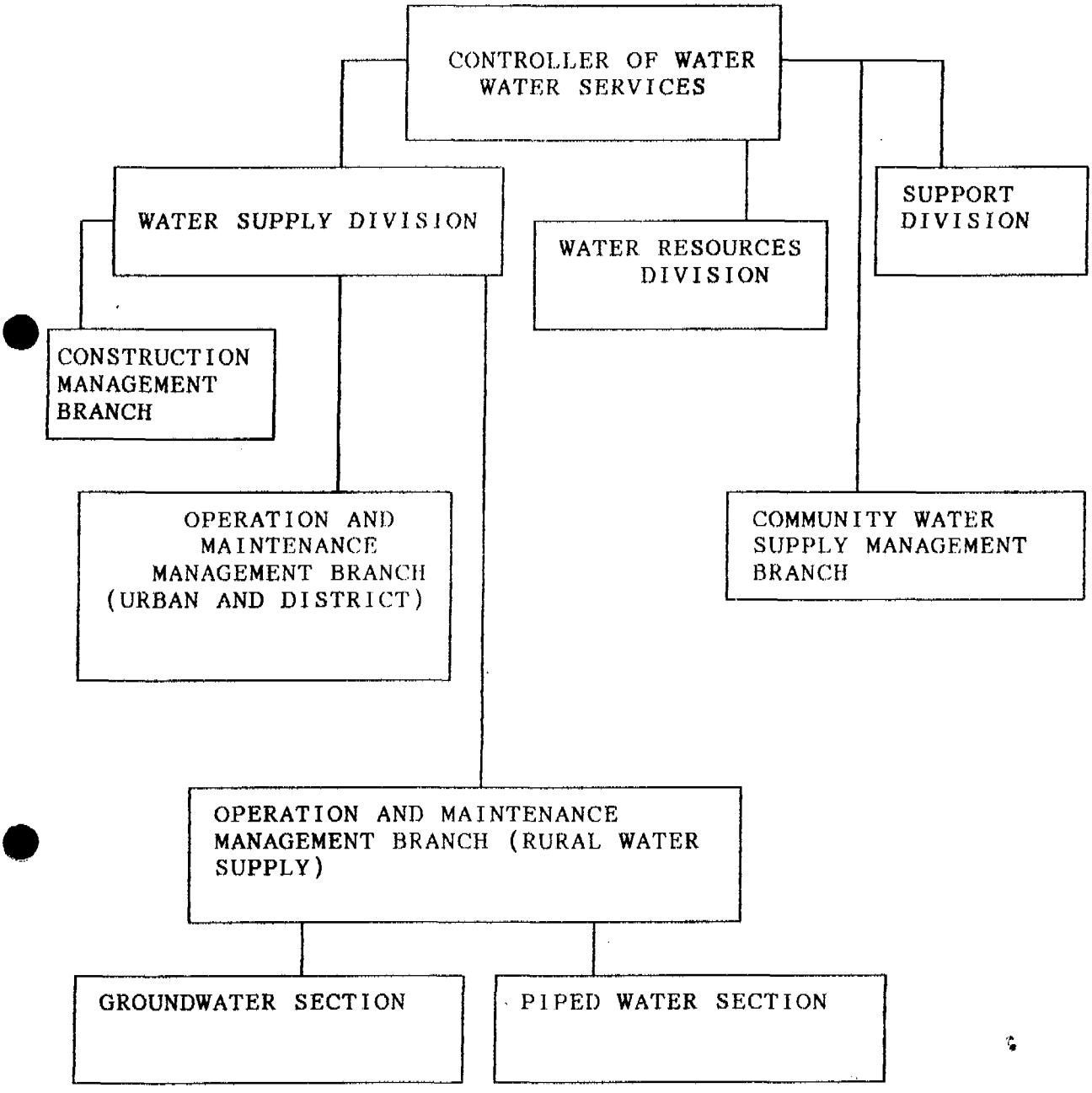


REGIONAL SETTING



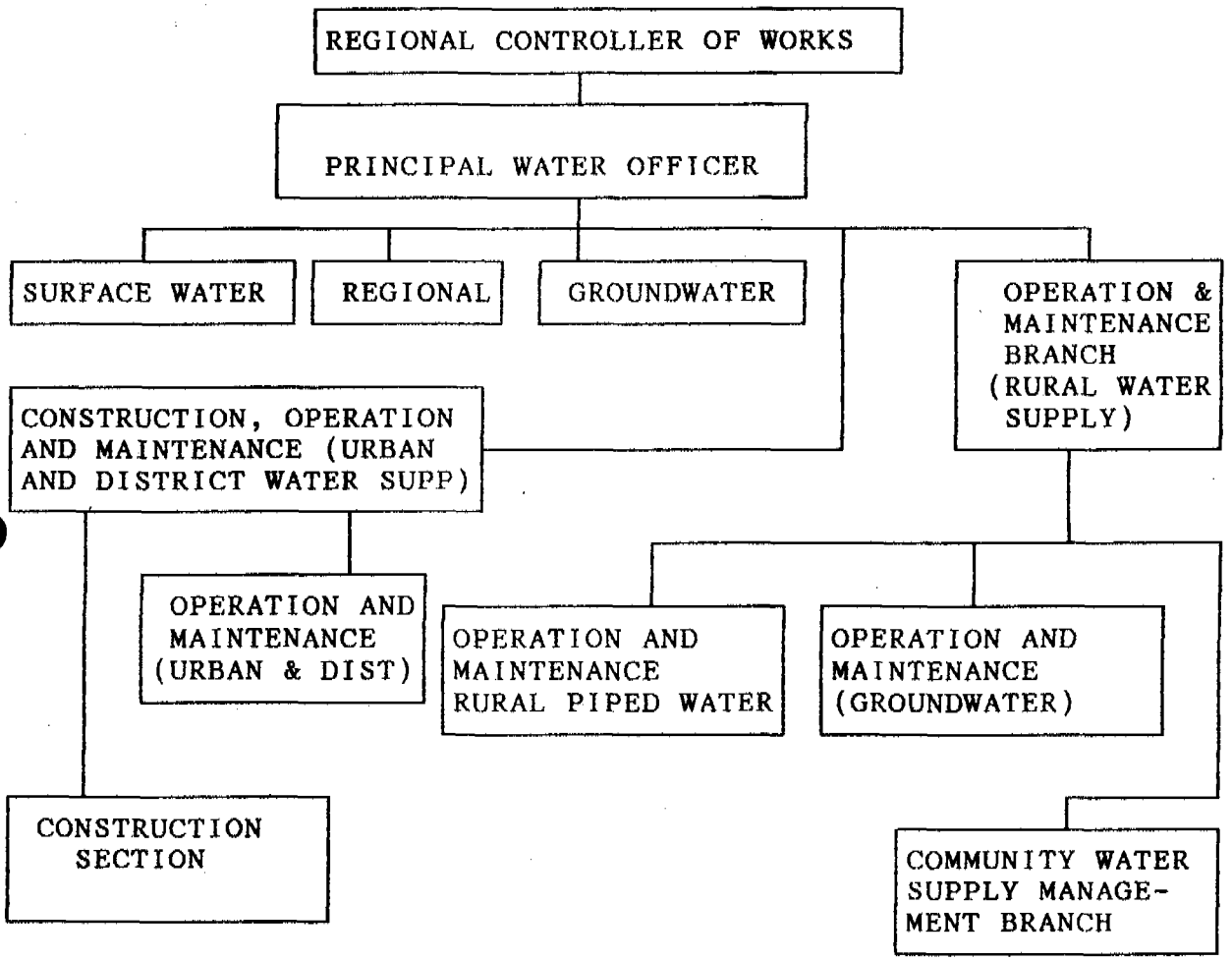
APPENDIX 4.0

PROPOSED WORKING STAFF STRUCTURE (ON BOREHOLE MAINTENANCE)



APPENDIX 4.0

REGIONAL SETTING



APPENDIX 5.0 DISTRIBUTION OF BOREHOLES UNDER REHABILITATION PROGRAMMES

FUNDING AGENCY	DISTRICT	TARGET BH POPULATION	APPROXIMATE AFRIDEV POPULATION
WORLD BANK IDA	CHITIPA	108	94
	KARONGA	43	325
	RUMPHI	100	87
	NKHATABAY	27	34
	MZIMBA	372	217
	KASUNGU	34	98
	LILONGWE	332	234
	DOWA	108	86
	NTCHISI	50	108
	MCHINJI	17	27
	SALIMA	70	66
	NKHOTAKOTA	37	17
	NTCHEU	67	94
	DEDZA	85	
UNDP/UNCDF	MACHINGA	144	70
	MANGOCHI	206	139
	ZOMBA	150	30
	CHIRADZULU	63	9
	CHIKWAWA	138	122
	THYOLO	63	7
	MWANZA	55	24
	BLANTYRE	94	36
	MULANJE	87	27
	NSANJE	0	123
TOTAL		2,450	2,221

REGIONAL WORKSHOP ON OPERATION AND MAINTENANCE OF RURAL WATER SUPPLIES, MALAWI 20 - 24 SEPTEMBER, 1993

Zimbabwe Experience
Mr Zanamwe - DDF
Masvingo

1. INTRODUCTION

PRIMARY WATER SUPPLY DEVELOPMENT

The Zimbabwe rural water supply sector has over the past six years experienced significant increases in the number of primary water supply facilities that have been made available for domestic use in communal areas. The majority (75%) of the country's 57 districts have in the last three years undertaken major water supply programmes on either small or large scale levels. Small scale borehole drilling and well digging programmes (averaging 20 new water points per annum) have been implemented in districts through Government's Public Sector Investment Programme and Non Governmental Organisation funding. While large scale integrated water and sanitation programmes have enabled many districts (35) to develop on average 50 new water points on annual basis through an inter-ministerial approach. Funding of such large scale programmes has been through bilateral agreements between the country and many other Governments. As a result of massive financial injection into the sector after 1987, the communal total of handpump fitted handpumps has increased statistically available water points from 12000 to about 25000 by end of 1992, representing 76% of the communal area people having access to improved potable water. The annual development rate of new water point facilities was notably raised to 1500 during the 1992 Drought Emergency Water Programme as the national drilling and well sinking capacity was increased with the engagement of more private drilling and well sinking contractors.

In an effort to ensure reliability of primary water supply facilities in the once neglected Communal Areas, the Government streamlined the operations of the District Development Fund, a technical arm of the Ministry of Local Government, Rural and Urban Development, by establishing a section fully responsible for the provision, maintenance and repair of primary water supplies in communal area. **Unfortunately the significant increase in new water point development has not been matched with a related increase in the financial resources for handpump maintenance requirements.**

Annual budget for primary water supply infrastructure development are estimated to amount to ZIM$...m, if one looks at the rural borehole drilling and well digging programmes currently financed by the Government, External Support Agencies and Private sector. A notable observation is the high number of financial resource sources for development purposes compared to the single source for recurrent expenditures. Currently, the Zimbabwean water sector has the Government, ... donors and several Non Governmental Organisation each contributing at least Zim$2m annually towards the development of new water supply infrastructures for the rural people. However, the annual maintenance allocation the sector receives from the Central Government (the sole source) for maintenance of only handpump fitted water supplies is just Z$..m, which fall short of the national maintenance requirement of Z$10m.

2. DEVELOPMENT PROCESS OF THE MAINTENANCE SYSTEM

Upon successful implementation of each rural water supply programmes, we as DDF and the Community enter into the long and more difficult phase of maintaining the facilities. Realizing the need to keep the water supplies in

operation, the Government established an Operation and Maintenance (O & M) section under the District Development Fund Water Division, in 1987. Also established in the same vein was the Department of Rural Department (DERUDE), which tasked with the responsibility of maintaining and repairing water points in the Resettlement Areas (former commercial areas settled by the landless peasants). The formation of a separate and a more decentralized O & M section, was a reflection of Government's commitment to its endorsement of the International Drinking Water Supply and Sanitation decade (1981). It also fulfilled the recommendations of our National Master Plan, for Rural Water Supply and Sanitation (1985) which covered an investment plan period 1985-2005.

However, before highlighting the limiting elements to sustainability of rural water supply maintenance, it may be fitting to give an outline of the development of the present DDF O & M Section's rural water supply maintenance system. The development can be classified into three distinct phases, namely;

a) the pre-1986 period - free for all
b) the 1986 to 1990 period - Government directed maintenance
c) the post 1990 period - Community Management demonstrations and other options.

PRE 1986 PERIOD - FREE FOR ALL

During this period, the development of primary water supply infrastructures was carried out by the Government agencies and External Support Agencies, as the responsibility of maintaining primary water supplies was left unclearly defined. Although District Development Fund featured as one of the many implementors which was also supposed to offer maintenance services, this was done in a disorganised manner.

The result of the above were the following:-

Co-existence of dual handpump maintenance systems in many parts of the country. The DDF through its self sufficient mobile maintenance unit (gang) became very popular throughout the communal areas as this was viewed by the community as a relief to maintenance problem. External Support Agencies, (Donors and NGOs) also facilitated this marginalisation of community efforts and participation in the management of their water supply facilities through support and strengthening of District Maintenance Team. In districts where the Lutheran World Federation (LWF) implemented community based well digging projects, a second tier structure that of a pumpminder was also established. This became a noticeable difference between Districts with or without LWF. The pumpminder system which was created as a community based maintenance structure was aimed at restoring community involvement in the maintenance of handpumps was found to have the following anomalies;

a) Different modes of transport, such as bicycles, motorcycles and even scotch carts, were used for handpump maintenance.

b) Although the workload was low, tools and equipment distributed to pumpminders were not adequate to carry out the required maintenance tasks.

c) The distribution of the Pumpminders was not related to the anticipated workload. The distribution was skewed depending on the point of entry of the programme with no relation to the workload or the distances to be travelled.

d) In some districts the Pumpminder coverage (which was ward based) was partial and hence one part of a district could have the 3 tier system while the other did not.

e) Some community participation was instituted but this did not result in all water committees being functional.

f) Where the government was involved in maintenance, the status of the employees in the maintenance system was not clear. Employees involved in maintenance were retrenched whenever the Authorities found it convenient. This showed that rural water supply maintenance was not a priority.

On the part of the Government, funds initially allocated for handpump maintenance were usually diverted to other uses. There was no system to monitor the expenditures and therefore maintenance suffered greatly.

The pre 1986 period therefore ended up with a mixture of maintenance structures, with a lot of overlaps and inefficiencies. There were probably no fixed rules to determine whether a governmental or community-based type of maintenance system, or whichever balance of both systems was the right choice. The system was generally found to be neither efficient nor sustainable.

1986-1990 PERIOD - GOVERNMENT DIRECTED MAINTENANCE

Based on the experiences of LWF in 45% of the country (most parts of Matabeleland, Manicaland, Masvingo and Midlands provinces), it was suggested in the National Water Master Plan that a three - tier maintenance system be established for handpump maintenance comprising of a District Maintenance Team, Pumpminder and Water Point Committee. At the same time the responsibility for maintaining all handpumps, piped water schemes and dams in the communal areas was given to DDF Water Division through its district level O & M Section. Necessary structures were established at Head Office, Provincial and District levels for water supply maintenance. Of particular interest was the Field Officer and the District Maintenance Team (DMT) at district level who became responsible for the actual maintenance and repair of handpumps.

Based on the recommendations of the National Master Plan for Rural Water Supply and Sanitation (NMWP), the District Development Fund established in 1987 an organisational structure to support all the other developmental agencies and render maintenance services throughout the communal area. Specific operational posts were created at Head Office, Provincial, District and Ward level for the envisaged efficient and effective execution of the operation and maintenance activities of the organisation.

Level	Operational posts (No.)	Overall roles/functions
Head Office	O & M Technician (1) Ass. O & M Technician (1)	Overall planning, policy formulation and provision of financial support for maintenance and repair work.
Province	Provincial Field Officer (1) Senior Field Officer (1)	Preparation of annual preliminary financial bids, communication link between Central (policy) and District (operational) levels, consolidation of district programme plans, technical support to the districts.
Districts	Field Officer (1) Field Supervisor (1) Water Supply Operative (+1)	1st Tier maintenance structure, carry out maintenance and repair work through community involvement. Identification of maintenance requirements and supervision of all water supply development projects.
Ward	Pumpminders (+4)	Repair and maintenance of all primary water supply facilities through their areas of operation, usually two wards per pumpminder.

In areas where the pumpminder system had been introduced by External Support Agencies, DDF took over in 1987, without clear guidelines on recruitment, job description, supervision and working conditions. It was also able to establish a vote to cater for pumpminder wages on an annual contract basis, but subject to annual renewal.

Development of this, maintenance system, although Government directed, was not uniform throughout the country. Marked improvement in the maintenance capacity for both the District Maintenance Team and the pumpminder was notable in districts which implemented integrated water supply and sanitation programmes. Most of the necessary maintenance requirements, such as transport, tools, equipment and spares, were/are easily made available through programme funding compared to those districts without integrated water and sanitation programmes. However, where the pumpminder system became more and more effective, its efficiency was compromised by the existence of the DMT, as the latter continued to directly carry out simple repair work.

The water point committees, comprising of four community members with 50% women membership, also became the third tier. Its initial roles were to carry out daily routine check of operational condition of handpump and its surrounding and submit break down reports to the pumpminder. The remuneration of pumpminders by the Government was observed to have created dissatisfaction among communities as this clearly demonstrated that the water point was for the Government.

Although this was essentially a centrally directed programme it did represent a significant attempt at decentralization. The systems could however be effectively operated with a financial budget of Z$10 to 13m which unfortunately has been difficult to receive.

POST 1990 PERIOD - PUMPMINDER SYSTEM AND COMMUNITY MAINTENANCE DEMONSTRATIONS

This is a distinguished period in the maintenance of communal handpumps as the Government realise the high financial burden associated with the maintenance of water supplies. All the country's districts introduced and strengthened the pumpminder system as the effectiveness of the DMT was weakened by the dismantling of the District maintenance gang. A total of 573 DDF paid pumpminders are deployed in the communal areas responsible for maintenance and repair of all handpump installed water supplies. Development of the pumpminder maintenance system is however limited to the Communal Areas, with the Resettlement and State land areas still being overlooked.

During this period the water sector adopted standard but somehow "inflexible" technology options. The model B Bushpump, a result of years of designing and testing was adopted as the appropriate handpump for the country. Unlike the old models, model B handpump has less moving parts, thereby reducing the maintenance costs. The handpump is viewed as appropriate for community based maintenance and management in that it is wholly manufactured in Zimbabwe. Subsequent innovation and wide scale testing of a Simple Weight Instrument for Lifting (SIWIL), developed for lifting pipes, was carried out late 1990. This greatly improved the maintenance capacity of pumpminders and has laid an ideal foundation for community based maintenance.

COMMUNITY BASED MAINTENANCE

As a result of sky rocketing prices of spares and shrinking resources in real terms for maintenance and rapid provision of new infrastructure the DDF began discussing the possibility of increasing the participation and involvement of the community in the maintenance of handpumps. This has been done through the establishment and demonstration of community based maintenance for handpump fitted water supplies. These demonstrations, which began late 1991 have been limited to two of the 57 districts of the country. The two districts located in the southern region of the country are in Agro-ecological region V, that is characterised by frequent drought spells and low annual rainfall thereby making surface water an unreliable source. Groundwater therefore forms the major source (96%) of domestic water which is exploited through borehole drilling and deep well digging and lifted to the ground using a robust handpump (Bushpump B model).

This is in fact the first Government - sponsored attempt at community based maintenance of handpumps in the country, a more genuine, revised and formalised pre-independence era situation. Introduction of the community based maintenance which began under the country's structural adjustment programme was in both districts made feasible through financial support from UNICEF. The financial support was mainly in the purchase and provision of required handpump maintenance tools and equipment, training of the village level bushpump mechanics and promotion of the strategy among different rural water related agencies. The District Development Fund, a technical arm of the Ministry of Local Government Rural and Urban Development responsible for the provision and maintenance of primary water supplies in communal areas, is the lead agency in the implementation of the project. Other support agencies that are involved

in the implementation include Ministry of Health and Child Welfare (MOHCW), the Ministry of National Affairs, Employment Creation and Cooperatives (MNAECC), the District Administrator's office and the District Council (local authority).

The principle on which Community Based Maintenance (CBM) is based is that the Community assumes responsibility for maintenance and therefore they make the detailed decisions on how the system will operate. The Government, through DDF and other agencies play a facilitating role in the process.

Experimentation of the system has been necessitated by the ever increasing dwindling of financial resources from the Central Government towards the maintenance of the completed facilities. Compounded by the increasing number of water points, the sustainability of the three tier maintenance system that was introduced mid 80s throughout the country has become more and more of a dream than a reality. If one looks at the NMWP proposed pumpminder distribution criteria, one per every ward, the country should be having about 1600 pumpminder. Using the current pumpminder wage rate, this would amount to Z$4.8m annual wage bill alone, excluding their transport requirements of a functional bicycle. Compared to national annual allocation of Z$3.5m, it is an unsustainable system for the economy.

Characteristic of the Zimbabwe CBM

Firstly, it is still an experimental project, currently introduced in only two of the country's 57 districts. In the first districts (Chivi) the project has been running for 18 months and only two of its ... wards. While in the other districts (Beitbridge) the project is being introduced using a modified approach of going through the community awareness and planning process.

Secondly, it involves the general acceptance of the principle that active community participation is required for sustainability. It is essential that this principle is deeply engraved in the hearts and minds of both the users and rural development extension staff. The users are viewed and have indicated to be capable of not only to carrying out maintenance work but also manage their water supplies, wherever they have been made aware of the Government's maintenance limitations.

Thirdly, it is a system that calls for a review of the roles and responsibilities of all rural water supply sub-sector actors. The Government, through DDF is now moving cautiously from directing community efforts to supporting community efforts, mainly on requests basis.

Fourthly, it is a system in which people carry out all the repairs on their own after undergoing the required maintenance and repair training sessions, run at district level by District staff. For the time being the DDF provides the required spare parts (distributed at VIDCO level), replace worn out or broken tools and also carry out major repair work such as welding and threading. Although this may change as in the future as centrally available funds become less and less.

Fifthly, it is a system upon which, its sustainability is dependent on the continued financial limitation of the Government, the number and operational conditions of the handpumps on system initiation.

Sixthly, its initiation and establishment calls for effective community consultation and awareness, which should be matched by political will to see it succeed.

What the system offers

Pumps which often took more than five days to be repaired by the pumpminder are now attended to within 24 hours.

The recurrent costs which have always been borne by the Government will in the long run be reduced, as pumpminder wages and high mileage charges are to be cut. The CBM has at the moment showed to be more superior over the expensive three-tier maintenance system. Supervision costs will also drop as the system gains ground.

User community groups and bush mechanic groupings have emerged, a good indication of a more informed, self motivated and organised community, aware of the water supply maintenance problems. Substantial VIDCO level maintenance fund have also been established.

A rapid assessment of the system has revealed that it is good candidate for replication, but with adaptation to suit other environmental and socio-economic conditions.

Community based planning has now started to gain momentum, and many community based promoters are appreciating this demand driven approach.

Major problems with this approach

a. The way in which DDF field staff and other Government extension workers operate must fundamentally change. We are much better at telling communities what to do than we are at facilitating the communities to THINK for themselves. (Guidelines for determining number of new water points required is statistically determined on the desk i.e. 250 people for a borehole, 150 people for a deep well community participation in the construction, given technology and service level.)

b. Its sustainability is based on a community based planning process, which unfortunately is still limited. Throughout the country of the only six districts that have had an exposure to this process, only two of them have adopted and utilised this process.

c. Most of the problems encountered are not technical but managerial and DDF is essentially a technical organization. Support from other Government agencies is limited because of other pressing needs and lack of funds. Communities are still largely dependent on DDF.

d. The teaming up of bush pump mechanics, while increasing the skill base has marginalised community participation.

e. Inheritance of old worn out unreliable water point facilities is detrimental to CBM success. Lack of strategies for handing over of completed water supply infrastructure to either the local authority or the community still remains an obstacle to active community participation, as the structures still continue to be viewed as DDFs.

f. Requires a high capital investment since more tools and equipment are now required.

g. CBM is still on experiment and a lot is being learnt.

h. The replacement of worn out tools and provision of spares is still not yet clearly defined.

SAMPLE ANALYSIS OF HANDPUMP BREAKDOWN REPAIR AND REHABILITATION WORK

TYPE OF SPARES REPLACED	UNIT PRICE			QTY USED		ESTIMATED COSTS		
	1987/88	1991/92	% INCRE	1987/88	1991/92	1987/88 Z$.00	1991/92 Z$.00	% INCRE.
Foot valves	$49.50	$89.00	80	748	761	37026	67729	83
Cylinders	$190.00	$484.00	154	600	709	114000	343156	201
Leather cups	$3.50	$6.00	71	2291	5421	8018	32526	305
Pump rods	$9.50	$52.00	447	1065	4076	10117	211952	2000
G I pipes	$63.50	$210.00	231	1313	3966	83375	832860	899
Base plate*	$15.00	$25.00	67	262	423	3930	10575	169
M 16 U bolt	$4.00	$7.00	75	222	243	908	1694	86
T piece*	$9.10	$15.00	65	350	252	3185	3780	19
Guide pipe*	$7.20	$22.50	213	279	393	2008	8842	340
Sleeve pipe*	$2.80	$15.00	436	216	281	604	4215	597
Bracket* arms	$14.00	$30.00	114	278	366	3892	10980	182
M12 U bolt	$4.00	$10.00	150	296	492	1184	4920	315
Wooden block	$18.00	$35.00	94	204	211	3672	7385	101
M24 U bolt	$2.00	$15.00	650	587	1146	1174	17190	1364
Pump stand	$160.00	$700.00	338	146	426	23360	298200	1176

For model A only

	1991/92	1987/88
nderground repairs =	78%	62%
boveground repairs =	22%	38%

he majority of underground repairs for 1991/92 were for replacement of leather cups (28%) a ossible indication of low quality standards of cylinders/leather cups or overuse of the the water upplies.

OVERVIEW OF THE WATER SECTOR IN MALAWI

BY

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ABSTRACT.

Malawi has abundant surface and groundwater resources that are being utilized to supply both urban and rural population. The Water Department within the Ministry of Works is responsible for water. Implementation of water programme is carried out by Government as well as NGOs.

It is important that statainability of the water supplies more especially those in the rural areas is acertained. This can only be achieved by transfering the responsibility of operation and maintenance to user community through a well established VLOM system on all water supply schemes.

Research programmes on handpump performance should be continued and monitoring of VLOM activities should be the mode for future programmes. The working of the National Steering Committee on VLOM should facilitate better working relationship among water supply implementing agencies.

Funding for water services more especially in the rural areas should be increased so that the intended targets are achieved timely.

INTRODUCTION:

Malawi is blessed with abundant surface and groundwater resources. The surface water resources occur in form of rivers and lakes. The largest water body being Lake Malawi which covers some 28,750 Km^2 and it the third largest lake in Africa (Fig. 1). The country also receives substantial rainfall averaging 1200 mm per annum. Due to very strong seasonality and considerable variation in total rainfall from year to year, surface water sources are very variable and therefore less dependent.

Groundwater in Malawi occurs in large quantities mainly in the two major aquifers of the weathered basement complex and the alluvium. The characteristics of the groundwater varies considerably depending on the formation in which it occurs. Groundwater from the basement complex is generally acceptable although localized quality problems do occur due to either natural or human contamination. While groundwater from the alluvium is generally more mineralized.

Both surface and groundwater sources are tapped for either rural or urban water suppplies.

Organization Of The Water Sector:

The programmes to supply water to both rural and urban population began a few years back. Until early 1980's the implementation of such programmes were disintegrated amongest the various institutions. The Water Department under the Ministry of Works (see Fig. 2) is responsible for supply of treated water in urban centres and protected piped water or groundwater to rural areas, assessment and development of water resources in the country and planning, design and construction of sewerage and sanitation works for certain town councils and municipalities.

FIG. 1.1)

MAJOR DRAINAGE SYSTEM

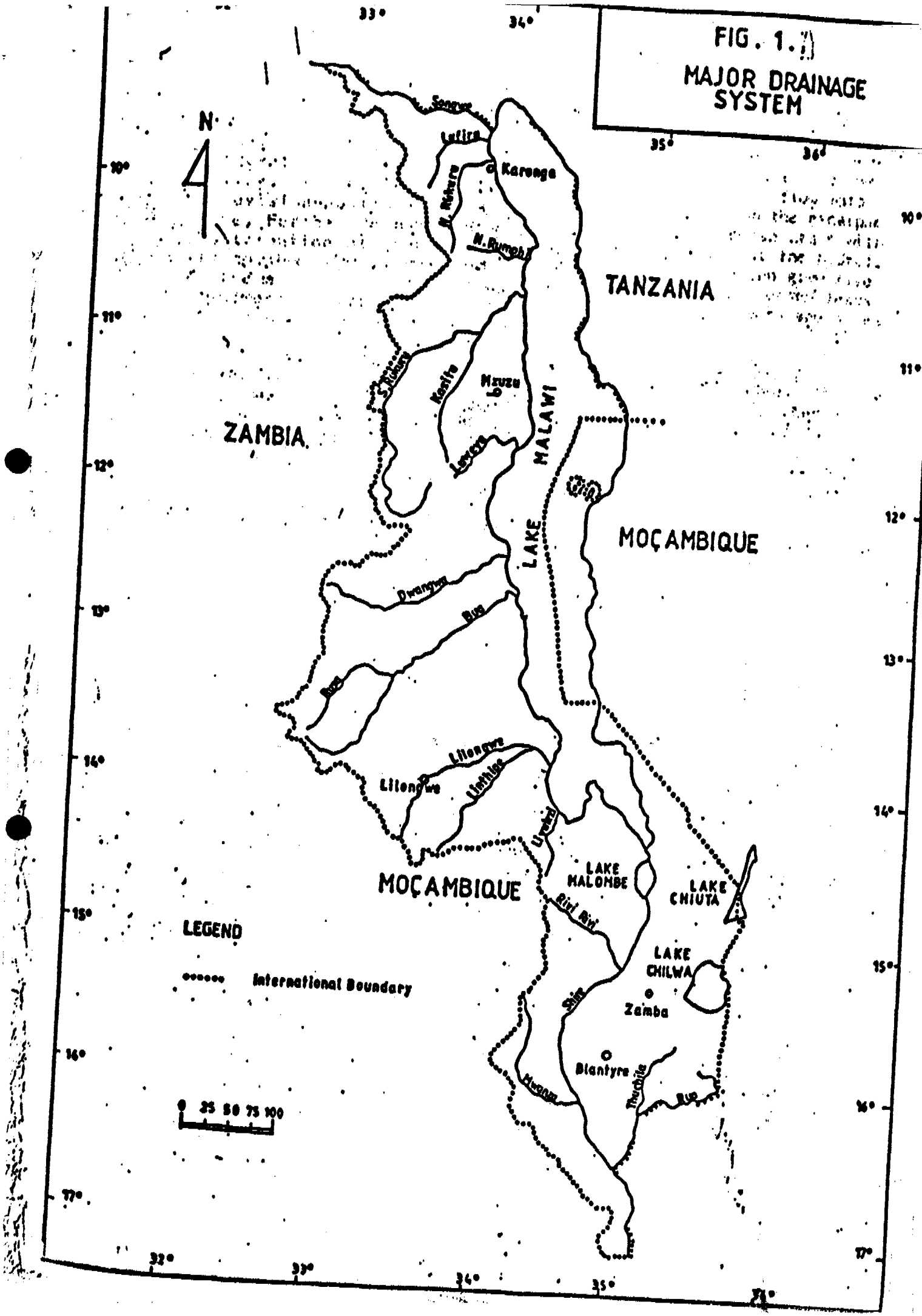
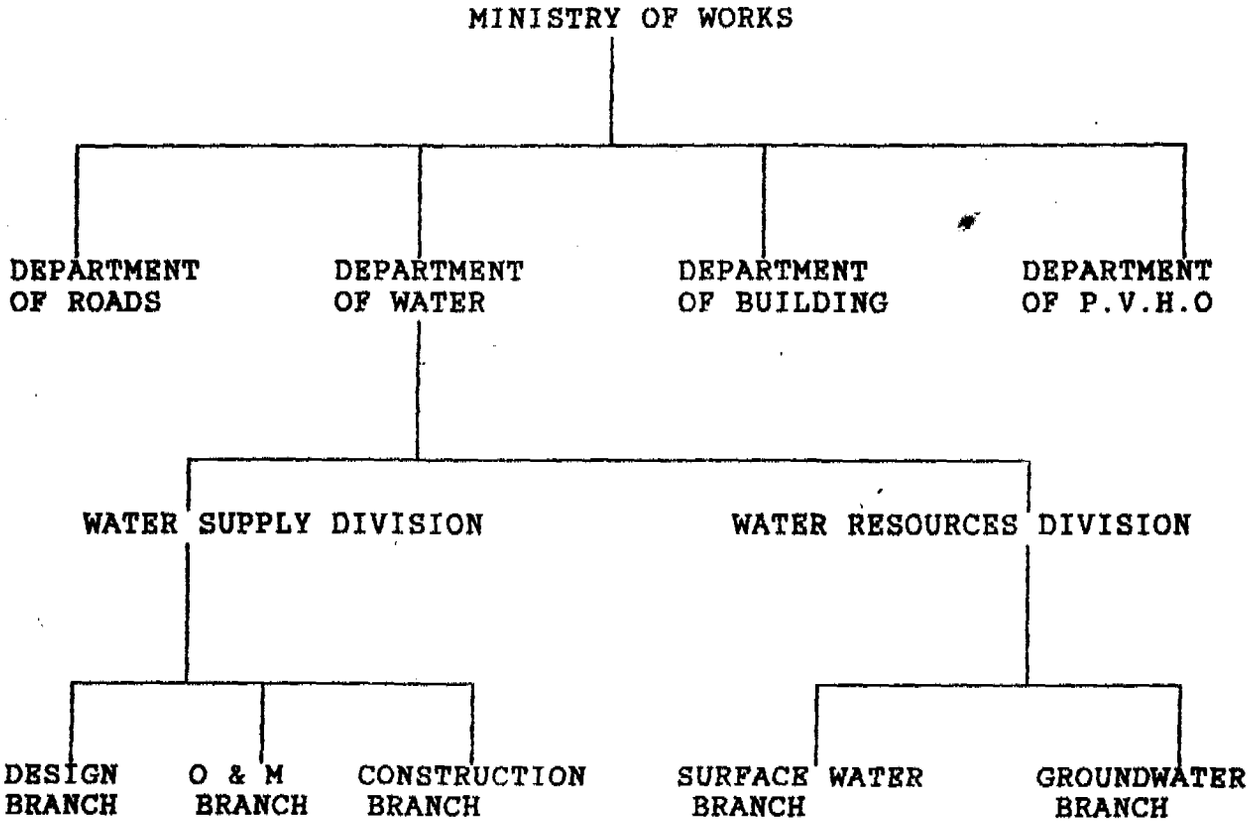


FIG. 2

ORGANIZATION STRUCTURE OF THE WATER SECTOR



Under the headship of the Controller of Water Services, the department is divided into two divisions:- The Water Resources and the Water Supply divisions. The Water Supply Division is responsible for the supply of treated water to all major towns except the cities of Blantyre and Lilongwe which have their respective water boards. The Water Supply Division also plans, designs, constructs and operates some institutional water schemes. Besides the urban water supplies, the division provides untreated piped gravity water supplies to rural areas whenever possible from surface sources in protected catchments. The water resources division is responsible for detailed planning of water resources utilization, water resources development, maintaining data records (hydrological and hydrogeological data) and liasion and information transfer between the Water Department and concerned agencies on the protection and utilization of all water resources. The Water Resources Division also plans, designs and implement rural groundwater schemes.

WATER SUPPLY DEVELOPMENT

The provision of potable water supplies to both urban and rural communities receives very high priority to the government of Malawi. Malawi has successfully undertaken several development programmes of water supplies both in rural and urban areas since independence. Water supplies are classified into two categories: Rural Water Supplies and Urban Water Supplies.

Rural Water Supply.

Rural water supply schemes are constructed by tapping both surface and groundwater sources. Gravity schemes tap surface sources from protected catchments where suitable gradients prevail while boreholes and protected shallow wells utilize the groundwater sources.

Gravity Piped Water Schemes.

The first rural piped water scheme was constructed in 1968 in Chingale area in Zomba District. There are now 56 gravity fed piped water schemes spread out in all parts of the country. The schemes are constructed on self-help basis and operation and maintenance is also largely carried out by the user communities themselves. The total rural population covered by the piped water schemes to date is 2.0 million (Table I).

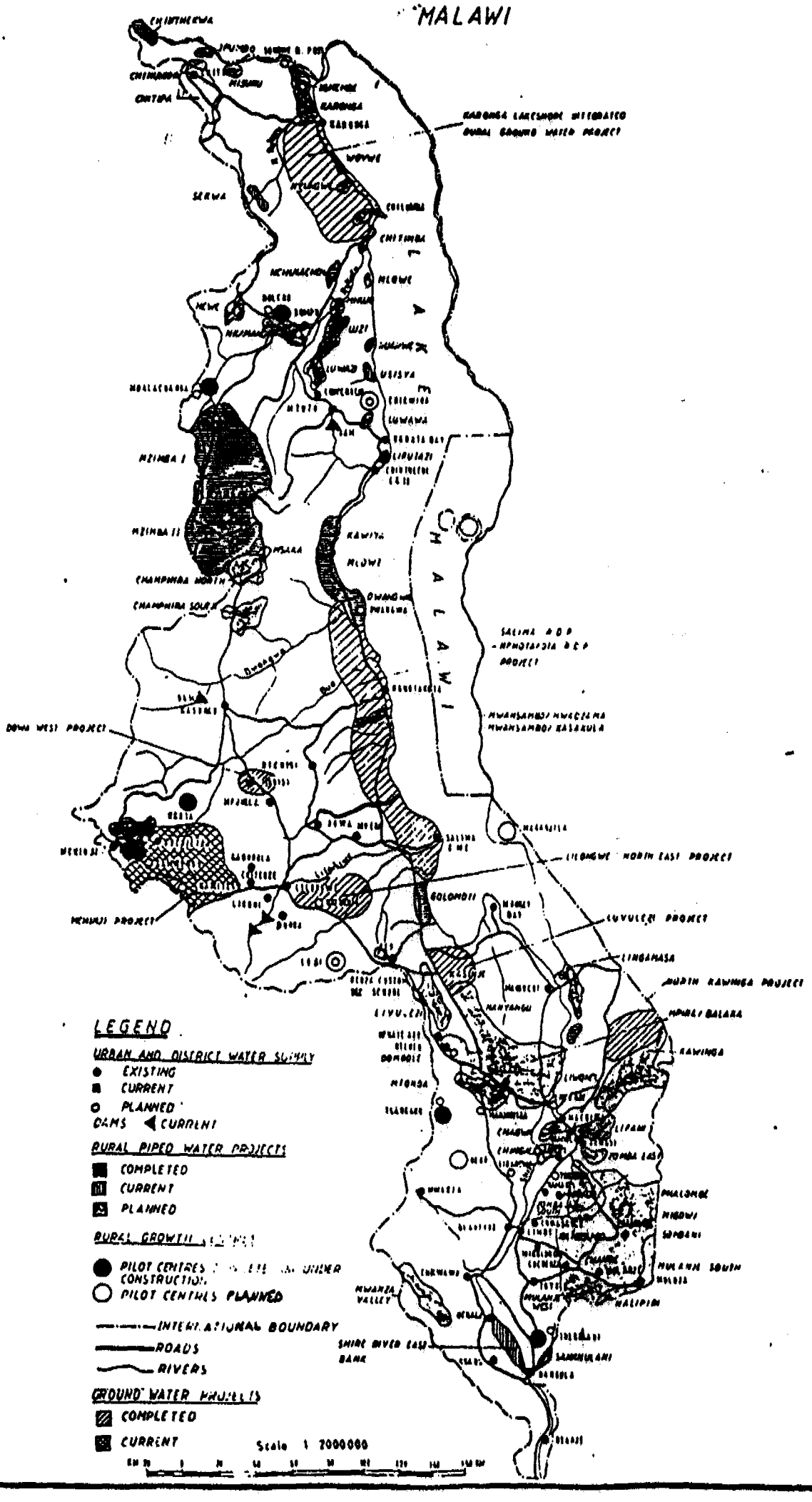
Rural Groundwater Supply.

Drilling of boreholes started in Malawi in 1930s with handpump installations. Groundwater supply development has continued to date under two programmes of shallow well protection and boreholes. The rate of installation has been variable over years with a peak of over 500 boreholes per year during 1970 - 1980 when there were large demand for improved water supplies in the Agricultural Development areas.

The programmes for protected shallow wells and boreholes developed rather independently and were dispersed in their approach. They proved to be difficult to manage and supervise with expensive overhead costs. During the 1980's the approach was changed to focus on specific area development.

Specific areas which may form part of basin or part of district are chosen and designated project areas for integrated development of old and new shallow wells and boreholes. The design criteria is to supply 27 litres per day per head within 500 metre distance one way in integrated projects. Using this approach integrated projects have been undertaken in upper Livulezi Valley, Lilongwe Northeast, Dowa West, Karonga Lakeshore and North Kawinga (Fig. 3). Three more such projects

EXISTING AND PROPOSED URBAN AND RURAL WATER SUPPLY SCHEMES IN MALAWI



are in progress in Mchinji, Nsanje and Machinga (T.A. Kalembo) districts. The Agriculture Development Divisions (ADDs) have continued to support groundwater development programmes along with other Government Ministries, NGOs and individuals. There are also three borehole rehabilitation projects underway in all the three regions of the country covering 2450 boreholes. The projects are dispersed in nature.

There are approximately 9000 boreholes and 5000 shallow wells fitted with handpumps dotted throughout the country (Table IIa, b). These serve an approximate population of 2,275,000 rural people. Another 1000 boreholes are motorized for use in urban or semi-urban centres or are privately owned.

Urban Water Supply.

The first urban water supply schemes date back to early 1950's. There are at present fifty two urban water supply schemes for district centres and townships. These utilize both surface and groundwater centres and the two water boards supply to an estimated population of over 1.1 million. 350,000 people for those supplied from the district and town centres while 771,000 from the two water boards of Blantyre and Lilongwe (see Table III).

In order to provide water to peri-urban dwellers who cannot afford individual connection the department has a communal water point programme. Under this programme, communal water points have been installed at locations where demand has been indentified through community participation. The consummers agree to form themselves into a Tap Committee which manages the tap and pays for the water consumed at an affordable rate. The programme has proved very popular and has managed to provide water to sections of the population who would otherwise have been unable to have had access to safe water.

WATER SECTOR DEVELOPMENT POLICY AND FUTURE PROGRAMMES.

The policy objective of the Malawi Government within the framework of the International Water and Sanitation Decade is the provision of clean water to all people inorder to reduce the incidence of water-borne diseases (50% of all illness in Malawi) and minimise the time devoted by individuals to water collection.

The Government policy over the next two decades is to steadily increase the proportion of the population covered by improved water supply to a targeted figure of 74% (current coverage is estimated at 58%). Important elements of this policy are high priority to water supply in the rural areas and maximising of financial and technical self - sufficiency at the community level. In terms of numbers the policy strategy is to meet a set of targets. For the rural population the target is the provision of 27 litres per head per day from groundwater sources and 36 litres per head per day from surface water sources through piped water schemes of safe water at a maximum walking distance of 500 metres (one way) where feasible.

With emphasis on rural water supply, future programme will largely dwell on the implementation of the National Water Development Project which has several components. As presently envisaged these components are likely to include:-

Rural Groundwater Supply.

Borehole rehabilitation programmes to contimine up to 4000 boreholes which will be fitted with VLOM handpumps (the Afridev). Construction of more new boreholes and hand dug wells in areas of need and establishment of an efficient VLOM system for all water points.

National Water Resources Mapping And Development Studies.

There is still need to map out all the potential water resources of Malawi and outline their development strategies in accordance with the population growth.

G.I.S. System.

The G.I.S. System will produce, replace and greatly expand database designs which could be capable of storing, evaluating large volume of existing and new information. G.I.S. System will be supporting tool for planning and analysis of water resources and supply for new and existing projects. It will be a tool for a firm decision making methodology which at the moment is non-existent.

Institutional Building.

The Water Department is currently restructuring its organisation and great effort is being done to employ new staff to fill in vacant positions. The department requires well qualified and updated personnel at all levels for efficient delivery of water services to the community. Thus, there is a great need to develop the local capacity and expertise for efficient planning, implementing and management of water services to nation.

In particular, the department will undertake the following improvements programmes:-

(i) Set up a Water Management Unit with the necessary tools for establishing an efficient nationwide VLOM system. The secretariat has already been put in place.

(ii) Put up Water Quality Monitoring Unit at each region including the development of laboratory workshops.

(iii) Set up a waste control unit for both rural and urban water supply.

(iv) Develop the know-how of incorporating environmental dimension into the water resources development activities.

CONSTRAINTS IN THE WATER SUPPLY SECTOR:

There are a few major constraints for the water sector development. These have mainly been the scarcity of skilled and semi-skilled personnel, lack of transport facilities, insufficient funding and use of inappropriate technologies as may be noted in rural groundwater schemes. These have adversely affected the operation and maintenance of water supply schemes and resulted in frequent breakdowns and premature replacement of costly facilities. The future programmes are being geared to address some of these issues.

CONCLUDING REMARKS.

The Water Sector aims at achieving 74% coverage of potable water supply to the rural areas by the year 2000. Assessment reports have indicated that 25% of the rural population will be served from surface water sources through piped water schemes while 75% will be tapping the groundwater sources. On the groundwater schemes, it is estimated that 30,000 handpumps will have to be installed for complete coverage. Thus it is therefore of extreme importance that an efficient system of delivery of water services be developed urgently if the intended targets are to be met.

In particular the water sector should undertake the following improvements among others:

- Establish a Water Management Branch within the Water Department which will be responsible for VLOM activities on full time basis. This will require funding.

- All projects on rural water supply being drawn up should always have a component on VLOM and donor agencies should be made aware of such approach.

- Programmes to replace old handpumps on boreholes and shallow wells with VLOM pumps should continue. The standarlization policy of handpumps should also be enforced in order to minimize the problems for procurement and local production of spare parts and therefore hinder progress on VLOM.

- Other technologies of abstracting groundwater for the rural areas should be investigated. These should include the use of windmills and solar power among others.

- Research programmes on statainability of rural water supplies under VLOM should be carried out from time to time and regional exchange of information be encouraged.

- The National Steering Committee on VLOM should commence to operate and that its membership should also include the relevant NGOs and some donor agencies.

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TABLE I .: RURAL PIPED WATER SCHEMES IN MALAWI

	NAME OF SCHEME	DISTRICT	REGION	POPULATION
1	Chinunkha	Chitipa	Northern	7500
2	Ifumbo	Chitipa	Northern	3000
3	Chisenga	Chitipa	Northern	69000
4	Iponga	Karonga	Northern	8000
5	Ighembe	Karonga	Northern	7500
6	Lufira	Karonga	Northern	45000
7	Chilumba	Karonga	Northern	4000
8	Msaka	Mzimba	Northern	7500
9	Nkhamanga	Rumphi	Northern	22000
10	Lifutazi	Nkhata-Bay	Northern	7000
11	Luwazi	Mzimba/ Rumphi	Northern	15000
12	Luzi	Rumphi	Northern	15000
13	Thunda	Rumphi	Northern	4000
14	Mhuju	Rumphi	Northern	2000
15	Ng'onga	Rumphi	Northern	4000
16	Hewe	Rumphi	Northern	15000
17	Nthalire	Chitipa	Northern	4500
18	Misuku	Chitipa	Northern	5500
19	Champhira North	Mzimba	Northern	36000
20	Champhira South	Mzimba	Northern	42000
21	Mwansambo/ Kasakula	Nkhotakota/ Ntchisi	Central	37000
22	Mwansambo/ Mwadzama	Nkhotakota	Central	24000
23	Mchinji	Mchinji	Central	37000
24	Lizulu	Ntcheu	Central	11000

25	Dedza	Dedza	Central	2600
26	Dombole	Ntcheu	Central	22000
27	Ntonda	Ntcheu	Central	46000
28	Kasinje	Ntcheu	Central	21000
29	Nanyangu	Ntcheu	Central	30000
30	Kalitsiro	Ntcheu	Central	
31	Chirobwe	Ntcheu	Central	
32	Mpira/Balaka	Ntcheu/ Machinga	Central/ South	354000
33	Lingamasa	Mangochi	Southern	18000
34	Chagwa	Machinga	Southern	13000
35	Doza	Machinga	Southern	1500
36	Mkala	Machinga	Southern	2000
37	Chinkwezule	Machinga	Southern	1500
38	Liwonde	Machinga	Southern	34000
39	Mirala	Machinga	Southern	19000
40	Lifani	Zomba/ Machinga	Southern	37000
41	Chingale	Zomba	Southern	9000
42	Kawinga	Machinga	Southern	105000
43	Zomba East	Zomba	Southern	156000
44	Muloza Crator	Mulanje	Southern	12000
45	Muloza Drift East	Mulanje	Southern	59000
46	Lichenya	Mulanje	Southern	69000
47	Nalipili	Mulanje	Southern	26000
48	Mulanje South West	Mulanje	Southern	30000
49	Mulanje West	Mulanje	Southern	160000
50	Chambe	Mulanje	Southern	9000
51	Chilinga	Mulanje	Southern	4000

52	Sombani	Mulanje	Southern	74000
53	Phalombe	Mulanje	Southern	185000
54	Mogowi	Mulanje	Southern	11000
55	Namitambo	Chiradzulu/ Mulanje	Southern	111000
56	Zomba West	Zomba	Southern	78000
57	Mwanza Valley	Chikwawa	Southern	60000
58	Makwawa	Zomba	Southern	24000

PLEASE NOTE: TWO OF THE 58 SCHEMES LISTED ARE SUB-SCHEMES. THE NUMBER OF ACTUAL SCHEMES IS 58.

TABLE II. (a) GROUNDWATER SUPPLY SCHEMES

e of eme	Funding Agency	Recepient Organization	Period	Cost Of Scheme	Target Population	Project Contents Boreholes / Shallow Wells		Remarks
				MK				
Dowa West	IFAD	Min. of Agriculture	1982 - 86	530,000	70,000	144 bh	190 SW	
Lilongwe North East.	IDA	- do -	1984 - 90	1066,000	91,000	512	235	
Livulezi	DANIDA/UNICEF	Water Department	1981 - 82	358,000	43,000	139	60	
Karonga Int. Project.	DANIDA	- do -	1986 - 91	565,000	75,000	300	0	Shared Maintencnce Scheme.
Mzgsweni	UNICRF	- do -	1986 - 89	286,000	22,500	40	20	
Dedza Hills	IDA	Min. of Agriculture	1987 - 88	650,000	71,000	167	220	
North Kawinga	JAPAN	Water Department	1989 - 90	989 Mill.	41,000	164	0	
Kasungu, Nchinji, Dowa East	IFAD	Min. of Agriculture	1987 - 90	820,000	62,000	248		All rehab. works on old wells.

. Salima -Bwanje	EEC	- do -	1987 - 90	1600,000	48,250	193	0	
D. Salima - Nkhotakota	EEC	- do -	1991 - 92	2500,000	50,500	53	25	
L. Nsanje	UNICEF	Water Department	1992	-	-	200	100	
?. Dowa, Kasungu, Mchinji	IFAD	Min. of Agriculture	1991 - 92	900,000	15,250	61	0	
. Namwera Mangochi	KFW	- do -	1989 - 92	2260,000	47,500	130	0	
. Central and Northern Malawi	IDA	Water Department	1992 - 94	USD 4.4 Mill.	262,500	1050	0	Rehabilitatio of boreholes only, in progress.
. Southern Region	UNCDF/ UNDP	Water Department	1993 - 95	-	250,000	1000	0	In progress rehabilitatio are major wor
. Mchinji	JAPAN	- do -	1993	25 bill. Yen	75,000	300	0	In progress.
. Kalembo	KFW	- do -	1992 - 94	MK 4 Mill.	56,500	226	0	In progress (preparations)

TABLE II. (b) NATIONAL BOREHOLE AND SHALLOW WELL POPULATION AS PER DISTRICT TO DATE 1993 WATER DEPARTMENT.

DISTRICT	TOTAL POPULATION IN DISTRICT		POPULATION SERVED (APPROXIMATELY)	APP. WORKING % OF WELLS	REMARKS
	BH	SW			
Chitipa	283	Nil	over 70,000	82	Majority population served by gravity schemes.
Karonga	628	Nil	over 150,000	93	Community based maintenance scheme operational.
Rumphi	303	105	over 75,000	94	Majority served by gravity scheme and the lake.
Mzimba	808	665	over 200,000	87	
Nkhata Bay	72	50	nearly 18,000	76	Served by the lake also.
(TOTAL NORTH)	(2094)	(820)	(over 513,000)	(86)	

Kasungu	323	632	over 80,000	80	
Nkhotakota	221	169	over 55,000	90	Served by lake partly.
Salima	412	202	over 100,000	85	Served by the lake and rivers.
Dedza	566	306	over 140,000	85	Served by lake and rivers.
Ntcheu	575	Nil	over 140,000	78	
Lilongwe	1399	690	over 350,000	70	Served by river also
Mchinji	267	Nil	over 66,000	85	
Dowa	232	809	over 58,000	75	
Ntchisi	135	526	over 30,000	75	
(TOTAL CENTRE)	(4130)	(3334)	(over 1019,000)	(80)	

Zomba	255	200	over 60,000	75	Gravity scheme serves some.
Mangochi	455	405	over 110,000	85	Lake serves part of population.
Machinga	329	230	over 80,000	85	Served by schemes also.
Chiradzulu	74	16	over 18,000	50	
Blantyre	191	Nil	over 47,000	65	
Mwanza	128	Nil	over 32,000	60	
Chikwawa	428	321	over 100,000	85	Served by gravity schemes also.
Thyolo	91	15	over 22,000	75	
Mulanje	174	65	over 43,000	75	Served by gravity also
Nsanje	362	263	over 90,000	85	Served by gravity scheme also
(TOTAL SOUTH)	(2487)	(1515)	(over 602,000)	(74.0)	
NATIONAL TOTAL	8711	5669	over 2134,000	-	

TABLE 11.1: URBAN WATER SUPPLY SCHEMES IN MALAWI

	NAME OF SCHEME	DISTRICT	REGION	CURRENT POPULATION COVERAGE
1	Mzuzu	Mzimba	Northern	55000
2	Mzimba	Mzimba	Northern	8500
3	Rumphi	Rumphi	Northern	12900
4	Chitipa	Chitipa	Northern	5000
5	Karonga	Karonga	Northern	21000
6	Ekwendeni	Mzimba	Northern	4000
7	Chintheche I	Nkhatabay	Northern	1200
8	Chintheche II	Nkhatabay	Northern	1200
9	Nkhatabay	Nkhatabay	Northern	8000
10	Chilumba	Karonga	Northern	4500
11	Bembeke	Dedza	Central	1500
12	Dedza Town	Dedza	Central	22000
13	Dedza Customs	Dedza	Central	100
14	Dedza Sec Scho	Dedza	Central	980
15	Ntcheu Town	Ntcheu	Central	5500
16	Salima Town	Salima	Central	10600
17	Nkhotakota	Nkhotakota	Central	10000
18	Ntchisi	Ntchisi	Central	3000
19	Dowa	Dowa	Central	2500
20	Mponela	Dowa	Central	4500
21	Likuni	Lilongwe	Central	8000
22	Bunda	Lilongwe	Central	1500
23	Mchinji	Mchinji	Central	5600
24	Mvera Army	Dowa	Central	Estimate not Made
25	Kamuzu Militar	Salima	Central	Estimate not Made

26	Kabudula	Lilongwe	Central	800
27	Kochilira	Mchinji	Central	1500
28	Kasungu	Kasungu	Central	16300
29	Madisi	Dowa	Central	4500
30	Zomba Town	Zomba	Southern	14000
31	Namadzi	Chiradzulu	Southern	3700
32	Domasi	Machinga	Southern	2000
33	Machinga	Machinga	Southern	4750
34	Liwonde	Machinga	Southern	
35	Balaka	Machinga	Southern	11000
36	Monkey Bay	Mangochi	Southern	4850
37	Namwera	Mangochi	Southern	2730
38	Mangochi	Mangochi	Southern	12680
39	Kuchawe	Zomba	Southern	270
40	Thyolo	Thyolo	Southern	12000
41	Mulanje	Mulanje	Southern	12000
42	Nsanje	Nsanje	Southern	11000
43	Phalombe	Mulanje	Southern	1500
44	Mikolongwe	Chiradzulu	Southern	3000
45	Mwanza	Mwanza	Southern	8000
46	Nchalo	Chikwawa	Southern	7500
47	Luchenza	Thyolo	Southern	7500
48	Chikwawa	Chikwawa	Southern	300
49	Muloza	Mulanje	Southern	6000
50	Chiradzulu	Chiradzulu	Southern	9000
51	Ngabu	Chikwawa	Southern	300
52	Bangula	Nsanje	Southern	(under Upgrading cater for 5,000)

TABLE IV.

NATIONAL BOREHOLE MAINTENANCE STATUS FOR PERIOD 16-30/07/93 WATER DEPARTMENT PHYSICAL PROGRESS AS PER DISTRICT

	(A)	(B)					(C)	(D)	(E)
		NOT WORKING							
DISTRICT	TOTAL IN DISTRICT	NEED FINISHING (B1)	NEED NEW * PUMPS(B2)	DRY (B3)	BROKENDOWN PUMPS (B4)	TOTAL NOT WORKING (BT)	WORKING	% WORKING	REMARKS
CHITIPA	283	(4)	5	38	34	51	232	82	MG 119E WORKING
KARONGA	628	-	25	15	10	45	583	93	MG 793G IN WORKSHOP
RUMPHI	303	(1)	10	2	24	18	285	94	MG 542H WORKING
NZIMBA	808	(6)	59	39	25	108	700	87	MG 334E STILL IN WORKSHOP
NKHATABAY	72	-	-	14	13	17	55	76	MG 704M WORKING
	2094						1855	89	
LILONGWE	1399	16	64	221	198	416	983	70	MG 157D WORKING
NKHOTAKOTA	221	NIL	7	30	9	30	191	86	NO VEHICLE
DEDZA	566	3	16	72	69	79	487	68	MG 794G BROKENDOWN
MCHINJI	267	4	3	37	63	41	226	85	MG 445N WORKING
KASUNGU	323	6	NIL	10	8	21	302	94	MG 157D WORKING
NTCHEU	575	6	47	35	30	47	528	92	MG 811G BROKENDOWN
SALIMA	412	NIL	2	12	10	12	400	97	MG 703H WORKING
DOWA	232	3	6	50	20	56	176	76	MG 279E IN WORKSHOP
NTCHISI	135	1	12	29	7	33	102	76	NO VEHICLE
	4130						3395	82	
ZOMBA	255	2	6	54	47	63	192	75	MG 578N WORKING
MANGOCHI	455	3	5	45	71	48	407	89	NO VEHICLE USED DC's
MACHINGA	329	2	2	33	22	38	291	88	NO VEHICLE
BLANTYRE	191	4	8	60	61	68	123	64	NO VEHICLE USED 446N
MWANZA	128	2	6	29	68	50	78	61	NO VEHICLE
CHIRADZULU	74	3	7	31	43	41	33	45	NO VEHICLE
THYOLO	91	2	4	22	-	24	67	74	NO VEHICLE USED 446N
MULANJE	174	0	2	41	58	41	133	76	NO VEHICLE
CHIKWAWA	428	5	4	49	86	58	370	86	MG 446N WORKING
NSANJE	362	1	2	49	7	52	310	86	NO VEHICLE
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REMARKS

1. A = BT + C 2. BT = B1 + B3 + B4 3. D = (C x 100)/A * DOES NOT MEAN NON - FUNCTIONING WELL

Keynote address

VLOM WORKSHOP : RYALLS HOTEL : BLANTYRE
KEYNOTE ADDRESS DELIVERED BY E.Z. LAISI
CONTROLLER OF WATER SERVICES

THE MINISTER OF WORKS HON. J.R. KANJERE
THE PRINCIPAL SECRETARY FOR WORKS MR. B.W. ZINGANO
MR. CHAIRMAN
THE FIELD DIRECTOR OF SAVE THE CHILDREN FUND(UK)
DISTINGUISHED DELEGATES
LADIES AND GENTLEMEN

I am privileged and honoured to have been requested to deliver a Keynote address at this very important workshop more so because I have always looked forward to an opportune time when experts of high professionalism like yourselves would come together to consider one of the most important items on the agenda of the Ministry of Works.

Mr. Chairman, the Ministry of Works has, through its Water Department, made greatstrides in the development of Water Resources in this country, continues and will continue to take these unparalled developmental efforts inorder to fulfil one of the goals of its mission statement which is to supply potable water to the Malawian community and so complement to the universal effort of national development. Water is commonly regarded as one of the most important felt needs of communities the world over. Suffice to say its not just water but rather water improved sanitation which forms the basis for development and contributes considerably to the improvement in the quality of life especially for women and girls. Convenient access to a safe water water supply source, Mr. Chairman, can and does significantly reduce the unnecessary, women and girl children have to undergo every day in Africa and indeed in Malawi as well.

In late 1992 the Ministry of Works collaborated with the Save the Children Fund(UK) to have a joint programme in the maintenance of some of the rural water supply schemes in the country as the effects of the drought then had overtaken the remedial efforts of the maintenance teams. Already at this point in time the Ministry of Works had recognized the fact that there was an urgent need to review the progress and relative success of the different operation and maintenance initiatives which had taken place in the country since the "Workshop on National Strategies for Operation and Maintenance on Rural Groundwater Supplies" held in Malawi in December, 1986.

This bilateral collaboration went further to include a proposal for a seminar on the Village Level Operation and Maintenance to facilitate a review of current efforts, to identify strategies and provide, if possible, a forum for proposals for pilot initiatives in order to test out the success of such strategies.

The objective of this workshop is to cover surface as well as groundwater supplies.

At a day in July of this year, Mr. Chairman, apart from the 56 gravity-fed rural water supply schemes, there were 9722 boreholes in the country. Today, this figure has been superceeded as more and more boreholes are being drilled and equiped. The present situation therefore should give us extra impetus to the great challenge which we already face in the maintenance of rural water supply facilities in this country and come up with concrete decisions and more with speed to implement them. The Ministry of Works has provided that of this population of boreholes in the country at least 70% of them are operational at any one time and this level is likely to increase with the current borehole rehabilitation programmes that are running and put in place for the North and Centre and the South respectively. With ever increasing demand for clean water in the rural communities, the need for long-term sustainable strategies for village level operation and maintenace becomes paramount.

The afridev handpump is labelled a VLOM pump and is part of the reason for its choice by the government as the standard pump. The concept of VLOM can vary depending on who is using it. The handpump manufacturers utilize the acronym as an ingredient to their marketing menu or trade mark to indicate that their product is fit for most rural communities for which it will for years live to satisfy they aspirations as only a few parts need to be changed.

Planners see VLOM as a way to privatisation thereby reducing the burden on government budget while government institutions directly responsible for rural water supply, regard VLOM as a means of reducing and indeed removing the pressure on already overburdened district maintenance teams. Both these views are valid but no one view takes into account the full range of structures required or needed too ensure that VLOM is not only a technical concept but equally a socio-economical concept which has a large community development component attached to its introduction an function. Once introduced VLOM is not static but is a dynamic process needing constant development and refinement to cater for the increased skills needed or already obtained by communities and thus increasing the possibility of the beneficiaries taking further responsibility within the system.

Initiated and running in advance of the World Bank - funded Borehole Rehabilitation Projects in the North and Centre has been the Community Based Maintenance project, which I will here refer to as the CBMP. This project has been seen to be running very well.

Yet one of the problems we have to accept is that the World Bank borehole rehabilitation programme involves the rehabilitation of boreholes throughout the country wherever a borehole is registered to require such rehabilitation. We may raise our eyebrows at this as to why it should be seen as a problem. However, at a district level this means that a number of communities will have had their borehole rehabilitated and be managing their own water supply with trained committees which

will strive to ensure the sustainability of their system. Meanwhile a neighbouring community with a borehole which was not in need of rehabilitation will not be trained in O + M of the handpump or raising funds for maintenance and will still be relying on the present centralized O + M system in which district teams will repair a broken down borehole although this can take up a long time. Thus, the sustainability of the CBMP initiative faces some hurdles. One of both things is likely to happen. Either the community with VLOM training by the CBMP will say, "Why should we pay for our maintenance and repair when our neighbours do not?" or the neighbouring community without VLOM training will say, "Why can't we manage our own system and receive VLOM training rather than rely on the Water Department and wait for a long time for the broken down supply to be repaired?"

Either way funding Mr. Chairman, is required for achieving district-wide coverage in community based management of water supplies. Decentralization of the Water Department's operations is therefore necessary. The establishment of relatively autonomous district offices would have several advantages in that they would be in a much better position to monitor the community's ability and resources required to maintain their water supply, they would be quicker to respond and more effective in providing training and maintaining folllow-up actions and activities. CBM activities have been possible in integrated projects and we now have to tackle the situation under the dispersed programme and this has to be done as soon as possible.

Mr. Chairman, part of what the SCF(UK) are trying to do in their USAID and ODA funded programmes is to test ways of reducing the current costs of the CBMP programme by shortening the length of training courses and trying to make them village-based rather than residential. The VLOM workshop should address such kind of issues and will, it is hoped, lead to a comprehensive analysis of the current situation in Malawi and the adoption of general principles to orient the development of concrete strategies. It is hoped that the meeting will lead to the establishment of an operation and maintenance strategy development task force which must follow-up on the meeting and develop these strategies recommendations and ideas generated at this workshop.

The task force should be interministrial involving those ministries which will have a part to play namely Health, Community Services, Agriculture and Works. The input of the University of Malawi would not ruled out.

One of the serious difficulties facing many developing countries in the water sector is the unwillingness by donor agencies to fund the operation and maintenance costs as they are seen to be recurrent costs which should be borne by the national government. However, the experiences of the 1980's have revealed that it is in many cases, completely hopeless to expect national governments of the developing world to meet these costs unless strategies to develop community management of water supplies are promoted which should have, as a principle objective, the determination of the means by which the community takes over full responsibility for their water supply. This means that at the community level, preventive maintenance and simple repairs need to be carried out

by trained villagers. However, in the foreseeable future there is likely to be an occassional need for expertise and equipment outside the capabilities and the capacities of rural communities. The lack of sense of ownership and responsibility of the water supply by the community leads to inevitable serious problems with future maintenance commitment.

The concept of community management implies that community members are active decision makers taking responsibility for and control over decisions affecting how services are provided and maintained. Sustainable services devolve upon this notion of power, authority and control in circumstances where communities are charged with a share of responsibility for the costs of operation and maintenance even more so when the costs are not necessarily financial. This concept suggests that the communities are able to organize and manage change. But they cannot be left to get on with it.

To ensure that community participation and management take place is rather a slow and complicated process void of established models and rules and not amenable to standardised and managerial techniques. It does conflict with technocratic efficiency such as the drive to meet construction schedules or to use up funds and is therefore very difficult for bureaucratic organisations to accommodate. In consequence the role of the expert must change from provider to that of facilitator. This shift in responsibility requires effective social research including participatory methods in order that the workings of communities be properly understood and appreciated and their own priorities identified.

It is felt that the objectives of the workshop would be better met by learning from the experiences of neighbouring countries.

Lastly Mr Chairman, Ladies and Gentlemen the workshop would wish to consider amongst other issues the following points:

(a) That there must be some water for all rather than more water for some.

The guiding principles would be:

(i) To improve environmental health through safe water supply and sanitation.

(ii) To initiate institutional reforms towards decentr-alisation.

iIi) To promote community ownership and management including the involvement and empowerment of women.

(iv) To promote innovative and sound finance and cost practices.

(b) INSTITUTIONAL ISSUES

Government should actively encourage and involve NGOs, community leadership, the formal and informal sectors in planning, design implementation, operation and maintenance. This can be achieved in forming national and local committees consisting of all concerned and ensuring adequate representation of women.

(c) The water resource department which is usually the key agency in government is not always fully equipped to deal with integrated and cross-sectoral approaches. More often than not this institutional constraint prevents, development of the integrated approach. In implementing institutional and financial reforms governments need to take the lead increasing innovative models of sector development by actively involving other ministries like those responsible for rural development, social and welfare, health, education and nutrition. As far as possible the implementation at local level should be coordinated by development oriented organisations keeping in mind that water supply and particularly sanitation issues cannot be exclusively solved through engineering solutions.

(d) The process of decentralisation will depend on the technology choice which should be cost-effective, simple, as far as possible indigenous, reliable, replicable and sustainable. Legal or administrative reforms if necessary have to be initiated to allow communities and in forming national and local committees consisting of all concerned and ensuring adequate representation of women.

(e) The promotional role of government will include support to the formal and informal sectors through human resource development, the provision of financial support to the communities through capital cost at the beginning, the provision of incentives like production bonuses, the provision of a standardised nationwide delivery system of spare parts to support the community-based operations and maintenance system, encouragement of NGO's as equal partners; privatisation of drilling and other services whenever they reduce the costs and improve efficiency.

(f) Achievable targets based on well defined criteria of target population selection, affordable norms of coverage and clearly set goals of activities.

(g) Effective donor coordination at national level towards low cost community-based approaches, effective community participation, standardisation, planning and implementation. Governments should take the responsibility of leadership with effective support from external support agencies.

(h) Formulation of a regional body to review progress and to provide regional directions to the campaign. Informal networking between major multilateral, bilateral donors,

international and local NGO's, governments and international and regional financial institutions would help to stimulate this initiative.

(i) Mobilisation of the entire population through communications and national campaigns for a healthy environment through supply of safe water and sanitation. High political profiles in such campaigns will go a long way to mobilise women, youth and children.

(j) Formation of water committees at a community level with majority participation of women will enhance community participation and sustainability. Sustainability cannot be achieved without full involvement of the community in the planning and design, implementation, operation and maintenance of the system. While government may support the community in the selection of affordable and sustainable technology, the community needs additional support in the steady supply of quality spare parts for maintenance. For capacity building and sustainability, governments and donors are important, and indigenous production of quality spare parts should be encouraged and supported.

(k) Human resource development not only in technical areas but also in the area of health education is essential for a sustainable programme.

The list is not exhaustive and distinguished delegates in this room would wish to add to it during the course of their deliberations.

The Minister of Works
The principal Secretary
The Chairman
Distinguished Ladies and Gentlemen.

The foregone points I have attempted to outline, should, I hope, stimulate further indulgence by us all into the work that lies ahead of us for the rest of the week and it would be sincerely appreciated particularly by the will-be-beneficiaries of this seminar if the recommendations turn into active programmes in the very near future.

Thank you very much for your attention and patience. Thank you.

P. 1-2

IS O&M OF RURAL WATER SUPPLIES AN ISOLATED PROBLEM ?

by Jo Smet
IRC International Water and Sanitation Centre, The Netherlands

Background paper to the workshop on
Village-level Operation and Maintenance of Rural Water Supplies

organized by Water Department and Save-the-Children (UK)

Blantyre, 20-24 September 1993

THE SITUATION

Every year the number of people in rural Africa that has no adequate drinking water supply grows. This despite the fact that through great efforts the estimated "coverage" of rural water supply in Africa increased between 1980 and 1990 from 22% to 32% (WHO, 1993). But the number of have-nots also increased from about 215 million to 230 million. What are we doing? Despite all the investments in the rural water sector (1.86 billion USD in Africa last decade) we can hardly cope with the annual population increase. And the estimated coverages are actually people reached, so we do not talk yet about the "effective coverage", i.e. the people whose water supply systems have not broken down and are really functioning.

But these are all Africa figures. So the question is: does the Malawian situation look different? The reported coverage (1991) of drinking water in rural areas is 58% (Mr R. Kafundu - w/shop 1993) or 3.6 million of the about 6.2 million rural inhabitants. The planning is to have the rural water supply coverage further increased to 74% by the year 2000. This means an additional 2 million people to be serviced since 1987 (Republic of Malawi, 1985).

Technologies, no. of systems and people envisaged to be reached by 1991 in rural water supplies by Water Department projects: (Statement of Development Policies 1987-1996 (DEVPOL)) are shown in the table below.

technology	no. of systems	no. of people served
boreholes	9,000	2,000,000
gravity piped system	56 schemes 11,100 standposts	2,143,000
shallow wells	3,000	750,000

However, Malawian water sector analysis reports that 30-50% of these systems do not function at all, not properly or intermittently. WHO reported that according to recent data O&M performance in many countries is deteriorating rather than improving.

We know that during the past decade the emphasis of the water sector was on expansion of the coverage through construction of new systems. External Support Agencies very much supported this emphasis as they have to report cost-efficiency of their aid through hard figures of achievements. Rehabilitation of broken-down systems and development of a reliable O&M system got low priority and as a result high numbers of water systems are not functioning well. This implies a low cost-effectiveness of rural water supply investments.

THE PROBLEMS

The following short historical sketch, but also valid for many present situations, illustrates the conditions and approach followed in rural water supply development.

Policies
Since independence politicians in many African countries have promised rural people that drinking water will be provided free. The governments reacted to this social commitment by installing standardized systems, designed and planned for in the national and provincial capitals.

Perception
The villagers mostly perceived the water supply as a free-of-charge service, as a gift, from the government to reduce their burden of living in the rural areas.

Technology
Building upon earlier experiences, the favourite technology was piped water supplies. Even treatment plants were often part of rural schemes. For reasons of investment costs and the low coverage figures, in the late seventies hand-pumped systems were introduced at a larger scale.

Community Involvement
The involvement of the communities was minimal until mid eighties. The programme approach was very much resource-driven planned from the central level. The surveys done by the Water Departments concerned the availability of water sources, the quality of the present water, distance to walk etc. Villagers were hardly asked to express their views on water supply and their preferences. They gratefully received the gift. Were they ever asked whether they wanted that type of system, that type of technology with such financial and technical implications? The technical departments overlooked the traditional water systems to which people were used and which had a clear position concerning ownership.

Only in the early eighties, community participation was introduced but in the beginning mainly as a free labour contribution to reduce the construction costs of the systems. Sometimes the "simpler"handpump systems were handed over to the communities after some technical training for caretakers but mostly without clarifying important issues as who owns the facility and the division of maintenance tasks. In the historical framework of free social and health services the community became often reluctant to take up the "responsibility" to contribute to O&M. And why should they? Were they ever asked whether they needed a new water supply system?

Management
The installed systems remained the property of the government. Furthermore, as most systems were beyond the financial and technical capacities of the villagers the government paid for all O&M costs. The operation and maintenance of the systems was done from provincial and/or district level.

The financial constraint

But....in the ever expanding coverage both in numbers and in more covered communities, the burden to manage and operate and maintain the systems becomes too big. Due to global and national economic recessions the really available national budget for O&M has decreased while the required departmental budgets for the operation and for the manpower, equipment, materials and logistics steadily went up as the number of systems to maintain went up. Structural adjustment programmes introduced in many East and Southern African countries led to significant cuts in the budgets of service-oriented departments such as water. department

Technology development

Handpump design and engineering is actually a young branch of industry. The type of pump required can not be compared with old Western-type of pumps where usually one household used it. The handpumps installed in rural Africa have to work under very hard conditions: up to 300 people and more get their water from one handpump, the operation by young and old people is often far from optimal, groundwater levels vary so pumps gets dry, groundwater may be aggressive or fine sand may intrude resulting in enhanced wear and tear etc. In some cases ESAs realized that the handpumps installed in the eighties were far from ideal, leading to increased maintenance costs. They therefore replaced the old pumps with new ones. The villagers get so the feeling that in future new pumps will be placed with donor support if serious maintenance problems arise again.

The need for handpumps resulted in many types appearing on the market. Each with advantages and disadvantages. It were particularly the ESAs which for political and economical reasons decided on the handpump type to be used. The result was a wide variety of handpumps mostly imported. The variety in pumps and need to import spares caused severe problems in spare parts availability in the rural areas.

Other common problems

* lack of maintenance capacities: manpower, transport and equipment
* unclear O&M responsibility
* insufficient revenues
* poor financial management by local bodies
* lack of monitoring, feed-back and communication
* poor construction quality of systems

Cost-effectivity

The above constraints result in breakdowns of the water systems. The downtimes of the systems may be very long depending on route of reporting and repair capacities of the responsible department. The result is as said earlier 30 -50% and more of the rural water systems are not functioning. Whatever the reason is, the result was that people went to their traditional sources, often less reliable, unsafe, further distance and less water. The limited amount of available water there and the poor water quality may substantially increase the health risks for the community. Donors and national governments aim for cost effective approaches. It is therefore of equal interest to donor and government to ensure that the systems they financed will be properly maintained to protect their investment and to contribute to economic development (Kalbermatten, 1990).

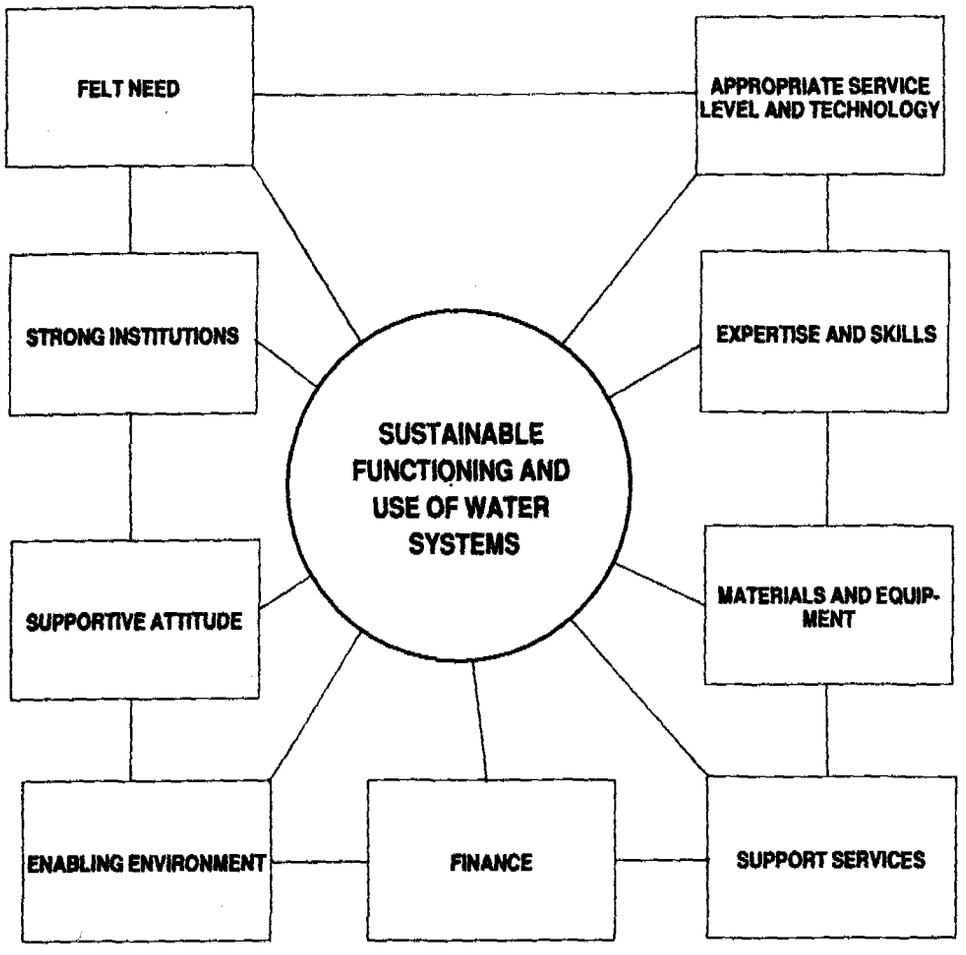
The alarming figures on poor functioning of the installed water supply systems and so the low cost-effectivity brought experts from DCs and ESAs together in the Collaborative Council's Working Group on O&M to discuss causes and possible solutions. This Group identified eight key issues contributing to poor O&M of water supply facilities (WHO, 1990):

* inadequate data on O&M
* insufficient and inefficient use of funds
* poor management of water supply facilities
* inappropriate system design
* low profile of O&M
* inadequate policies, legal frameworks and overlapping responsibilities
* political interferences.

The Information Package prepared for this Workshop gives full details of these causes indicated by the Working Group.

The wider setting

Poor operation and maintenance is often seen as the sole cause of failure of the water facilities. Actually, poor O&M is the result of a series of mistakes and short-comings in the approach and implementation of the programmes and projects. The inter-relationship between the key issues relevant for proper functioning and use of the rural water systems is given below. All key issues have elements for users, community and water agencies.



Felt need: expressed need for improved water supply; agency has willingness to support the communities in improving their water supplies

Strong institutions: community with recognized leadership, good organization and all groups represented; agency has defined responsibility, legal framework for autonomous organization and control

Supportive attitude: partnership approach to assist villages and acceptance of roles, responsibilities and ownership

Enabling environment: political will for community managed systems; clear policies; strategies; legal framework for ownership; backstopping role

Appropriate service level and technology: financially and technically feasible and sustainable technology and service level; effective demand as decided by community

Expertise and skills: managerial, financial and technical skills at community level; at agency level planning, implementation and backstopping skills; private sector implementation and technical repair skills

Materials and equipment: readily available and affordable materials for O&M

Support services: at community, agency and private sector level: back-up; maintenance; training; monitoring comm.-based OEM system

Finance: community level: to manage system including payment for O&M activities; agency level: to finance activities from planning to training and backstopping

The elaboration on these key issues for sustainable is given in the O&M Information Package appendix 13.

Isolating and concentrating on the direct O&M elements (i.e. technical skill training, spare parts availability) will most probably not result in long-term sustainability of the assets. Hence the functioning and use of the water supply systems would not significantly improve and the cost-effectivity remains low.

THE CHALLENGE

The challenge is to aim at sustainable development of the rural water sector using O&M as an entry and not as a goal in itself. Only then functioning and use of the rural water systems will be sustained and the high rates of breakdown and downtime will be diverted. Direct measurable results will be: minimized breakdowns, lower O&M costs and optimal socio-economic and health benefits for the users.

This challenge was clearly expressed during the Delhi Conference in 1990. There a statement was issued called "Towards a new philosophy on Operation and Maintenance". The statement indicated three fundamental changes to take place:

* the agencies should change their orientation and begin to perceive of their primary role as provider of a service to people and not the constructor of physical works;
* the agencies themselves should become autonomous in efficient and transparent management and financing of the services;

O&M SYSTEM DEVELOPMENT

Although global problems and solutions could be indicated, each country faces its specific problems and constraints resulting from prevailing conditions. Therefore a process aiming at improvement or optimization of the country-specific O&M system could be considered. The outcomes of this workshop will definitely make steps towards an improved O&M system. As constraints and problems will be identified and some solutions will be found, a step will be made in the direction of an improved O&M system.

For the improvement of the O&M system four main phases could be identified:

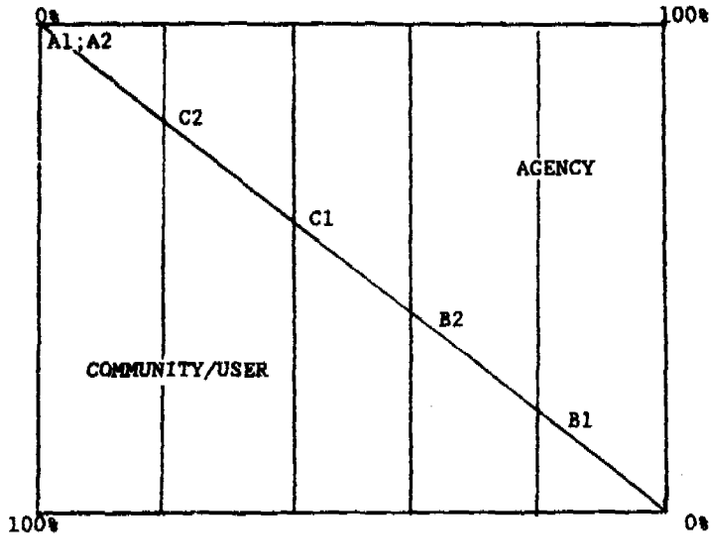
* Phase 1: review the existing O&M situation and indicate possible solutions
* Phase 2: develop a preliminary O&M system including issues related to the wider setting
* Phase 3: test this O&M system on feasibility
* Phase 4: expand the application of the field-tested O&M system

Each phase will have a number of activities and outcomes, leading to a flexible and region-adaptable O&M system which needs regular adjustment for improvement. Each phase should also have workshops and seminars to discuss with decision-makers and key-sector staff policy issues and managerial, financial and technical implications etc.

The partnership model

The provision and continuing of any water supply system involves costs and responsibilities which are usually shared between the agency and the community or users. The diagram shows the degree of responsibility of the water agency and the community/user (WHO, 1990).

The distances above and below the diagonal line reflect the relative responsibilities of each partner. Agency-managed systems are far right in the diagram; an example is a town-water supply system. Community-managed systems are far left; the traditional source is an example of such systems. All systems in between are characterized by a partnership between agency and community/users.



The degree the community will manage the water system in terms of finance, maintenance care, etc. may be the starting point for the development of the O&M system. The implications on managerial, financial, organizational, technical and manpower aspects should then be determined.

The following table is meant to guide the process of selecting technology, service level and O&M management system. Key points for consideration in the process are included.

Table: Selection Process for technology, service level and O&M management system (Draft)

Step	Key considerations	Key points
1	**INITIAL TECHNOLOGY AND SERVICE LEVEL ASSUMPTION** discussed with users and community based on assessed local conditions based on hydro-geological conditions	- improved traditional sources - bucket pump borehole - well with handpump - public standposts - house connections
2	**INITIAL DEGREE OF COMMUNITY MANAGEMENT**	- agency-managed - community managed - mix of management
3	**ACTIVITIES AND ACTORS IN O&M MANAGEMENT** - government authorities - water agency - community - users - private sector - ESAs and local NGOs	- detailed analysis of system - preventive maintenance - minor repairs - major repairs - revenue collection - monitoring - training
4	**TECHNICAL MANPOWER: SKILLS AND EXPERTISE** - at agency level - by private sector - at divisional level - at community level	- available technical skills - attitude and interest - salaries and remuneration - training need assessment - training for skills
5	**ORGANIZATIONAL CAPACITIES** - agency level - private sector - divisional level - community level	- reporting system - transport capacities - tools and equipment - materials - spare parts - distribution of spare parts - electricity, fuel, chemicals - price control - workshop management - legislation
6	**MANAGEMENT CAPACITIES** - are actors capable to take up roles/responsibilities - can management capacities be developed? - is management support available (facilitation)?	- decision-making process - leadership and authority - management capacities - management structure - legislation - ownership of system
7	**FINANCIAL CAPACITIES** - financial requirements - financial resources - agency level - community level	- legislation - financial resources - ability to pay - willingness to pay - revenue collection - payment system - cross subsidy - government subsidy - ESA/NGO support
8	**TECHNOLOGY AND SERVICE LEVEL MANAGEABLE?** at all involved levels otherwise chose other technology or service level	- discussed with community/users - discussed with private sector - discussed with water agency - discussed with legal bodies

There should be a process of consultation between the agency and the community undertaken by both parties as equal partners. The partnership starts from the very beginning of the project cycle, i.e. with the identification of felt needs, up to the management phase with O&M. The agency advises and supports the community in their efforts to improve the water supply situation. This advice includes the information on type of water sources and technologies most feasible for that specific community. This demands full consideration of available capacities and technology-related requirements in terms of technical skills, costs and management. The community and the users should have the final say in the decision. A mix of technologies and service levels may be the result (IRC, 1991). This partnership not only has to continue throughout the project cycl, including the monitoring and evaluation of all phases, but also after the project, when community and agency co-perate in maintenance of the system.

ELABORATION OF SOME KEY ISSUES IN O&M SYSTEM DEVELOPMENT

A number of key issues in a sustainable O&M system are further elaborated:

* Technology selection
* O&M management models
* Ownership
* Finance
* Information exchange

Technology selection

Most water projects need to involve a range of technologies and service levels. The aim is to match the needs, water resources, financial, technical and managerial capacities and willingness to pay of different community groups with an appropriate mix of technologies. For example service levels in piped water supply are house connections, yard taps, multi-family taps, neighbourhood taps and public standposts. For groundwater the technology choices would be open well, protected well with bucket and perhaps windlass, protected well with rope pump, borehole with bucket-pump or well/borehole with handpump. Technology upgrading from open well via protected well to well with handpump is a development route which is hardly followed, but which would reflect the increase in financial and management capacity of the community over time.

Family wells appear to be a big success in rural water supplies in Zimbabwe. The present implementation rate is about 5,000/year. Protected hand-dug wells with windlass and bucket are constructed by local builders with a low subsidy (US$ 3/capita or US$ 30/well) for individual or grouped families. The economic benefits pay back the investments in a few years time. Private sector involvement through local builders, tinsmiths etc. is obvious(Waterkeyn, 1993).

Does the VLOM pump exist? Many attempts over the last decade to design a pump that could be fully maintained at village level by trained village mechanics. "The dream of easy maintenance has only been partly realized", says Peter Morgan (1993). The village conditions are usually less favourite in terms of technical and managerial capacity than the manufacturers and project planners assume. In 1992 four international agencies took (UNDP/WB, UNICEF, CL, SKAT) (Baumann, 1992) the initiative to establish the Handpump Technology Network to ease the exchange of technical information on handpumps and to coordinate the research needs and results.

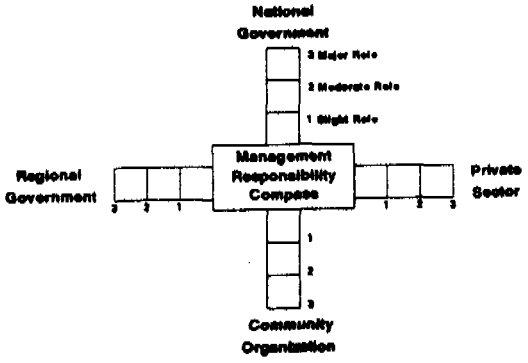
Standardization of the handpump is an important issue to address. Mudege (1993) mentioned that standardization has advantages in terms of limited range of spares parts required, and so the availability of spare parts in remote areas would probably increase. Training programmes and materials for caretakers and pump mechanics can concentrate on one pump type. On the other hand standardization has the disadvantage that the chosen pump will probably not ideal for all hydro-geological conditions. And competition between pump manufacturers may lead to better product quality and adaptation of pump parts to specific natural conditions and preferences of the users.
If different manufacturers will produce the same pump, still some competition in quality and price will take place.

A compromise may be found in the limitation of the number of handpump types per region of group of regions with similar /comparable hydro-geological conditions. This will also favour the availability of spares, and the rise of the interest of the private sector in the distribution of the spares in rural areas.

O&M management model

When analysing the present management of a water supply system, different models appear depending on the actors and the activities they undertake. The relative importance of each actor in the total O&M management can be graphically shown in a STAR diagram. The four legs of the star are: the national government water agency, the regional government water agency, the private sector and the community organizations (after Roark et al., 1993).

Star-diagram



Activities in O&M

To develop the best management model, an analysis of the O&M technical, organizational, managerial and financial requirements is needed for each water supply technology applied.
To facilitate the development of the management model the following systematic approach can be used:

- detailed description of the scheme (visualization)
- detailed description of O&M activities
- detailed description of O&M requirements
- detailed identification of tasks and responsibilities
- identification of actors for each task/responsibility

Actors in O&M

A great number of actors may be involved in the various tasks and roles in O&M of the water supply system. Each has its own potential and limitations. They together create the enabling environment, one of the ten key elements for sustainability (see appendix 13).

Six main actors:

a. Community: Users, users' groups, caretakers, local craftsmen, community water committee, other committees, local leaders,

b. Private sector: Local entrepreneurs, local craftsmen, mechanics, local hardware store, cooperatives, spare parts wholesalers, spare parts producers, bankers

c. Public authority: Administrative bodies at local, district, regional and national level (Rules, regulations, and legal and institutional framework)

d. Water agency: Maintenance team (major repairs etc.), training team (technical, bookkeeping, organizational), monitoring team

e. Local NGOs: Active in sector (funding, training, development issues, etc.)

f. External support agencies: Multi-lateral and bilateral aid agencies, international NGOs and Development Banks

Common O&M management systems used in Southern Africa are the three- and two- tier systems.
The three-tier system has: (i) village-level caretaker for preventive maintenance; (ii) area-based pump mechanic for minor repairs; and (iii) district/region-based for major repairs.
The two-tier system has: (i) village-level caretaker for preventive maintenance; and (ii) area pump mechanic usually paid by the government.

In the Village-Level Operation and Maintenance (VLOM) system or one-tier system all capacities required are available at village level: caretaker and village mechanic

If operated well, the advantages of the three-tier system are (Mudege, 1993):
* opportunities for on-the-job training of local personnel
* good linkage between users and responsible institutions (water department)
* effective monitoring system
* equity in provision of services

On the other hand the disadvantages of the three-tier system are:
* system is resource-driven and not demand-driven
* overlapping responsibilities of pump mechanic and district maintenance team
* centrally-directed system and hence expensive

* no room for local initiatives and local response, also because ownership of system is not clearly spelt out
* limits scope for community management, community and users role, technology choices and accountability
* long downtimes due to long reporting lines

The disadvantages become fewer in the two-tier system. The one-tier system misses the linkage between users and responsible institutions. The capacity of the community/users to manage their systems determines their functioning.

With the constraints and problems indicated earlier, the feasibility and replicability of the three-tier system is very limited for rural water supply systems. As one of the option for improvement the privatization of the presently government-employed area mechanics could be considered.

Ownership

Many projects are very unclear about the ownership of the wells and handpumps, and piped schemes and standposts. In most situationsvillagers accept the handed-over wells/handpumps/systems, sign the agreement on division of tasks etc., but feel that the system is still government-owned. Unless they are forced, people may not be very willing to invest their hard-earned money in a technology which may not work for long; they also look for value for money.
Often there are no legal arrangement for communities to own their water supply system. Village structure exist often of a number of clusters of households. Sense of ownership is crucial for the cohesion of the users group and the willingness to keep up "their" supply. This also leads to the logic consequence that the owners decide on location, type of technology, service level etc.

Family ownership or users' group ownership (multi-family group).
A community is a dynamic social entity with many social factional aspects. Many projects expect the establishment of a community organization around community water facilities. But is there a common interest in a community water committee? Has this committee got the trust of the people? Are water services equally distributed to all money contributors?
In general, water point management is easier for cohesive groups of users: a multi-family or neighbourhood group. Villagers may be ready for this approach but projects not. Especially in a resource-driven approach, the identification of a larger group or the whole community that shows interest makes the project planning and implementation easier. The smaller the number of users the easier the management. But certain costs can not be borne by one users' group: e.g. major repairs, replacement, expansion/extension, there a village development fund (not for water supply issues alone) could come in.

Finance
Financing is at the heart of the management of water systems. It is the key to the sense of ownership. Issues for deliberations remain the dilemmas on whether all costs should be

recovered or only part, thus cost recovery or resources coverage. Essential is whether the community sees the value of the system and is willing to pay for it.
Transparency of financial management is another key issue, that means adequate book-keeping and regular review of accounts.

Ability and willingness to pay are important issues but would not cause constraints if the technology and service level selection is based on reliable information on expected O&M costs.

Information exchange

Information is a most important management tool. Decision makers at community, agency and government levels need to know when problems are starting to develop and to have access to data from other projects, or even from other countries, where similar situations may have arisen. Collection and exchange of information should therefore be a priority in the organization of programmes. Guidelines on the establishment of simple project-level information exchange system is given in "Framework for Technical Information Exchange" (IRC, 1988). Agencies can help themselves to build up knowledge and experience of successful approaches by linking monitoring and evaluation of projects to the performance and use of installed facilities. These type of data help to steer planning and design of future programmes, and their collection can be initiated simply and cheaply. (Partners for Progress, IRC 1991)

CONCLUSIONS

The challenge is to aim at sustainable development of the rural water sector using O&M as an entry and not as a goal in itself. Only then functioning and use of the rural water systems will be sustained.

A process of improvement of the present O&M system to arrive at a sustainable O&M system is to be started. This workshop is just one step in the direction of this process but continuation of the intellectual process and testing is needed.

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OPERATION AND MAINTAINANCE STRATEGY FOR RURAL GRAVITY PIPED WATER SCHEMES

PREPARED FOR INTERNATIONAL WORKSHOP ON VILLAGE LEVEL OPERATION AND MAINTAINANCE

BY

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OPERATION AND MAINTAINANCE OF RURAL PIPED WATER SCHEMES

1.0 INTRODUCTION

There are 56 gravity-fed rural piped water schemes in Malawi covering a rural population of over 2.0 million people. The earliest project was constructed in 1968 and is still functioning. The schemes are implemental with full participation of the community. The community provide unskilled labour in trench digging, laying of pipes and digging of foundations for storage tanks. The Government provides all materials and technical expertise.

2.0 OPERATION AND MAINTAINANCE

Maintainance of Rural piped water schemes has evolved from experience. The responsibilities are clearly set out and explained to the community.

The community are responsible for various items during operation and maintainance and these include:

(i) Replacement of broken taps. When a tap gets broken, the tap committee collects money and buys a new tap. Taps are bought from the project office on a revolving fund basis established by Government. Each tap cost MK35.00.

(ii) Payment for Intake Caretakers

In almost all the piped water schemes, intakes are of simple structures. During the rainy periods, the intakes get blocked with leaves or sand. The community employs a caretaker. The monthly wages range from MK15 to MK20. Caretakers are employed from a village close to the intake. This is done so to allow the caretaker attend to his field after two hours cleaning of the intake. The funds for the payment of the caretakers are collected by the project's main committee from individual tap committees.

(iii) Repair Team Members

These are members of the community elected and are responsible for minor repairs on self-help basis. The repair team members report to Government employed monitoring assistant for technical advice. They report to the main committee on community based problems such as non-cooperation of the people to expose a broken pipe before mending. The organisation chart showing how the repair teams fit in with other committees is shown on figure II.

(iv) Tap Apron and Washing Slabs

Repair of tap aprons and washing slabs is the responsibility of the community. The money is collected by the tap committees for the intended repair.

(v) Cleaning of Sedimentation and Storage Tanks

Cleaning of the sedimentation and storage tanks is the responsibility of the community. The main project committee in conjunction with the monitoring assistant formulates the programme for tank cleaning. The tank cleaning is more frequent in rainy season than in dry season.

(vi) Maintainance of Treatment Works

Three of the 56 gravity-fed schemes have components of treatment works using slow sand and roughing filters. The community are involved in the scraping of the sand when the slow sand filters operate below normal due to blockings. However, the participation of community on the maintainance of slow sand filters has not been encouraging. The maintainance of the two schemes of Mwanza Valley (Chikwawa) and Dombole (Ntcheu) is done by using direct labour. Mpira/Balaka water supply has treatment works for slow sand and roughing filters. Though the project was completed by end March, 1993, the community have started contributing money to pay for caretakers working on the treatment works.

3.0 TRAINING

Refresher course for monitoring assistants (from projects already completed) and project assistants (from schemes under construction) are conducted once in every year. The aim of the course is to update the knowledge of the field staff.

The main committees are trained by the monitoring supervisors and assistants. Supervisors from Health, Forestry and Community Services are involved. Among the topics covered for community training are leadership, the importance of preserving catchment areas from deforestation, health education and many other topics. Inorder to make the training procedures similar in all the schemes, syllabuses were formulated in 1990.

4.0 EVALUATION AND MONITORING

The Water Department established an evaluation and monitoring unit (1980) within the Rural Piped Water Section. The evaluation and monitoring unit has its offices at Zomba sub-region.

Monitoring forms are distributed to all the schemes in the country for monitoring assistants to use. Among the information required on the forms include:

(i) Number of taps working

(ii) Washouts if any

(iii) Condition of tap aprons

(iv) How many taps have been out of function and the reasons for the same.

(v) Number of pipe breakages for individual pipe sizes and the reasons for the breakages.

(vi) Lines inspected for a particular period.

(vii) How much cleaning fluid, solvent and pipes have been used.

The inspection is done with main or section committees.

The duly filled forms are sent to Zomba where a six month evaluation report is compiled and sent to Headquarters for comments.

5.0 CONCERN

5.1 Since the rural piped water schemes started the community's enthusiasm has been very high. However, for the last few years, the community participation has gone down. There are a number of factors for this and one of them is the social change. However, this problem is being addressed by encouraging meetings with committees.

5.2 Thefts of steel and upvc pipes is becoming common in a number of schemes. We are informed that these steel pipes are used for making implements such as hoes, axes and so forth. The upvc pipes are used for cups or even tea pots.

Taps are removed and sold by vandals. A strategy was made that the exposed steel pipes across gullies and streams must be encased in Asbestos cement pipes.

5.3 The number of piped water schemes has increased almost every year and the Government support has also been increased. However, there is concern that the Government may not have adequate funds for continued support. Discussions will soon be made to review the existing policy.

5.4 Encroachment of catchment areas (within intakes) is becoming alarming. Quality of water deteriorates due to sediments. Treatment plants have been designed and constructed (Three schemes). Roughing and slow sand filters are used. Most of the old schemes were constructed without treatment because the catchments were protected. Although the slow sand filters are less costly in operation and maintainance than the conventional treatment, this is not a long term solution. Catchment areas need to be protected. The community should be involved in the protection of the catchments.

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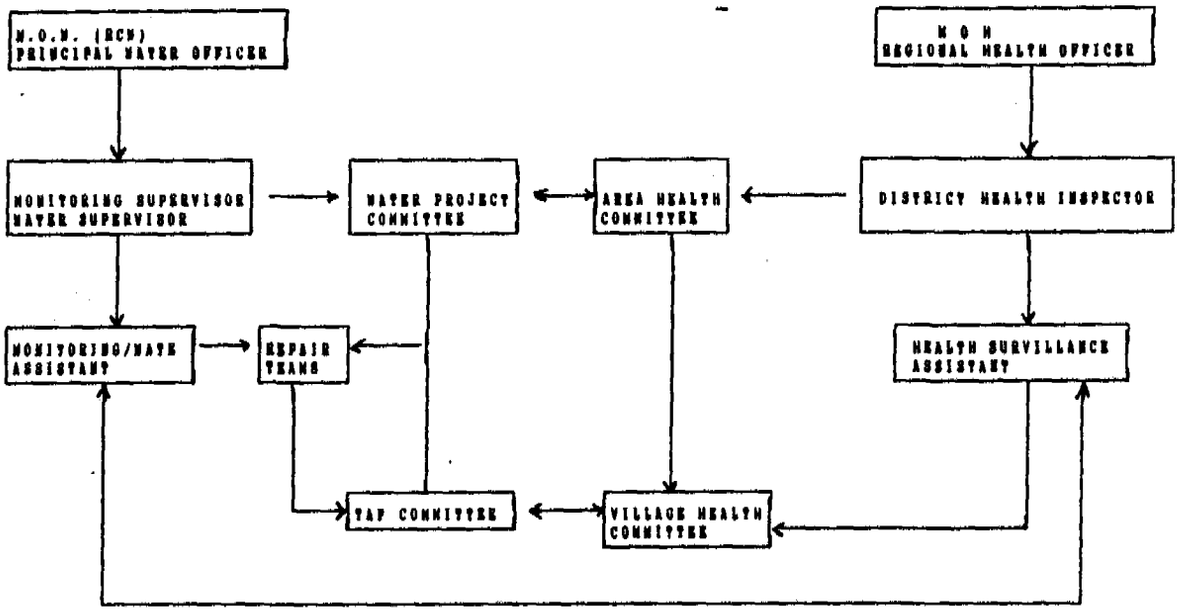
FIGURE II: MAINTAINANCE STRUCTURE FOR RURAL PIED WATER SCHEMES



ABBREVIATIONS

MOH = MINISTRY OF HEALTH

HESP = HYGIENE EDUCATION AND SANITATION PROMOTION

MA = MONITORING ASSISTANT

MINISTRY OF WORKS

——→ COORDINATION RELATIONSHIP

——→ ADMINISTRATION RELATIONSHIP

Workshop

on

Village Level Operation and Maintenance
of
Rural Water Supplies.

Blantyre, Malawi
20th-24th September 1993.

A brief on

MALAWI

KARONGA INTEGRATED RURAL GROUNDWATER SUPPLY PROJECT

VILLAGE LEVEL OPERATION AND MAINTENANCE SYSTEM

THE KARONGA VLOM

by
C.B.Jespersen

Water Department/Danida Karonga. August 1993.

MAP SHOWING LOCATION OF KARONGA LAKESHORE INTEGRATED RURAL GROUNDWATER SUPPLY PROJEC

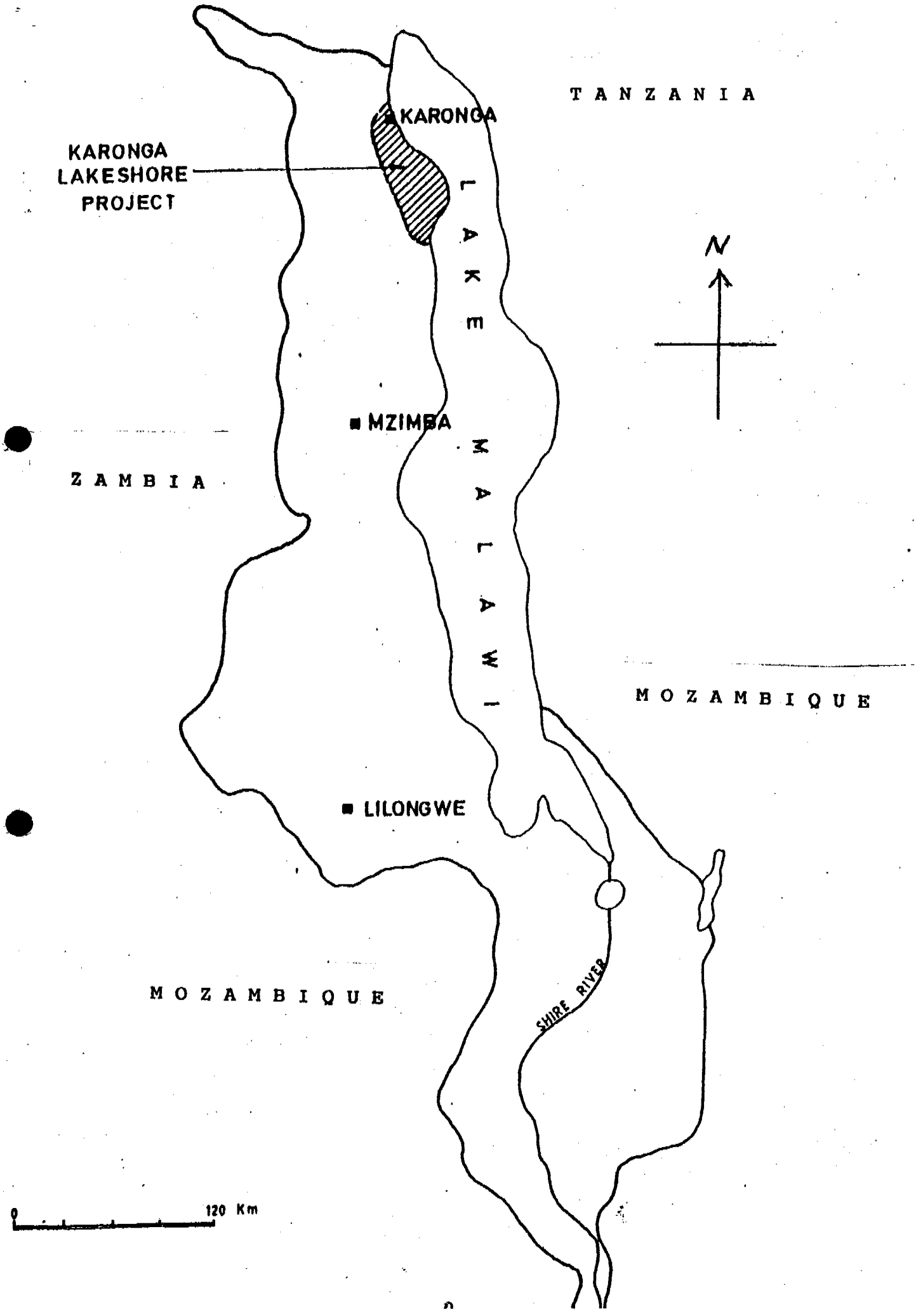
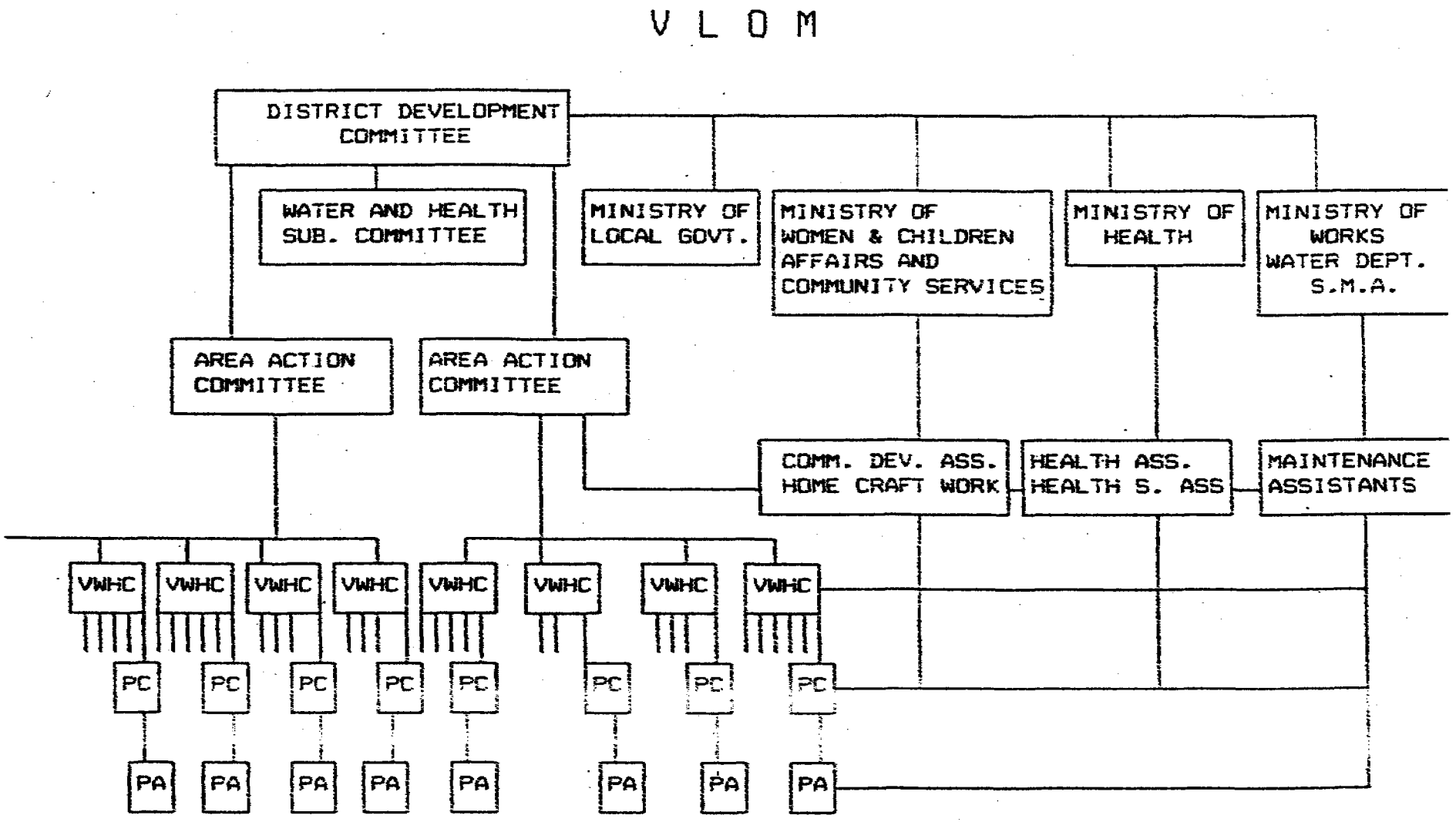


FIGURE 1: ORGANIZATIONAL STRUCTURE FOR VILLAGE LEVEL OPERATION AND MAINTENANCE
KARONGA LAKESHORE INTEGRATED RURAL GROUNDWATER SUPPLY PROJECT



LIST OF ABBREVIATIONS:

AAC	Area Action Committee
CDA	Community Development Assistant
CP	Community Participation
CPC	Community Participation Co-ordinator
CSR	Centre for Social Research
DANIDA	Danish International Development Agency
DCDO	District Community Development Officer
DDC	District Development Committee
DHI	District Health Inspector
DHO	District Health Officer
GOM	Government of Malawi
GVH	Group Village Headman
HA	Health Assistant
HESP	Health Education and Sanitation Promotion
HSA	Health Surveillance Assistant
ICC	Interministerial Co-ordination Committee
KIP	Karonga Lakeshore Integrated Groundwater Supply Project
KW	Malawi Kwacha
MA	Maintenance Assistant
M and E	Monitoring and Evaluation
MCS	Ministry of Women and Children's Affairs and Community Service
MLG	Ministry of Local Government
MOA	Ministry of Agriculture
MOH	Ministry of Health
O and M	Operation and Maintenance
PA	Pump Attendant
PC	Pump Committee
PLOP	Plan of Operation
PM	Project Manager
PP	Preparatory Phase
RHO	Regional Health Officer
RWSG	Regional Water and Sanitation Group.
Sanplat	Sanitation platform to be fitted in pit latrines
SME	Social Monitoring Exercise
SMA	Senior Maintenance Assistant
STMR	Social and Technical Monitoring Report
TA	Traditional Authority
TME	Technical Monitoring Exercise
TOR	Terms of Reference
VH	Village Headman
VLOM	Village Level Operation and Maintenance (of water points)
VWHC	Village Water and Health Committee
WD	Water Department
WPMF	Water Point Maintenance Fund

- Government Financial year 1st April to 31st March

- All measures in metric.

- 1 US $= 4.35 KW (10th March 1993)
  1 US $= 6.31 DKK(10th February 1993)

BASIC PROJECT DATA

Title of Project	:	Karonga Lakeshore Integrated Rural Groundwater Supply Project. Monitoring and Evaluation, Operation and Maintenance Activities.
Sector	:	Rural Drinking Water Supply.
Recipient Country	:	Malawi
Project Area	:	Southern Part of Karonga District Covering approx 2000 sq KM. (see map)
Responsible Authority on Recipient Side	:	Ministry of Works, Water Department
Responsible Donor Agency	:	Danida
Funding	:	Danida for Monitoring and Evaluation DKK 2,97 Million. Danida for Operation and Maintenance on a declining scale: 100% in 1991-92 Financial Year 75% in 1992-93 - do - 50% in 1993-94 - do - 25% in 1994-95 - do -
Technical Assistance	:	Carl Bro International A/S Granskoven 8. Glostrup, Denmark. Provision of Project Co-ordinator.
Date of Agreement	:	1st April 1991
Project Period	:	1st April 1991 to 31st March 1993
Objectives	:	Development Objectives: Improvement of basic living conditions in the KIP area by the year 2000. Intermediate Objectives: A sustainable Operation and Maintenance of the project in accordance with VLOM principles and operating without expatriate assistance by 31st March 1993. An initiation of the longer term objective

of achieving a 50% coverage of all households in the project area having improved latrines with sanplats by 31st March 1995.

Objectives cont. : Project Objectives:

1. By 31st March 1992 VLOM concept in Karonga is functioning:

- Committees are functioning i.e they collect money and can afford to buy spare parts.

- Pump Attendants can manage to maintain the pump.

- Senior Technical Assistant and Technical Assistants are able to assist and advise with regard to repairs and carry out repairs on rising mains and advise and train committees.

- Spare parts are locally available for purchase.

2. 20% of all households have a latrine with a sanplat by 31.03.92.

SUMMARY AND LESSONS LEARNED.

Danida have since 1974 been supporting the development of the drinking water supply in Malawi. In 1984 Government of Malawi (GOM) requested the support for an integrated groundwater supply project in the north. Project appraisal was done in 1985 with project preparation commencing in 1986 and the Plan of Operation finalized March 1987.

The present project is a two year continuation of the three year implementation phase during which 301 boreholes were constructed. 295 of these were fitted with the Afridev Deep Well Handpump.

Based on the 295 water points the aim of the project is to establish a sustainable village level operation and maintenance system (VLOM), including health education and the utilisation of pitlatrines fitted with a sanplat.

To be able to follow project progress a technical and sociological monitoring system should be created.

Organizationally the project is part of government structures, located in the Water Department of The Ministry of Works. All staff involved in project activities is assigned and are drawn from the parent ministry and cooperating ministries i.e Women and Children's Affairs and Community Development (MCS) and Health

(MOH).

Project management team, situated in the Water Department offices in Karonga, consist of a Project Coordinator, a Senior Maintenance Assistant (SMA), two Community Development Assistants (CDA) and a Senior Health Assistant(SHA).

Funds for project activities are available through three accounts, one provided by Danida, one by Danida and GOM and one fully funded by GOM. Budgets have been kept but changes between budget lines have been necessary in one budget, reflecting project needs as found by monitoring.

In the following a schematic summary of project activities are presented.

Training in VLOM was in 1991 given to:

- 25 extension workers (20% female) of cooperating ministries staff in project area.
- 21 members (14% female) of Karonga District Development Committee.
- 52 members (29% female) of two Area Action Committee's
- 286 members (47% female) of 97 Village Water Health Committees.

In 1992 the following received training in VLOM, Health and Sanitation:

- 19 members (11% female) of Karonga District Development Committee.
- 3214 members (47% female) of 295 Pump Committees and their Pump Attendants.

Monitoring:

- A social monitoring system created and tested.
- A technical monitoring system created and tested.
- A computer programme for treating monthly technical monitoring data developed.
- Two Sociological Monitoring Exercises completed.
- 18 Technical Monitoring Exercises completed.
- Two Sociological Technical Monitoring Reports completed.

Health Education:

- Production of a Health Education and Sanitation Play.
- Performance by four groups in 100 villages (approx 6000 spectators) of the Health Education and Sanitation Play.
- 7 San-Centres started at 7 Health Posts, sanplat production is demand driven.
- Approx 1900 san plats produced with more than 85% installed.
- Approx 50 local leaders trained in sanitation and sanplat casting.

Spare part distribution:

- Two Chipiku wholesale shops in Karonga District stocked with one year supply of Afridev Handpump spares.
- 15 local shop owners are selling fast running spares.

The EFFECTS and IMPACT of the above outlined outputs are as follows:

- Committees are established and function. 40% of the VWHC and 55% of the PC members consist of women.
- Water Point Maintenance Funds cover approx 70% of the water points with an average content of KW 32.-.
- Pump Attendant can do all maintenance and repairs except cracks in raising mains. 42% of PAs are female.
- Fast running spares are available within 5 Km distance of all but 10 pumps in very remote areas.
- Both fast and slow moving spares are available at two private wholesalers within the district.
- At least 95% of the pumps are in operation at any given time.
- Approx 30% of project area households have an improved pit latrine fitted with a sanplat.

IMPORTANT LESSONS:

The main conclusions from the project are:

- It seems possible to establish a sustainable rural groundwater supply based on users own organisation and manpower (VLOM) with spare parts supplied through private outlets (a 1-tier system as an addition to the 2- and 3 tier system mentioned in appendix 1 p.73.)

- A basic requirement for the function of the system is user confidence in their own abilities to manage VLOM in respect to organisation, finance and technical aspects.

- Creation of confidence can only be reached through training and support for a minimum of 3-4 years.

- Support can only be given through knowledge of users demand of, and reactions to, the structures and function of the VLOM system introduced.

- Knowledge can only be obtained through social and technical monitoring, with 90% being related to Socio-economic factors. Intensity of monitoring will be highest in the first 2-3 years after which it can be reduced and finally cease.

- Ownership of water points, community participation and self determination will reduce possibilities of donor preferences in relation to system capacity, distance requirements and selection of technology.

- Utilisation of monitoring as a management tool require donor flexibility and accept of immediate project shifts from on budget line to the other. In some cases monitoring will reveal the need for additional budget lines and related funding above the original budget. This could be covered by a certain percentage of the original budget set aside and only utilised if proved needed by monitoring.

For DESIGN and IMPLEMENTATION the traditional sequence of events ie.

Preparation - Mobilisation - Construction - Handover to users - Operation and Maintenance

SHOULD BE CHANGED TO:

Preparation - Technical and Social mobilisation - Establishment of Operation and Maintenance (VLOM) system - Construction and Simultaneous handover to users.

This will slow down construction activities but ensure community participation throughout and in this way prepare for sustainability.

In relation to present government policy of equity in distribution of boreholes leading to large rehabilitation programmes being implemented dispersed all over the country, the Karonga experience suggests that concentrated programmes covering a district or part of a district is preferable as it:
- reduce transport costs.
- increase efficiency of supervision.
- increase efficiency of training programmes.
- increase the possibility of inter community support.
- increase the possibility of privatisation of spare part distribution and sales.
- avoid social tension in villages as all boreholes are covered and not only one or a few.

In connection with HESP training of trainers, where the trainers are village leaders, has failed. A direct approach to water point users, through training and drama and sanplat casting done by village contractors, connected to Health Centres, show better results. Further, by having sanplat customers deliver basic materials i.e. sand, stones and gravel to the site of casting a demand driven production and high percentage of installation is ensured.

As for the sanplat technology the project have had success with pitlatrines with a sanplat(with a lid) and WITHOUT a vent pipe.

SUSTAINABILITY

Sustainability is dependent of a number of factors i.e

Affordability to users

Community Institutions

Developed skills

Institutional support

Supply of Spare parts.

After handover of the water points i March 1991 the users voiced serious concern regarding their ability to pay for maintenance. However, with an average expense of KW 28.- so far experienced, affordability is not a problem. In the future increased expenses will occur when slow wearing parts needs to be changed. An average of KW 100.- per year is expected. This will not be a deterrent to the sustainability.

The institutions responsible for the Karonga VLOM are:

District Development Committee

Area Action Committees

Village Water Health Committees

Pump Committees.

Of these are the Pump Committees the most active as they are owners and users of the water point. Despite intensive training of all levels, the only sustainable institution is the Pump Committees. Whether they can maintain their own dynamic in terms of re-elections and solutions to problems such as defaulters remains to be seen. Future Sociological Monitoring is important in relation to determination of viability and sustainability of the social institutions. The question of sustainability can therefore not be assessed now.

Skills developed especially through the PC-PA training carried out in 1992, have left a pool of knowledge which is passed on to new committee members and pump attendants. How long this passing on will last is not known but as committee members and pump attendants are part of the owners and users of the water point, it is expected to be sustainable in the medium term.

With the 1 - tier system being created by the Karonga VLOM, future institutional support from Water Department will only be needed when boreholes have to be redeveloped. With the low occurrence of redevelopment, this is not regarded as a problem for sustainability.

The development and test of fishing tools for rising mains and broken pump rods is an important factor in the 1 - tier system. There is an urgent need for their delivery to safeguard sustainability. This is also dependant on training of local artisans in using these tools and thus enable them to assist in rising main repairs.

Supply of spare parts are at present regarded as a bottleneck in relation to sustainability. 15 local shops carry stock of fast running spares. Whether they will continue this business now they have to purchase their stock at a whole sale is not yet known. The country's largest wholesale chain Chipiku have agreed to cooperate by including Afridev spare parts as part of their business. The sale of spares from Chipiku to local businessmen commenced on 1st March 1993. Modalities for Chipiku to buy their future supply of spares from local producers and Water Department still has to be worked out. The basis for long term sustainability is created. Experience still needs to be gained and registered, through future monitoring, before a definite answer, as to real sustainability, can be given.

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UNICEF

DANIDA SECTOR POLICIES

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April 1992

5.3 Organization for Operation and Maintenance

Rural schemes

It is now generally recognized that operation and maintenance of village water supplies must be organized, to the maximum extent possible, at village level by the users themselves. Maintenance of remote handpumps by motorized units based at district or central level creates

serious administrative and financial problems.

However, even with trained caretakers, VLOM-type handpumps and local generation of maintenance funds, some maintenance back-up and support at higher levels is required, to handle repairs beyond the capability of village pump caretakers. The maintenance system must be designed to ensure efficient flow of information from village level upwards, and immediate response in terms of spare parts and required services flowing downwards, so that the reported breakdown of a handpump is attended to without delay.

Many handpump maintenance systems function in this manner. Examples from India include the so-called 3-tier system, with a village-level caretaker, a block mechanic responsible for some 50 handpumps and a district-based motorized team for major repairs. This has potential for establishing a sustainable maintenance system in some states (e.g. Tamil Nadu), while in others various forms of 2-tier systems are found to be more appropriate (e.g. a system based on self-employed local mechanics, blacksmiths or similar in Orissa). Similar systems operate in Africa, e.g. in Niger (based on "reparateurs des zones"), Mali (based on "forgerons

App 1.

reparateurs" each covering a number of villages) and Zimbabwe (based on caretakers, pump minders and district level back-up).

In rural piped water projects in Malawi and Tanzania, local village committees and scheme caretakers have technical back-up at district level from their respective water agencies.

Urban schemes

While a user-based maintenance system is possible for rural water supplies, traditional urban water supply systems are generally operated and maintained by a water utility, with no direct involvement of users. Since they are generally more complicated to organize, skilled staff are required for system operation and maintenance, billing, and collection of charges from public standposts and individual connections.

In most West African countries (e.g. Niger, Burkina Faso and Mali), authorized standpost operators buy water from the agency and sell it to consumers at a fixed rate which will provide a modest income for the operator. Where operation and revenue collection at standpost level is not organized, experiences from both Asian and African countries show that there is a

considerable risk of deterioration and eventual shutdown. This is most unfortunate as public standposts are intended for those who cannot afford individual connections or shared yardtaps.

In many countries, operation and maintenance of urban water supply are administered by a concessionary company having its own accounts. It is therefore easy to know whether the company operates with a surplus or a deficit. Management improves the financial situation by seeking to increase the rates, cutting off bad payers or cutting down on administrative costs. The disadvantage is a tendency to ignore the social aspects of a safe water supply and to neglect the poorer parts of the population. Furthermore, such companies are not generally free to set tariffs based on economic calculations. Tariffs are subject to political interference and it kept too low leave the company with a deficit in operating smaller urban schemes.

5.4 Human Resources Development

To strengthen and reorientate staff of the various ministries/agencies responsible for water supply and sanitation, Danida provides training for different categories of staff in a range of project-relevant topics. Support is given for the production

DEVELOPMENT OBJECTIVE Improvement of basic living conditions in KIP Area	1. Improved health - derived from health statistics 2. Increased agricultural production derived from Ministry of Agriculture statistics	1. Improved water and sanitation practices by the villagers
INTERMEDIATE OBJECTIVE 1. VLOM concept working without expatriate assistance by 31.03.93 2. 50 % of all households have a latrine with a san-plate by 31.03.93	1. CSR monitoring 2. DANIDA evaluation	1. GOM endorses user payment for spare parts 2. Spare parts for Afridev locally available through Government channels or private channels 3. Legal for Government to sell pump - spare parts to private wholesalers/retailers or the distribution of pump spare parts is completely privatized 4. It is possible to buy new spare parts in local currency latest by 31.03.93 5. GOM continues to supply materials free of charge for san plat casting
PROJECT OBJECTIVE 1. By 31.03.92 VLOM concept in Karonga is functioning: * Committees are functioning i.e. they collect money and can afford to buy spare parts * P.A. can manage to maintain the pump * STA and TAs are able to assist and advise with regard to repairs and carry out repairs on rising mains and advise and train committees * Spare parts are locally available for purchase 2. 20 % of all households have a latrine with a san-plate by 31.03.92		1. Local leaders will train their villagers in sanitation and san-plate casting 2. Ministry of Health and Ministry of Local Government will use their extension staff for education in sanitation and san-plate casting 3. Villagers can afford to pay for spare parts 4. Villagers will cooperate in supporting village-level organisations
OUTPUT 1. An established sustainable spare part distribution system by 31.03.92, based on user payment using the local private sector for: * Fast wearing (fast moving) spares 2. An established sustainable spare part distribution system by 31.08.91, based on user system using TAs. The spare part price will include a service charge for all spares brought to the village. 3. An established wholesale store for spare parts run by the KIP latest by 31.03.92 4. A monitoring report after 6 months i.e. 30.09.91 5. A monitoring report after 12 months i.e. 31.03.92 6. Monitoring reports with intervals to be agreed upon after the first year. 7. Completed training and refresher courses in accordance with the on-going monitoring exercises. 8. Five remaining local leader training courses in sanitation and san-plate casting completed by November 1991.		1. Private businesses are interested and capable of spare parts 2. It is accepted by Water Department and the UNDP supported project that KIP is a pilot project from which experiences should be incorporated in the future national policy on handpump VLOM operation and maintenance
ACTIVITIES 1. Identification of private businesses regarding spare part sale 2. Selling of spare parts from KIP wholesale store to private businesses 3. Executing, testing and modification of the monitoring system 4. Training and refresher courses of all parties in the project area 5. Liaison with Water Department and the planned UNDP Financed Community Based Management Project		1. The Government accepts that spare parts are sold and not given free of charge 2. The Government accepts that spare parts are distributed and sold by the private sector 3. TA training completed by 31.03.91 4. CSR researcher available and capable 5. Water Department pays operation and maintenance as agreed (0, 25, 50, 75, 100) 6. If the revolving find for spare parts becomes exhausted due to unforeseen demand, DANIDA will assist 7. Fluoride and pH problems will be solved before 31.03.91 8. The chosen TAs and STA are suited for their job 9. Two CDAs for Ministry of Community Services will remain availa 10. Ministry of Health and Ministry of Local Government co-operate with the project on the water use and sanitation component. Ministry of Local Government pay their allowances as required
INPUT 1. 300 functioning installations installed and handed over 2. Baseline study + monitoring system for sociological aspects 3. A monitoring system for technical aspects 4. Written instructions on all operation and maintenance procedures specified for each involved party (TA, FA, VWHC, PC And Water Department at District level) 5. One STA and four TAs trained in pump maintenance and simple accounting techniques, monitoring and community participation 6. One expatriate project coordinator + local support staff (CPC, ass. CPC, one secretary) financed by DANIDA for two years 7. Two CDAs seconded by Ministry of Community Services 8. Necessary transport and office equipment 9. Support from CSR on a regular short-term basis for monitoring 10. Short-term expatriate input as required 11. Two years estimated consumption of pump spare parts 12. DANIDA funds for operation and maintenance for the first four years (100, 75, 50, 25, 0) 13. Water Department Funds for operation and maintenance for an indefinite period (0, 25, 50, 75, 100) 14. Personnel from Ministry of Health and Ministry of Local Government, transport from DANIDA and materials for san-plate casting 15. Bicycle allowances incorporated in the co-operating ministries's budget 16. Motor bikes for District Community Development Officer and District Health Inspector		**PRECONDITIONS** 1. Pump spare parts will be kept under the jurisdiction of the project coordinator until a national system of distribution and sale of spare parts has been established latest by 31.03.93 2. Equipment for support staff is kept under the management contr

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MINISTRY OF WORKS

WATER DEPARTMENT

The Community Based Management of Rural Water Supplies Project

By

Fabiano Kwaule

Paper presented at the Regional Workshop on Operation and Maintenance of Rural Water Supplies, Blantyre, 20 - 24 September 1993

1. INTRODUCTION

As part of the efforts to instutionalise Village Level Operation and Maintenance in Malawi various programmes were implemented aimed at testing procedures. These programmes were intergrated and concentrated activities in specific locations.

The Community Based Management of Rural Water Supply Project funded by the UNDP attempted Village Level Operation and Maintenance in a dispersed manner, to simulate the national situation.

The aim of the project was to develop and test procedures for effective Village Level Operation and Maintenance.

Pilot centres were developed in the three regions of the country to test procedures. Results in the pilot centres were very encouraging.

This paper outlines activities which were implemented in the pilot centres and the outputs of the project which are now being utilised in the introduction of Village Level Operation and Maintenance in the national borehole programme.

2. COMMUNITY BASED MANAGEMENT OF RURAL WATER SUPPLIES PROJECT

2.1 PROJECT BACKGROUND

In Malawi over 1.5 million rural people are being served with potable water supplies close to their homes by 9,000 boreholes and 5,000 dug wells, all equiped with handpumps.

However, despite considerable investment of manpower and financial resources in maintenance, it is estimated that 20% to 40% of these pumps are out of order at any one time, with severe consequences to the users. It was also estimated that over 30,000 more boreholes and wells are required, and the need for a lasting solution to the serious maintenance problems became urgent.

In order to redress this problem, the Government of Malawi, with assistance from the UNDP, hosted a workshop on "National Strategies for Operation and Maintenance of Rural Groundwater Supplies", in Mangochi in December 1986.

One of the main objectives of the workshop was to make detailed recommendations including timetables, allocation of responsibilities, the inputs required, if any, from donors or other agencies, regarding the selection, manufacture, installation, operation and maintenance and financing of handpumps for rural water supplies in Malawi.

The workshop set out to address this issue and its key conclusion was that:-

> "Self help should play an important role in the maintenance of wells and boreholes, as it does in most spheres of rural development in Malawi. Communities must be involved to the maximum extent possible in the planning, siting and construction of their wells and boreholes and then should undertake the management of their water supply, including the execution of routine repairs and the purchase of routinely wearing spareparts. Government has a major role to play in extension service and training, including the execution of major repairs that communities can not handle themselves."

In order to implement this recommendation effectively, the Government sought assistance from the UNDP, to launch a pilot project, the Community Based Management of Rural Water Supplies Project in 1989.

3. PROJECT OBJECTIVES

3.1 Development Objective

The development objective of the Government to which the Community based Management of Rural Water Supplies Project was to contribute, was to increase health and productivity of the population through the provision of safe and sustainable water supply and adequate sanitation services.

3.2 Project Objective

The principal objective of the Community Based Management Project was to develop procedures and coordinate, monitor and render technical assistance to activities promoting community management in the rural water supply sector in Malawi.

3.2.1 Specific Aims

To create a special unit within Water Department, to be known as the Rural Water Supply Support Unit, which would be responsible for project implementation and the promotion of commuity based management in rural water supplies;

To establish a community-based rural water supplies management system , and an arrangement whereby the community would contribute to maintenance costs;

To institutionalize procedures and linkages for multisectoral collaboration and coordination in community water supply development;

To rationalise and standardise community based management procedures;

To standardise handpumps through replacing of existing pumps with Village Level Operation and Maintenance (VLOM) type pumps;

To establish quality control and manufacturing procedures for handpumps and spareparts and their distribution;

To implement established procedures in a selected number of rural groundwater schemes.

4. INSTITUTIONAL BUILDING

Inorder to implement the project there was need for institutional building. The project set up to establish various support institutions which would be utilised for the project and also for other future community based programmes.

4.1 Project organisational structure

4.1.1 The Project Advisory Committee (PAC)

The organisational structure of the project was such that a national inter-ministerial steering committee,the Project Advisory Committee (PAC) was established to oversee implementation of the project.

The PAC was chaired by the Office of the President and Cabinet (OPC) and members included ministries active in the water and sanitation sector, the Ministry of Works, (Water Department), the Ministry of Health, Ministry of Women and Children's Affairs and Community Services and Ministry of Local Government.

The main role of the PAC was to facilitate the implementation of the project and coordinate inter-ministerial collaboration.

The PAC had reviewed the project workplan, and made recommendations on the modalities of collaboration between staff from the different ministries attached to the project.

4.1.2 Regional PAC

The PAC was replicated at the regional level where regional representatives of the collaborating ministries formed working groups to facilitate project implementation.

Regional PACs were responsible for selecting areas for borehole rehabilitation.

4.1.3 Centre Water Councils

At the district level, the CBM project utilised existing sub-committees known as Centre Water Councils, which were established in all districts under the Urban Communal Water Project, 1981-85

Centre Water Councils are sub-committees of District Development Committees (DDCs) .

Membership for these councils is wider, in addition to district level representatives of the project, collaborating ministries, local leaders such as councillors, chiefs, and Party leaders are represented.

The role of these councils is that of the PAC at the district level.

However, for effective project implementation, technical district working committees were established,comprising District Water Supervisors, District Health Inspectors and District Community Development Officers.

4.1.4 Local Coordinating Teams

At the centre or borehole area level Local Project Coordinating Teams, comprising field extension workers from three of the collaborating ministries, Ministry of Works, Ministry of Health and Ministry of Women and Children's affairs and Community Services were established.

Water Monitoring Assistants, Health Assistants and Community Development Assistants worked hand in hand in this committee providing integrated extension service.

4.2 Local Organisational Structure

4.2.1 Borehole Committees

At the community level, Borehole Committees were established at each water point, comprising of ten members elected by the communities.

These committees are responsible for coordination of all project work from the community side including operation and maintenance of rehabilitated boreholes.

These committees have been instrumental in mobilising communities to participate in rehabilitation work.

They were also active in establishing maintenance funds which will be used for purchasing spareparts for maintaining the pumps.

4.2.2 Pump Caretakers

Each borehole committee then selected a caretaker committee, comprising three members two women and one man who are technically responsible for carrying out preventive maintenance and repairs of the pumps.

5. MAIN PROJECT ACTIVITIES

5.1 Establishment of the Rural Water Supplies Support Unit (RWSSU).

The establishment of this unit commenced with the nomination of a Project Manager in 1990.

The Project Manager also assumed the role of Community Development Officer for the Central Region.

With the assistance of UNDP, the Government recruited a Mechanical Engineer who commenced work in Water Department in February 1991.

Two Community Development Officers were recruited and commenced work in July 1991. After briefings and orientations, they were posted to the Southern and Northern regions.

The Water Department attached a Water Supply Engineer to the project in October 1991.

Three regional Water Monitoring Assitants were recruited and commenced work in September 1991, they were then trained and posted to the North, South and Central regions.

Thus consolidation of the support unit was completed by the end of October 1991.

Active project work however only started in November 1991, when all key project staff were in position.

5.2 Review and analysis of existing approaches and arrangement in community management.

In order to formulate a system and procedures to be followed at national, regional/district and local levels, it was necessary to carry out detailed reviews and analysis of present approaches and arrangement in community management, including organisational frameworks and inter-ministerial relationships, cost recovery and related financial implications.

This activity involved both desk work on literature of existing programmes and field surveys.

As a baseline, use was made of the Centre for Social Research report titled "Community-Based Operation and Maintenance of Rural Water Supplies: A Baseline Survey Report for Groundwater of 1991".

This survey, which was commissioned by the Water Department, with financial assistance from USAID, aimed at "recommending the most feasible system of community-based maintenance, with proper definitions of responsibilities and backstopping provided by Government, that would be sustainable".

The survey comprehensively reviewed the following programmes:-

- The Karonga Integrated Groundwater Supply Project;
- The Shallow Wells Programme;
- The Livulezi Integrated Groundwater Project
- The National Borehole Programme.

Recommendations from this survey have been taken into account in formulating procedures for the Community Based Management Project, which will be outlined later in this report.

5.3 Review of UNDP/World Bank Field Testing and Technological Development of Rural Water Supply Handpumps Project.

From the UNDP/World Bank Hand Pump Testing Project, the CBM project adapted the "SKAT specification for the AFRIDEV handpumps".

These specifications have through the CBM Project now been adopted by the Malawi Bureau of Standards as "Malawi Bureau of Standards Specifications for the AFRIDEV Handpump, MBS 358:1991.

5.4 Lessons from Non-Groundwater Programmes

The project also reviewed other water programmes which have successfully utilised community based approaches, in order to draw up experiences which can be applied in the new project.

5.4.1 Rural Gravity Water Supply

From the Rural Gravity Water Supply programme, the CBM project has adapted the project initiation approach, the concept of project based on community demand and also agency response in assessing needs, awareness raising procedures and finally procedures for evaluating commitment and willingness to participate.

The system of community involvement in all project stages including maintenance has also been adapted.

Lastly, the extension support and monitoring system which are crucial for sustainability of community based programmes have been adapted.

5.4.2 The Piped Supplies for Small Communities Project

From the IRC funded Piped Supplies for Small Communities programme, the CBM Project has adapted the inter-ministerial collaboration approach, system of integrated extension service-- whereby the Water Monitoring Assistant, the Health Assistant and Community Development Assistant works hand in hand to provide integrated extension service.

Project Information dissemination system has also been adapted.

The PSSC Project Training approach has also been adapted, particularly the UNDP/PROWWESS developed SARAR methodology for training trainers in participatory techniques.

The CBM approach has thus been shaped out of these reviews which were carried out between October 1990 and October 1991.

As already mentioned, the reviews included desk work on literature of the specified programmes including field surveys of on going programmes.

6. TRAINING ACTIVITIES

Training was given top priority in the Community Based Management project approach. It is among the major activities considered to enhance sustainability community water supplies in the long term.

Among the major training activities which were carried out were:

6.1 Technical training

Technical training courses were organised for Water Monitoring Assistants who are responsible for monitoring operation and maintenance, training communities in maintenance including backing up maintenance.

The Monitoring Assistants were assentially trained as trainers of communties.

6.2 Integrated training for extension workers

Integrated training courses were organised for Local Project Coordinating Teams - the field extension workers comprising Water Monitoring Assistants, Health Assistants and Community Development Assistants from the three collaborating ministries.

The main objective of these courses was to equip the Local Coordinating Teams with the necessary skills to guide communities to be able to take responsibilities in operation and maintenance of boreholes with appropriate sanitation in all households.

The courses also aimed at enabling the field extension workers to appreciate the value of multi-sectoral collaboration in addition to giving them skills necessary to support community based management of water supplies and sanitation facilities.

The courses, which were organised in all the three regions, were facilitated by regional and district officials draw from Water Department, Ministry of Health and Ministry of Women and Children's Affairs and Community Services.

A total of 126 field extension workers were trained.

6.4 Community Training

Borehole Committees after being formed and given initial orientations, were trained in leadership and hygiene education and sanitation.

The courses lasted for four days each.

A total of 456 borehole committee members and community leaders

were trained.

6.4.1 Caretakers Training

Caretakers were also given technical training to equip them with skills for maintaining and repairing the borehole handpumps.

These courses also lasted for four days each and included some leadership and hygiene education elements.

A total of 90 Caretakers were trained.

7. FIELD ACTIVITIES

7.1 Selection of Pilot Areas

In order to ensure that procedures which the project developed were applicable on a national scale, a criteria was used to select pilot districts in all the regions.

One of the criteria used was that the centres selected for borehole rehabilitation covered a cross section of ethnic and cultural groups.

The following were thus the districts selected for borehole rehabilitation:-

Northern Region:
- Mzimba District
- Rumphi District

Centre Region:
- Lilongwe District
- Salima District

Southern Region:
- Zomba District
- Mwanza District

7.2 Selection of boreholes

A criteria was also developed for selection of boreholes to be rehabilitated.

Among the main factors considered were community willingness to participate in all project phases including maintenance.

Boreholes were thus initially pre-selected, needs assessments were carried out and community awareness raised.

Community commitment and willingness was then evaluated before final selection of the boreholes.

In all, 30 boreholes were selected, 10 in each region.

Technical data on each of the 30 boreholes was then compiled and stored in computer.

7.3 Baseline data collection

After the final selection of the boreholes, awareness raising campaigns continued.

Extension workers then collected baseline data which was again entered into computer.

Among the major information collected were: Population around the boreholes, community sources of income, existing sources of water, water use and water handling practices, sanitation situation and major diseases in the areas.

7.4 Formation of borehole and caretaker committees

Borehole committees were then established at each of the 30 boreholes. The committees comprise 10 elected members, 70 per cent of whom are women.

Each committee then selected caretakers, comprising three members, two women and one man. This team is responsible for carrying out preventive maintenance and repairs on the boreholes.

Extension workers from the three collaborating ministries were present during the election of the borehole committees, to give initial orientation and briefings on committee responsibilities

8. ESTABLISHMENT OF LOCAL MANUFACTURE OF THE AFRIDEV HANDPUMP AND SPAREPARTS

8.1 Development of the Aridev handpump

Development of the Afridev deep well handpump system was carried out through the following UNDP funded, World Bank executed projects:

- Field Testing and Technological Develoment of Rural Water Supply Handpumps Project (INT/81/026) and

- Community Water Supply Project (RAF/87/049).

A complete set of technical specifications including working drawings is available now internationally for the pump through the Swiss Centre for Appropriate Technology (SKAT) in Switzerland.

These specifications for the pump incorporate very few types of raw materials. The three main types of raw materials commonly used are STEEL, PLASTIC and RUBBER. This feature and the minimum quality control requirements on the specifications simplifies the local manufacture of the Afridev pump.

8.2 Development of Local Capacity for Pump Manufacturing

One of the main tasks for the CBM Project was to develop local capacity for the manufacture of the Afridev handpump. This was being accomplished through identification and attracting developing staff capabilities in local manufacturing firms.

(Full details in a separate technical paper)

9. BOREHOLE REHABILITATION

9.1 Selection of Borehole Sites

Thirty borehole sites have been selected in the three Regions for rehabilitation. (See section 7.2)

The criteria used for selection included both social and technical aspects.

9.2 Procurement of materials

All the raw materials required for rehabilitation have been purchased and distributed to the Regions.

Thirty Afridev handpumps were locally manufactured at Brown and Clapperton (Engineering) Ltd. The pumps were subjected to Quality Assurance checks by the Malawi Bureau of Standards. This batch of pumps were used to introduce and test the newly drafted Quality Assurance Procedures.

The following deviations from the specifications were observed on the above batch of pumps.

- B&C was not able to galvanise all the components at Encor because the plant was shut down due to shortage of Zinc. On these components B&C did a crude galvanising coat by themselves and painted with industrial Aluminium paint.

- B&C found it difficult to obtain components for the pump cylinder separately. Therefore they had to import complete cylinders from Mono Pumps Ltd., in U.K. These cylinders have stainless steel liners instead of brass liners.

9.3 Distribution of Spareparts

Spareparts for preventive maintenance should be made available to the Village Borehole Committees for them to purchase and be able to carry out the maintenance.

For these Committees, the Monitoring Assistant is the direct contact person from the Water Department. Therefore spareparts could be easily made available to the pump committees through the monitoring Assistant.

Arrangements have been made to ensure that monitoring assistants should stock the necessary spareparts for the committees to purchase.

Efforts were also made to ensure that existing district maintenance units stocked the spareparts.

The project was however exploring possibilities for village shop keepers to stock the spareparts in future.

This approach was not feasible because of the small number of boreholes rehabilitated. It would have been uneconomical for shopkeepers to stock the spareparts.

10. CONCLUSIONS

The Community Based Management Project achieved its objectives in :

Establishing organisational structures and interministerial relationship to handle community based management of rural water supplies;

- Setting up Community Water Supply Unit with staffing structures at the national, regional and district levels.
- Defining and formalising roles and responsibilities of key ministries in the water and sanitation sector.

Developing procedures for effective Village Level Operation and Maintenance;

- Developing guidelines for:
  - Community mobilisation;
  - Community training;
  - Handpump quality control
  - Handpump installation
- Developing training manuals for
  - Extension workers;
  - Borehole committees;
  - Pump caretakers.
- Developing guidelines for monitoring

Field testing of procedures

Rehabilitation of 30 No. of boreholes

Local manufacture of 30 No. Afridev Handpumps

Training of 456 borehole committee members, 90 pump caretakerand 126 community trainers (extension workers).

Community involvement in: collection of locally available construction materials, establishment of borehole maintenance fund through community contributions, maintenance and repairs of handpumps.

Institutional structures and procedures developed through different programmes are available now for application on a national scale, to ensure sustainable Village Level Operation and Maintenance in rural water supplies.

However there are a number of issues which should be addressed before a fully fledged Village Level Operation is fully realised, these include:

- Key agencies should give a high profile to the issue of Village Level Operation and Maintenance;
- Clear policies should be formulated including legal frameworks should be set up in support of VLOM;
- Handpump standardisation issue should be pursued further;
- Sufficient funding should be made available in support of VLOM activities;
- Local manufacture of handpumps and spareparts should be given top priority;
- Training of personnel should also be given priority.

These are some of the issues which this workshop could consider seriously.

LOCAL MANUFACTURE OF THE AFRIDEV HANDPUMP AND SPAREPARTS IN MALAWI

PRESENTED AT THE VLOM WORKSHOP
20 - 24 SEPTEMBER 1993
BLANTYRE, MALAWI

K. LIYANAGE
WATER DEPT
P/BAG 390
LILONGWE 3

LOCAL MANUFACTURE OF AFRIDEV HANDPUMPS AND PARTS IN MALAWI

1. INTRODUCTION

Success of community managed rural water supply schemes is related to a sense of community ownership of the well and pump and can only be achieved when the organisation capacity of the community is adequate. The water committee or other community organisations finances and organises all handpump maintenance and repair in such schemes. For community management to be feasible the selected pumps must be suitable for simple routine maintenance with basic tools and minimal skills. Common spareparts must be readily available in or near the community, which will usually mean that they are manufactured locally.

2. ADVANTAGES AND DISADVANTAGES OF LOCAL PRODUCTION

There are several advantages of local manufacture of hand pumps, of which some are quantifiable monetary terms, while others, although very important may be difficult to qualify in monetary terms. At the same time local manufacture has it's own disadvantages and limitations.

Advantages:

a) Easy procurement:

Local availability of pumps and spareparts makes the procurement process a lot easy and fast.

b) Less foreign exchange:

Requirement of foreign exchange is less because only raw materials are imported.

c) Better after sales service:

A local manufacture is in a position to provide a better after sales service specially for spareparts than a foreign supplier.

d) Less down time costs:

Improved spareparts supply will reduce downtime costs such as financial and health care.

e) National Identity:

Locally produced handpumps have a national identity and therefore their acceptability in national rural water supply programs.

f) Response to field complaints:

Local manufactures are able to respond field complaints or requirements through Research and Development efforts quickly.

g) Employment generations:

Local manufacture helps employment generation and development of skills which is vital for a developing country.

Disadvantages:

a) High Price:

The price of locally produced pumps may be higher than imported ones.

b) Limited technology choice:

Insistence of local manufacture in a developing country may result in limited choice in technology.

c) Quality Problems:

if proper quality control measures are not established generally locally pumps could be of poor quality.

3. STATUS OF LOCAL MANUFACTURE OF AFRIDEV HANDPUMPS IN MALAWI

3.1 Market Demand

Market demand is the most important factor affecting local manufacture of handpumps in Malawi. Majority of the handpumps are procured for donor funded rural water supply programs. Average requirement of handpumps for these programs varies between 500 to 1,000 units.

Generally, the production costs decrease with the increase of scale of production. This is because investment on tooling. jigs and fixtures, machinery and equipment and other costs could be spread over a large number of units. Also with a low demand, adequate competitions would not exist among manufacturers and as a result cost savings may not be critically looked at and passed on to users.

The above figure of 500 - 1,000 pumps a year is considered low for economical production processes.

3.2 INDUSTRIAL INFRASTRUCTURE AND SKILLED MANPOWER.

Industrial facilities that are generally required for the production of handpumps are:

light engineering facilities as machining and fabrication, plastic extrusion and moulding, rubber moulding and hot dip galvanising The above mentioned facilities are available with the private sector industry in Malawi. Since the industrial base in Malawi is small only one or few of each facility exist and as a result there isn't much competition between them.

As an example there is only one dip galvanising facility in the country. The plant is large in capacity and uneconomical to operate for small quantities of items. Non availability of a suitable hot dip galvanising facility is as an obstacle in establishing local manufacture of Afridev handpumps in Malawi.

Generally the availability of skilled manpower with the private sector industry is adequate.

4. CONCLUSION

Despite the fact that the demand for handpumps in Malawi is relatively low, it has a great potential to establish manufacture of the complete Afridev pump. Already several moulding tools for plastic and rubber spareparts are in the country and the knohow for local manufacture has been acquired through technical advise and training.

Under these circumstances it is recommended to consider establishment of a 'Regional' production facility in Malawi which will meet the demand of the whole Region. Such a facility will be able to cater several countries in the region and will be economically viable.

3.3 AVAILABILITY OF RAW MATERIAL

Malawi has to import all the raw materials required for pump manufacture. The supplies mostly come from Republic of South Africa. Local manufactures face problems obtaining raw materials in time.

3.4 LOCAL HANDPUMP COST

Cost of a locally manufactured Afridev handpump is about twice the imported cost of a similar pump from India. the reasons for the high production costs being; high overheads, custom duties on materials + components, high transport charges and high labour costs.

3.5 STANDARDISATION AND QUALITY CONTROL

Malawi Bureau of Standards is entrusted with establishing standards for locally manufactured products. Malawi Bureau of Standards has adopted the SKAT specifications for the Afridev handpump in full as the local standards.

The Bureau is involved in assessing the quality of locally manufactured pumps and components using guide-lines drafted with assistance from the Water Department.

3.6 LOCAL MANUFACTURE OF SPAREPARTS

The Water Department of the Ministry of Works has rendered assistance to the private sector for the establishment of local manufacture of fast moving spare parts of the Afridev pump. This assistance incorporates equipment, raw materials and technical knowhow.

Moulding tools for the bearing bushes and foot valve receiver were obtained by the Department through donor assisted projects. A large quantity of plunger/footvalve bodies and foot valve receives at Pipe Extruders Ltd in Lilongwe using these tools. Also plastic Bearing Bushes are being manufactured at Pipe Extruders Ltd. These quantities will suffice requirements for new pumps and spare parts for maintenance over the next few years. Similarly necessary steps have been taken to establish local manufacture of Rubber components of the pump as well. Moulding tools for thee Rubber Bobbin were locally manufactured and procured by the Water Department. A Rubber consultant was brought in to set-up the manufacturing process at Advanx Ltd and to train the Malawi Bureau of Standards staff in quality assurance of the product. The Water Department is in the process of placing order for moulding tools for the other fast running spare parts such as 'U' Seal and 'O' Ring.

CPAR WATER AND SANITATION PROGRAMME

PAPER PRESENTED TO

VLOM WORKSHOP

SEPTEMBER 20-24

BY

MCDONALD KAPATUKA

CPAR WATER AND SANITATION OFFICER

ABSTRACT

The use of clean water from protected wells, and hygienic practices, are inexpensive ways to prevent illnesses in communities. Unfortunately, not all communities are aware of sanitation practices and/or do not have access to facilities such as protected wells and latrines. As a result, many people, especially in rural communities, chronically suffer from diseases which are transmitted through contaminated water and poor hygiene.

In response to this problem, Canadian Physicians for Aid and Relief (CPAR) is assisting rural communities to gain access to a source of clean water. CPAR is also fostering active community participation in awareness building, and activities designed to prevent the transmission of waterborne diseases.

This paper is a summarized version of the water and sanitation activities carried out with CPAR assistance in the traditional authority (TA) of Chitukula in Lilongwe District. It discusses the background of CPAR's water and sanitation programme, describes CPAR's approach to community participation, and outlines the components of the programme, its achievements, problems, and future plans. An appendix and figures provide technical data on well construction.

WATER AND SANITATION PROGRAMME - TA CHITUKULA, LILONGWE

1. BACKGROUND

For the past 3 years, Canadian Physicians for Aid and Relief (CPAR) has been supporting a Primary Health Care (PHC) programme in Chitukula Traditional Authority (TA) in the district of Lilongwe. This district was selected for assistance by the government of Malawi because it was experiencing some of the worst health statistics in the nation. The TA of Chitukula was chosen on the recommendation of the Lilongwe District Health Office (DHO).

In 1991, a water and sanitation programme was incorporated into the larger PHC programme. This was in response to a Community Needs Assessment which indicated that the development of a dependable source of potable water was a major priority for communities in Chitukula TA. The programme has been carried out in conjunction with the Water Department, the Department of Women's Affairs and Community Services, the Lilongwe District Health Office, and communities in Chitukula.

The programme is thus enabling communities to develop their capacity to plan, and implement water and sanitation activities. It is also assisting the above-mentioned government departments to effectively support community initiatives.

2. COMPONENTS OF THE PROGRAMME

The programme engages in several activities including

- Community Awareness Raising and Organization
- Well Siting and Construction
- Well Maintenance Training and Support
- Sanitation Activities

2.1 Community Awareness Raising, and Organization

Diseases arising from poor sanitation and contaminated water will only be sustainably reduced if communities come to understand how they are caused, what their effects are, and what they can do to prevent them. Without improved sanitation practices, water from protected wells is easily contaminated before it is consumed, and illnesses continue to spread. This has been confirmed by research carried out jointly by CPAR and SCFUK. Samples of water taken at the source, during transit, and in the home, indicated that levels of contamination increased in transit and during storage.

To prevent this contamination, CPAR is initiating an awareness-raising process in which individual communities explore their water quality problem and how they wish to resolve it. Extension workers (EWs) called Health Surveillance Assistants (HSAs) and Community Development Assistants (CDAs) assist in this process by providing these communities with technical information pertaining to water contamination and water-borne diseases. They also encourage community members to relate their experiences and ideas. Sources of contamination and how to prevent it are major points discussed at meetings.

Extension workers play an important role as facilitators, assisting communities to organze themselves, plan, and manage their projects as they see

fit. Individual communities are encouraged to become aware of their capacity to carry out *their* development goals, and are stimulated to work together, using their resources effectively. This approach is critical to the sustainability of the programme, as it develops a strong sense of community responsibility and interest in their project.

2.2 Well Siting and Construction

Traditional community water sources are easily contaminated, and unreliable. In 1991, it was found that only 12% of the communities in Chitukula had access to water from protected sources (CPAR Community Needs Assessment Report). CPAR has thus been enabling communities to build wells which are sealed with cement covers and fitted with handpumps.

Well sites are jointly selected by the communities and CPAR staff. This encourages good relations, and ensures that community knowledge is combined with the technical experience of CPAR staff. Wells are thus sited a good distance from refuse pits and latrines. They are also sited according to community preferences for accessibility and water flavour. Once a good site has been located, the ground is cleared, a circle drawn, and community members begin digging.

When the water table is reached, a trained crew with necessary equipment move in to assist with further digging. Simultaneously, other members of the community bring local materials (bricks, stones, and sand) to the site.

Well construction starts when digging is completed (for details on well design see Appendix 1). At this point, CPAR supplies non-local materials including cement, reinforcement bars, and finally, the pump. While communities participate, technically trained crews hired by CPAR play a crucial role in well construction. These crews are composed of residents of Chitukula TA who are trained by CPAR. Thus, upon programme completion, a local body of technically skilled individuals will remain in Chitukula.

The general composition of a completed well is the actual well, fitted with a Mark V pump, apron, washing slab, and drain (see figure 2). Completed wells are chlorinated and then sealed against contamination.

2.3 Well Maintenance Training and Support

In order for communities to care for their wells with little outside assistance, volunteers must be provided with maintenance training. A tiered training system has thus been established. Initially, extension workers receive pump maintenance training from programme staff. These extension workers, in turn, train two volunteers who are selected by their communities, and lend their support in case any major repairs are required. Selected HSAs are provided with tool kits for this purpose. CPAR considers that by having volunteers trained by extension workers, communities are enabled to develop stronger relationships with the government departments which support them.

CPAR staff also monitor initial maintenance and repairs activities, providing guidance if necessary. As part of well maintenance monitoring, CPAR and Save the Children of the United Kingdom (SCFUK) have been jointly sponsoring a Water Department staff member to carry out water quality tests on wells in the impact area. This activity has shown excellent results for the water quality of CPAR-Chitukula wells.

2.4 Sanitation Slab Construction

Increased awareness must be translated into action to improve water hygiene and overall sanitation. Communities must engage in activities to prevent the accumulation of wastes (especially human), and stagnant water. Household hygiene practices also can be improved through the adoption of new practices including the use of pit latrines.

While less extensive than well construction initiatives, sanitation slab (sanslab) construction for pit latrines is also an important component of the programme. Sanslabs are five times larger than sanitary platforms and require no wooden supports. CPAR chose to use this design on the suggestion of Chitukula communities, who pointed that wooden supports were hard to obtain, and were subject to termite infestation -- resulting in the collapse of sanplats.

The construction of sanslabs is carried out entirely by individual households or schools. Using, once again, a tiered system, CPAR trains EWs in latrine site selection and sanslab construction. EWs, in turn, train community volunteers. Households or schools which have prepared a pit are provided with non-local materials (cement and reinforcement bars), and equipment (which is passed from site to site). Sanitation slabs are built according to a simple design which communities can easily modify to suit their needs.

While only twenty sanitation slabs have been built as yet, it is expected that additional households will gradually follow the example of their neighbours. The stimulation of community interest in pit latrines will, however, be an important goal of the programme in the future (see section 6).

3. CPAR'S APPROACH TO COMMUNITY PARTICIPATION

CPAR's water and sanitation programme aims to encourage self-discovery, build confidence, and increase locally available skills by ensuring that each community essentially runs its own project. While some changes are now being proposed in future endeavours of this programme (see section 6), the approach to participation in this programme generally takes the form described below.

Community participation in the programme begins when a community determines that it has a water and/or sanitation problem and decides of its own accord to take action. Having heard about the programme through the local Area Action Committee (AAC), extension workers (EWs), or adjacent villages, an interested community requests a meeting with CPAR. At this meeting, the community presents its vision of its water and/or sanitation needs. As a result of these discussions, the community, the AAC, and CPAR jointly decide what kind of action should be taken. CPAR then explains that it will provide non-local materials and technical assistance, once the community has organised itself and assembled local materials and labour.

If a community wishes to proceed, they engage in a series of village meetings, obtain the required local materials for either a well or sanitation slab, and organised a suitable labour system. In the case of well construction, a community must dig their well until they reach the water table. At this point, they alert their AAC that they are ready for assistance. Through this approach, a semi-competitive system has been developed. Accordingly, communities which have already been identified (according to need and expressed interest) are assisted on a "first-prepared, first serve" basis.

HSAs and CDAs have consistently played a crucial role in stimulating communities to work together and organised themselves. These EWs are currently receiving special training in participative facilitation techniques through

CPAR's Family Health Programme.

Although CPAR provides assistance in the form of crews (for the wells only), equipment, and non-local materials (ie cement and pumps), the communities continue to be responsible for organising and participating in their project in order to maintain an agreed upon schedule. The emphasis placed on community involvement and participation in their project is crucial to ensuring that wells and pumps will be maintained.

4. ACHIEVEMENTS

In the past two years, this programme has scored a number of achievements. Eighty-nine communities now have protected water sources, and informal discussions with the beneficiary communities have revealed a significant decline the incidence of intestinal diseases. As mentioned above, water quality tests on these wells have had excellent results.

The community well maintenance system which has been implemented has shown strong signs of sustainability. In villages where there have been pump breakdowns, communities have been able to purchase parts on their own initiative, and have carried out repairs with minimal CPAR intervention.

The success of the programme has triggered a very large demand for wells in the impact area. Perceiving the benefits of protected wells (and in some cases of sanitation slabs) in adjacent villages, communities are organising themselves with increasing rapidity. In fact the demand has exceeded the funding which is currently available. This is a source of concern because although morale is currently high, it may fall if CPAR is unable to address the felt need -- thus undermining the programme.

5. PROBLEMS/CONCERNS

While the programme has enjoyed considerable success, there have also been various difficulties. Some of these are being effectively dealt with, while others have been targeted for attention in the proposed plans for the programme's future.

5.1 ***Lack of awareness of sanitation and water hygiene*** has been exacerbated by a national failure to emphasize preventive health care. While most communities are enthusiastic about constructing dependable and protected water sources, it is difficult to encourage them to adopt hygienic practices, and construct facilities such as latrines. As yet, only 20 sanslabs have been constructed, and water continues to become contaminated in transit. The programme has sought to improve this situation by training extension workers and community volunteers. This problem will also be a major focus of the future programme.

5.2 ***The inactivity of the AAC,*** and its poor links with the communities have also been a problem. CPAR has begun dealing with this by including the AAC in decision-making, stimulating them to regularize meetings, and providing leadership training using creative adult education techniques. The most important effect of this work, has been increased community awareness of the AAC's existence and the support role it should play.

5.3 ***Limited involvement of the Water Department (WD)*** is a result of the initially small size of the programme, the low priority which WD has placed on shallow wells as compared to borehole pumps, and WD's limited resources. This has been problematic because the water department plays a key role in the

production, distribution, and monitoring of Mark V pumps. Pump standardization and the development of a sustainable support network thus relies heavily on WD's participation.

5.4 *Pump parts are not locally available.* While Mark V parts are produced in Malawi, they are only available in major urban areas such as Lilongwe city. This hampers the capacity of communities to independently purchase spares and carry out repairs.

6. FUTURE PLANS

With two years of experience in water and sanitation projects, CPAR now feels the need to expand the programme, and attempt new approaches through pilot initiatives. A three year programme, in which three hundred wells would be constructed, and greater emphasis placed on sanitation activities is thus planned. Central to this new programme would be a partnership (which is currently being established) between the communities, the Water Department, the Ministry of Health (MOH) (through the District Health Office), UNICEF, and CPAR Malawi and possibly another NGO based in Malawi. This partnership will ensure the increased sustainability of the programme. It will also allow the programme to explore possible ways to resolve previous problems through pilot initiatives such as:

6.1 *The formal testing of shallow well pumps* with the intention of selecting a pump for national standardization. As yet no shallow well pump has been selected for national standardization. While the Mark V is currently being used by the programme, CPAR is involved in a joint CPAR/UNICEF/WD evaluation of several direct action pumps, with the intention of selecting one which will be thoroughly tested for standardization through the programme.

6.2 *Linking well construction with sanitation activities* more closely in order to direct enthusiasm for well construction towards equally important sanitation and hygiene. In addition, increased emphasis will be placed on sanitation activities which are easier to undertake than sanitation slab construction, such as the use of dish racks, refuse pits, waste water channels, and clean water storage containers.

6.3 *The intensive use of innovative health education methods* based on adult education techniques originally developed by AMREF, greater emphasis on focus group discussions to develop community awareness, and improve communication flow in the communities.

6.4 *Including the water department in the well maintenance* network, in order to strengthen support to communities.

6.5 *Development of a water quality control system* carried out jointly by communities, WD, and MOH.

6.6 *Promotion of the productive use of well run-off.* Through awareness building and stimulation, the programme will seek to encourage communities to make use of well run-off for such things as vegetable gardens or tree seedlings which could be used for income generation or improving nutrition.

6.7 *A pilot initiative to increase the availability of spare parts* by decentralizing their distribution to local businesses. This too will depend on an effective partnership with WD.

APPENDIX 1 TECHNICAL INFORMATION ON WELL CONSTRUCTION

CONSTRUCTING THE WELL

The bottom of the pit is laid with three to four loads of stones, These are laid without mortar. On top of this, six loads of bricks are laid without cement mortar. These are followed by bricks joined with cement mortar, until the wall reaches the top (see Fig 1). The inside of the well is plastered with cement, and shined.

The space between the bricks wall and the side of the pit is back-filled with soil (preferably from anthills) which is rammed as it is being filled to stop water seeping through the sides into the well.Because of the capacity of the pump (Mark V) see
Figure 1, the maximum depth of the well is seven metres

QUALITY OF BRICKS AND SAND

Bricks and sand should be of high quality and uniform in size. As such, when soaked in water for 24 hours, they should not disintegrate or dissolve. In addition, they should give a ringing, metallic sound when two bricks are struck together, .

River or pit sand is used throughout construction. The sand should be free of organic matter (this can be verified with a test in which sand and water are mixed in a bottle, and the organic matter floats on top).

TOP SLAB

The slab is casted with a socket anchored in the concrete. There is also a manhole beside this socket which can be used if the pump breaks down. The manhole is also covered by a small slab. which is raised at the centre and slopes towards the edges. The top slab is fitted with a Mark V pump (see Fig 1).

PUMPS

The Mark V pump which is currently being used by the programme, was developed for use in Malawi. Its plastic parts are produced by a Malawian manufacturer, and it is assembled by WD. Maintenance of Mark V pumps is simple once community volunteers receive a short training. These pumps are particularly suitable for the depth of the wells which are being constructed in Chitukula (up to 7 metres), and are appreciated by communities for their high discharge rates.

WASHING SLAB AND DRAINAGE CHANNEL

A washing slab and a drainage channel are built before or soon after the well is completed. The height of each washing slab is discussed with each community to ensure that it is an appropriate height. As yet, the drainage channels have not been directed to soak pits, as communities are being given the opportunity to use the run-off for vegetable gardens.

WELL WITH MARK V PUMP

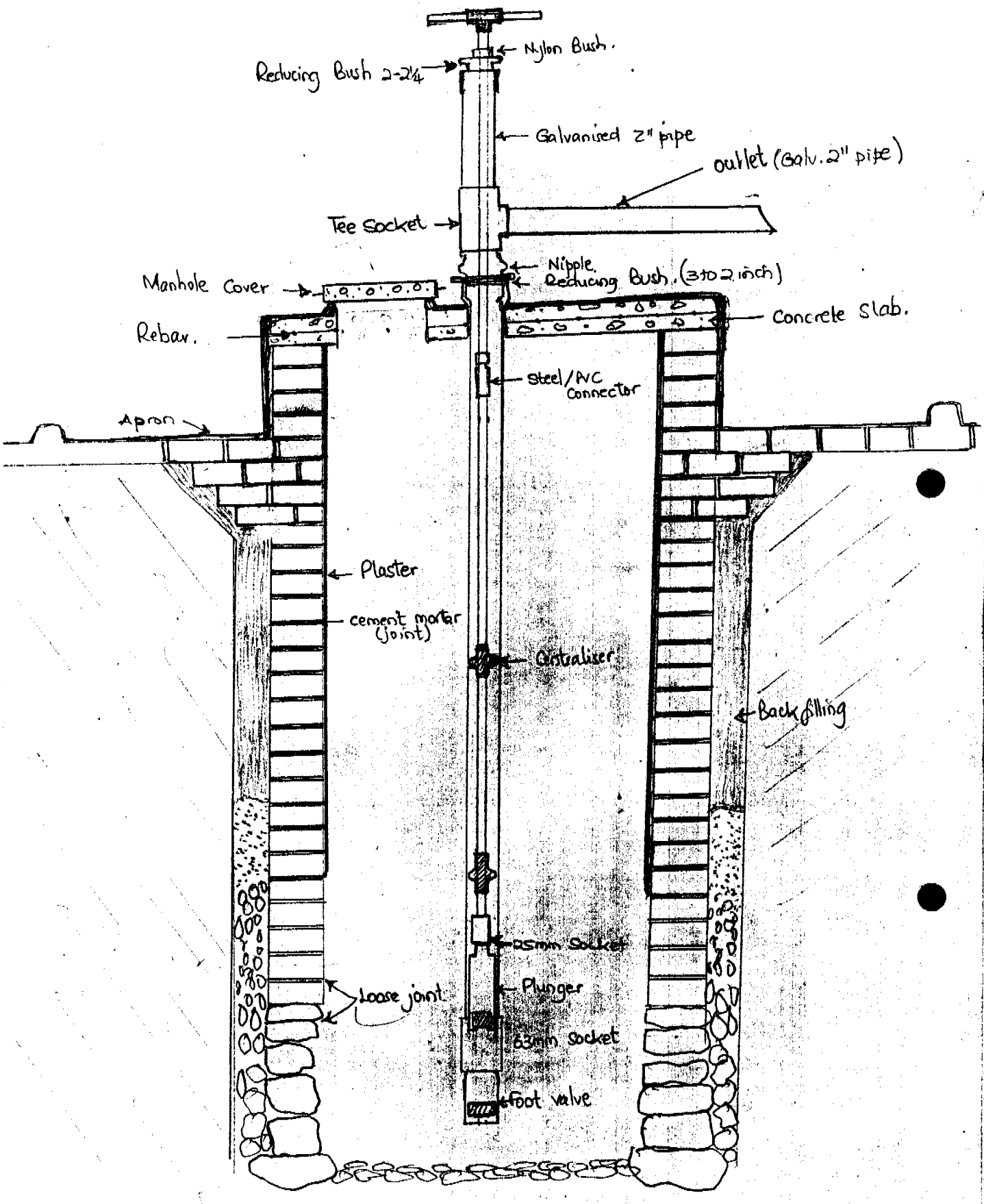

FIG 1

Design by: Water & San. Officer MK.
CRAR MALAWI

SHALLOW WELL WITH A PUMP.

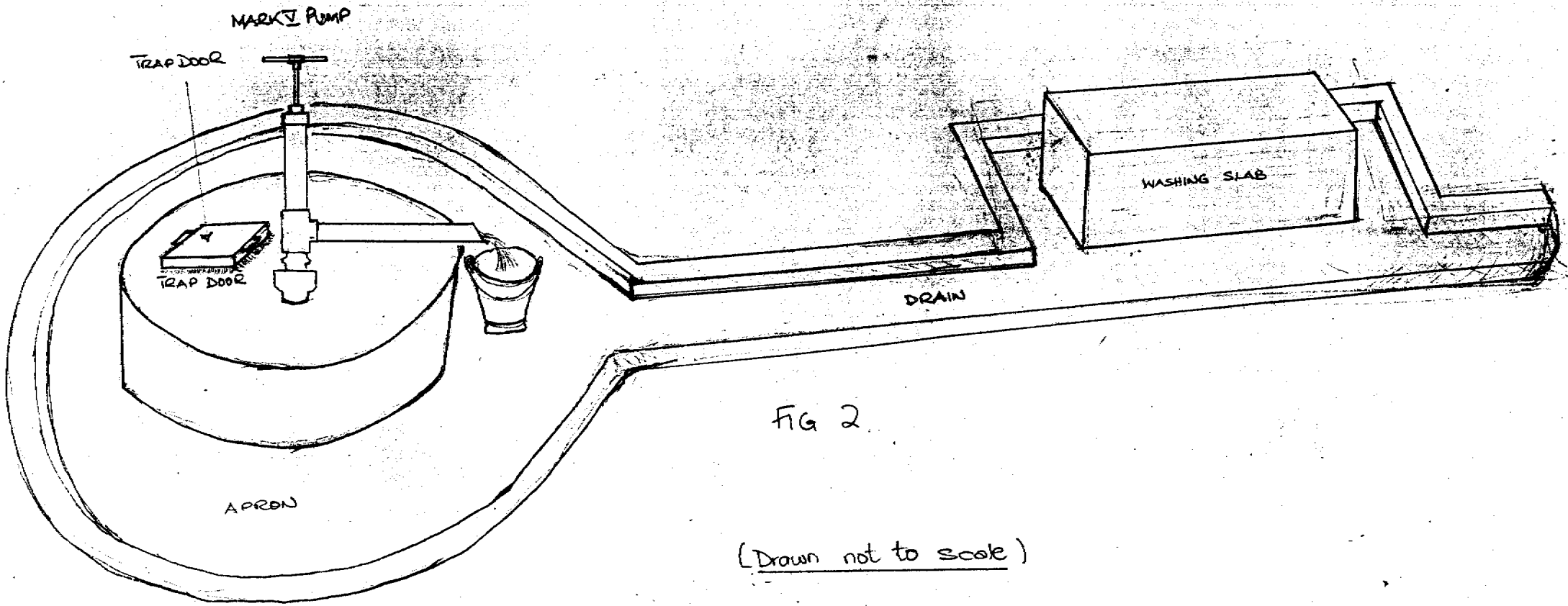

FIG 2

(Drawn not to scale)

P 4-3

REGIONAL WORKSHOP ON OPERATION AND MAINTENANCE OF RURAL WATER SUPPLIES. PAPER PRESENTED BY MR. J. NANSUNGWI AT RYALLS HOTEL FROM 20TH TO 24TH SEPTEMBER 1993, IN BLANTYRE.

Water is life and the Christian Service Committee of the churches in Malawi (CSC) has been giving priority to the provision and development of sustainable systems of water supply in rural Malawi.

The importance of providing rural communities with potable water cannot be over-emphasized. In most developing nations water borne diseases play a major role in the high infant mortality rate. Traditionally, the time and labour used in collecting water for household use in the rural areas has been calculated to be an expense on its own. Indeed, every government or donor agency knows the excitement that follows the installation of a new source of potable water in rural areas. Ululation follows and in some places people dance to celebrate the arrival of safe drinking water.
Yet, there is another aspect to the provision and development of water facilities to rural communities that has been a bone of contention between the donor/government and recipient of the water facilities provided.

The question of maintenance of water points has been a thorny issue for a long time in Malawi. For the purpose of this discussion I will cite some of the experiences that CSC has had and perhaps try to offer some suggestions. CSC's involvement in the provision of water services to rural areas goes back as far as the inception of the organization in 1968. At the outset it was agreed that CSC would provide the services and then the government would take over the maintenance of the facility provided. This was good in theory but it did not work well in practice. The result was that a lot of water points were left unattended and hence did not benefit the user communities.

OWNERSHIP
Projects such as boreholes are usually "handed over" to communities in the belief that the true "ownership" is thus transferred at the "hand-over" ceremony. This is a misconception. Communities rarely accept the actual ownership of communal facilities, and "borehole ownership" is a case in point. This arrangement is usually tested when the facility breaks down and the "owners" are asked to make modest contributions towards repairs. They rarely make these contributions because they feel that the borehole belongs to the people who installed it in the first place.

The problem is that the "ownership" of the borehole was not clear to the user community. There should have been some form of education that the facility is their's and hence that they should be responsible for its upkeep. This never take place, however,and because of this the user community always feels that the facility belongs to the provider, be it the donor or government.

The Christian Service Committee embarked upon a new system of creating committees for each project. The committee was charged with the responsibility of caring for the borehole. These committees were given basic training in simple maintenance procedures. It was assumed that if a borehole has a pump which can be easily maintained by the user community, that necessary maintenance costs would therefore be cheaper than if CSC had to come and do the maintenance. This didn't happen because even simple maintenance turned out to be difficult. There is a story going the rounds that a representative of a sales organization in Europe tried to demonstrate to a local community how simple it was to maintain the model of his pump. He failed to do so because of lack of tools and technical know-how. This demonstrates that pump maintenance is not as simple as it is often thought. Indeed the truth of the matter is that maintenance should really be considered as a major component of any water project. It is not reasonable to expect a borehole that is fully utilized day in and day out to withstand the rigors imposed on it if full attention is not given to maintenance.

PUMP BREAK DOWNS AND MANUFACTURERS

Experience has shown that there are several major reasons for pump break downs: the age of the pump, how it is used, how it was installed and the durability of its parts. A study undertaken in Zimbabwe (Waterlines April 1993) states that the frequency of breakdowns varies from place to place.Only a very small percentage of one or two-year-old pumps breakdown at least once a year, while nearly all the 15 to 20-year-old pumps break down at least once a year.

It should be emphasized that irrespective of the make or design of the pump, pumps will always break down. What is at stake,however, is to identify the most cost-effective system of repair or maintenance.

Many pump manufacturing companies have come up with designs or modifications they consider appropriate for village use and maintenance. Some of the problems brought on by these modifications are:

a] Too many types of pumps have been experimented on with communities whose resources have failed to cope with the pumps' shortcomings.

b] The cost of some pumps has been so high that they could not be widely used.
c] Spares for replacing the broken parts are expensive and not readily available.
d] Some spare parts which were meant to be replaced by hand have proven to be too heavy for such manual work.
e] Some rod connector designs are prone to disconnection as they move within the riser pipe.
f] Some pumps have used galvanized down components and bronze cylinders whose weight and specialty require the use of expensive repair equipment. This has also increased the wear of the pump head moving components.
g] Inaccessibility of the pumping elements on some pumps has rendered village maintenance impossible.
h] Poor pedestal designs and installations have also adversely affected operations and maintenance at the village level.

LOCAL PARTICIPATION

A 1991 World Bank/SKAT study showed that communities in Kenya and Malawi were willing to assume their share of responsibility for reasonable operation and maintenance costs. The study also showed that the communities were capable of performing simple repairs, like replacing seals, provided the spares were available. However,if the costs are too high, the villagers will refuse to participate.They prefer to return to their traditional, and usually unprotected, water sources rather than pay their hard earned money for expensive repairs. Indeed the expensive nature of repairs usually is beyond the means of the ordinary village.

Perhaps it is time that there was a rethinking as to who should be responsible for maintenance of boreholes and other water facilities. There also needs to be increased emphasis on community mobilization leading to community "ownership" of the water point. Our experience shows the following:
1. Not enough time has been given for training sessions in the simple maintenance of boreholes.
2. The project committees have neither the tools nor the spares to carry out repairs.
3. At times, individuals appointed to these committees do not have the clout to control, or influence other members of the community. In addition, those with influence who are excluded from the committees could negatively impact the functioning of the committee.
4. Lack of available funds for the project committee to use in cases of break downs.
5. Infrequent follow-ups by CSC personnel to the project committees.

It is generally accepted that the government is responsible for the provision of services in the rural areas such as access to safe drinking water. Government has attempted to provide facilities wherever possible, but as you are all aware, the government on its own cannot satisfy the needs of all its people. Hence the existence of Non-Governmental Organizations.

WELL DESIGNS

It should be mentioned that faulty design and shoddy construction have contributed to difficulties in achieving effective operation and maintenance of rural water schemes.

CONCLUSION

The reduction of break downs of rural water points has occurred in areas where the local communities have been keen to correct the problems encountered. In other cases good workmanship when installing pumps has resulted in infrequent break downs. As stated elsewhere, however,there needs to be a rethinking as to who should be responsible for maintenance of water facilities in the most cost-effective manner.

A long standing aim has been to involve communities full participation right from the start. Where this has been a success, communities have felt responsible for their boreholes. Perhaps this area needs to be pursued further. A suggestion that a "Communal Fund" be created is not out of place. Perhaps this fund could be used as part contribution towards installing the borehole, or to pay for minor repairs.

Thank you.

MINISTRY OF HEALTH

TRAINING OF TRAINERS FOR EXTENSION WORKERS IN COMMUNITY BASED WATER AND HESP PROJECTS IN MALAWI

A PAPER PRESENTED AT A REGIONAL WORKSHOP ON OPERATION AND MAINTENANCE OF RURAL WATER SUPPLIES. RYALLS HOTEL. BLANTYRE 20TH TO 24th SEPTEMBER, 1993

by

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NATIONAL HESP COORDINATOR

TRAINING OF TRAINERS FOR EXTENSION WORKERS IN COMMUNITY BASED WATER AND HESP PROJECTS

INTRODUCTION

Training is a strategy which has gained unprecedented popularity among Malawian extension workers in community based (CB) water and HESP Projects in recent years.

Extension workers are entrusted with the responsibility of training local communities to enhance their involvement and participation in the sector activities.

The Government, Non-governmental Organisations (NGO) and donor agencies have invested a lot of money and effort in this venture to train extension workers as trainers of community leaders and community members.

Inspite of these inputs, impact of training on the beneficiaries' adequecy to sustain the introduced community based activities in water and HESP leaves much to be desired.

This is partly due to the communities' failure to perform certain functions, but largely, it has been the result of ineffectiveness on the part of the trainers themselves.

COMMUNITY BASED TRAINERS

Most of the Government implemented rural water development projects have a hygiene education and sanitation promotion (HESP) component. This arrangement has been replicated in similar projects implemented by NGOs.

Trainers in community based (CB) activities in these projects have been extension workers from Ministry of Works (Water Department) and Ministry of Health. The ones that are commonly used are Water Monitoring Assistants (WMA) and Health Assistants (HA) or Health Surveillannce Assistants (HSA).

Of late, we have witnessed the development of another cadre on the list of trainers, i.e. Community Development Assistants (CDA) from Ministry of Women and Children Affairs and Community Services.

Basically, the WMAs are responsible for providing extension services pertaining to the provision of Water Supply. The HAs and HSAs are responsible for implementing HESP activities, and the CDAs are responsible for mobilising the communities.

These extension workers form a multisectoral team at the community level and operate jointly in most of their activities e.g. training and supervision. Usually, their activities are coordinated by the WMAs.

TYPES OF TRAINING FOR CB TRAINERS

The present practice is for extension workers, as trainers, to undergo a series of training courses in form of workshops and seminars. These courses are intended to increase their knowledge and impart skills which will make them into effective community based educators and trainers.

Initial orientation sessions aim at acquainting them with the project activities, leadership and communication skills. They are usually conducted jointly in form of integrated workshops.

Specialised training sessions are organised separately for each respective group of extension workers, such workshops aim at providing more detailed information on subjects which might have been touched during the initial workshops. For instance, WMAs receive more detailed training in operation and maintenance of water pumps and taps, financial management, etc. HAs and HSAs receive special training skills in hygiene education, lining of pit latrines, casting of sanitation platforms (sanplats), constructing laundry slabs, proper handling of water and food, etc. CDAs receive special training in leadership and committee procedures, financial management, involvement of women, etc.

Training of extension workers in CB projects is organised and conducted by their district supervisors. These are sometimes assisted by officers at Regional and National levels. The major constrain faced by most district supervisors is lack of skills in training.

Training of extension workers relies on the supervisors' competence, experience and interest. Consequently, subject content, duration of training, and methodology vary from one trainer to another.

Most trainers advocate the use of participatory methods, such as group discussion and demonstration. However, there is need for skills improvement to perfect their teaching skills.

Training of trainers is usually conducted at a central point e.g. Agricultural Training Centres, School halls, Hotels, etc. Often, duration of such workshops range between a few days to several weeks.

Once trainers have been trained no follow-up is made to assess the trainers performance in the field.

SIGNIFICANCE OF TRAINING OF TRAINERS (TOT)

Training of trainers is important in promoting capacity building among extension workers as well as community leaders and community members.

In addition, TOT develop the extension workers or trainers into better motivators of the community; reliable supporters of community's efforts in planning and implementation of project; and trusted ambassadors for both the agency and the community.

An effective training of trainers workshop should be able to produce trainers with an attitude of willingness to work with the community in true partnership.

Where genuine partnership is present extension workers will be able to respect community's ideas, knowledge and experience. They will also give due respect to people's practices, traditions, values and culture which will eventually enhance their relationship.

An effective TOT enables extension workers to become better listeners and effective communicators. It facilitates openess and facilitates their ability in sharing skills and experiences with the people they serve.

Generally, a good TOT will be able to achieve the major objective of transforming the extension workers into learn-centred trainers as opposed to the traditional trainer-centred approach.

LESSONS LEARNT FROM COMMUNITY BASED TRAINING

It is very encouraging to note that extension workers from the three implementing Ministries have been very enthusiastic and have devoted much of their time in training local leaders and other community members into trainers of their own people.

Unfortunately, very few of the trained local communities have come forward to perform the trainers' role. No formal evaluation has been made so far to substantiate this. However, I have noticed, during my field visits, that out of every ten trained community leaders or members only one or two have actually gone out to give health talks or participate as facilitators in CB training sessions.

This observation prompted me to take a closer look at how training is organised and conducted at community level by our extension workers. The following things were noted:-

(a) Most of the trainers were able to indicate the topics, determine target groups, formulate training objectives, and decide on the teaching methodology for their training sessions. However, they had problems in explaining how they determined peoples' training needs (problems), how they decided which subjects to include on the time-table, and how to determine the difference between teaching objectives and learning objectives.

(b) It was pleasing to note that all trainers opted for participatory teaching methods. They spoke highly of group discussion and demonstratation. However, they require more training in using participatory approaches; their skills were deficient in most cases.

(c) Most of the trainers seemed to know their subjects well. As a result, sometimes they went too deep into the subjects with a likelihood of confusing the communities. Guidance in this area was, therefore, necessary.

(d) Most of the trainers took one week to cover their course content during CB training. However, most of them could not justify their decisions. Some of the subjects included in the time-tables were irrelevant to the objectives.

(e) Very few trainers used teaching materials. WMAs for instance, were good at using realia when demonstrating how water pumps can be repaired. HAs use demonstration in teaching how to cast san plats . However, most of them did not see the need for such things as posters, flip charts, pictures, flyers, reference books, leaflets, etc.

(f) Most ofthe trainers seemed quite confident in presenting their subjects. However, they lacked skills or methods in assessing whether or not learning was taking place during or after the lessons.

(g) Most trainers had problems in developing or identifying key messages for their lessons; some of the messages were apparently irrelevant to the objectives. Sometimes the lessons were so crowded with unnecessary messages,over-shadowing the key messages.

(h) None of the trainers made use of lesson plans or any written guidelines to conduct training sessions.

POSSIBLE METHODS OF IMPROVEMENT

Lessons learnt from the field indicated that trainers lacked skills in management of training. This deficiency subsequently affected the performance of community leaders and community members.

One way of addressing this problem would be to conduct an evaluation to assess the impact which training has had on extension workers and community leaders. Recommendations should then be made as to how best training of trainers might be improved.

Based on the same field observations I designed a TOT on how to manage training. This was aimed at addressing most of the issues identified during the field visits.

The procedure adopted during the TOT was one which offered optimum opportunities for participation by the participants in the learning process. Participatory teaching methods, namely, group discussions, demonstration, role plays, field visits and songs were used.

Facilitators' role during the TOT was more of providing guidance than spoon-feeding. This was necessary in order to achieve the intended broad objective of imparting training skills into the trainers.

The TOT has so far been field tested at Mpira/Balaka Water Project (HESP Component) with considerable success.

IMPLICATIONS OF TRAINING OF TRAINERS

Initial training costs of extension workers in CB training may be heavier than subsequent costs met at the time when such training has been institutionalised and conducted by community leaders and community members.

Proper planning and preparation is very crucial in training CB trainers. This would involve identification of the right extension workers for the job, development of key messages, selection or development of appropriate training materials, determination of content and duration of training sessions, and identification of funds.

The TOT is best done by competent trainers. These could be locally available, however, use of consultants or hired experts may be necessary when the local personnel fall short of certain skills in TOT. When such a thing happens, it implies need for use of large sums of money.

Other possible expenses are expected to be met during mobilisation of extension workers to one central venue for training. These would include funds to cover transport, food and accommodation charges.

It is essential to properly monitor and evaluate the effect of each training that has taken place. Skills required to do this type of activity may not be readily available. Expert advice and

and guidance may, therefore, be sought from local or external consultants or specialists.

As a result of inadequate funding of the water and HESP activities it has not been easy to conduct such evaluation surveys in this country. The dependency on donations has aggravated the problem further since donors like funding activities which appeal to them.

CONCLUSION

Sustainability of community based water and HESP projects relies heavily on genuine community involvement and participation. To achieve this is not easy. Much depends on how the community is approached by extension workers and community leaders.

When communities are properly trained and made aware of their responsibility over their own health, they become more confident and develop the capacity to plan and manage their community based activities properly.

Effective education and training of communities can best be achieved by the involvement of well trained extension workers who in turn train community leaders and other community members.

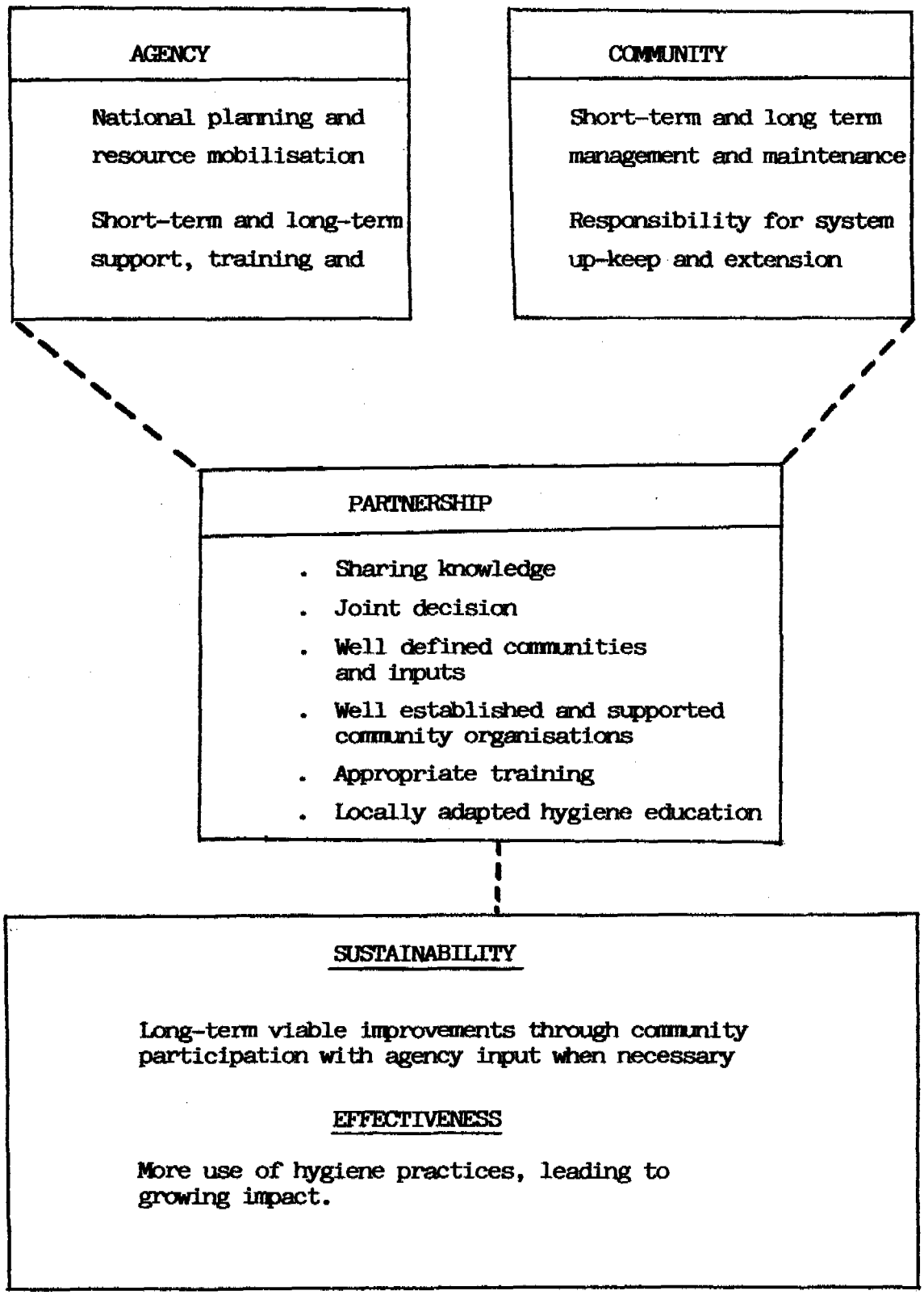
Training of trainers must aim at preparing both the extension workers and community leaders e.g. water and Health Committee members, to effectively plan, organize, conduct and evaluate their training sessions.

Mindful of the costs involved in training of CB trainers, efforts should be taken to utilize appropriate, locally available resources. Use of external consultants and experts should be ~~discharged~~ discouraged as much as possible, unless otherwise, to reduce training costs.

Instead of depending on donations, the Government should explore possible methods of funding water and HESP Projects. It should also try to set aside some funds, on its recurrent budget, to sustain training and other activities in water and HESP projects when donors pull out.

ANNEX II

AGENCY AND COMMUNITY PARTNERSHIP



MINISTRY OF HEALTH

HYGIENE EDUCATION EDUCATION AND SANITATION PROMOTION (HESP) PROGRAMME IN MALAWI

A PAPER PRESENTED AT A REGIONAL WORKSHOP ON OPERATION AND MAINTENANCE OF RURAL WATER SUPPLIES, RYALLS HOTEL, BLANTYRE

20TH-24TH SEPTEMBER, 1993

by

B.B CHANDIYAMBA
NATIONAL HESP COORDINATOR

HYGIENE EDUCATION AND SANITATION PROMOTION (HESP) PROGRAMME IN MALAWI

INTRODUCTION

Malawi has a very strong and long standing selfhelp spirit. In view of this background, the country started developing a self-help rural piped water supply programme in 1968, but at a small scale. In 1980, the United States Agency for International Development (USAID) agreed to support the programme with a total of US $6 million grant over a five year period which was later extended for another six months to December, 1988. Among the activities included in the grant was the incorporation of health education and sanitation component. This, therefore, marked the birth of the Health Education and Sanitation Promotion(HESP) Project in July, 1982.

The name has since 1985 been changed to Hygiene Education and Sanitation Promotion(HESP) Programme.

AIM

In order to implement the Malawi National Health Policy in efforts to attain the ultimate goal of Health for All by the year 2000, HESP aims to strengthen the delivery of primary health care(PHC) activities in rural communities through the integrated expansion of PHC elements of water supplies, hygiene education and sanitation.

PROGRAMME OBJECTIVES

Broad objectives

To promote health of the beneficiaries by reducing morbidity and mortality due to water and sanitation related diseases.

Specific Objectives

- To promote coverage and utilisation of improved sanitation facilities.
- To improve water supply surroundings.

- To increase knowledge and skills of health workers and local communities in the prevention and control of water and sanitation related diseases.

PROGRAMME STRATEGIES

HESP programme is committed to achieve the above objectives through:

- effective health education that will create awareness, impart knowledge and skills, change attitudes and improve habits and practices of rural communities.
- community involvement in planning, implementation and management of HESP activities.
- multisectoral involvement.

Steps used to effect HESP [redacted]

- Selection of traget villages
- Meet traditional and local political leaders
- Conduct public meeting
- Election of village health committee (VHC)
- Orientation meeting for the VHC
- Baseline village survey
- Village Health Committee training
- Regular VHC meetings
- VHC compliance
- Health Education course for the VHC
- VCH refresher courses
- Continued follow-up visits.

ACTIVITIES

(a) Sanitation

To increase coverage and usage of pit latrines to a target of 80% of the households. [redacted] Improve condition of latrines e.g. by the provision of sanplats. Promotion of proper refuse disposal e.g. using refuse pits.

(b) Water Supply

HESP provides aprons, open drains, soakway pits and laundry slabs to all existing stand posts in the water development projects. About 8,000 laundry slabs will be constructed by HESP by the year 1996. Construction of these depends heavily on donated funds and community contribution.

(c) Environmental Improvements

HESP makes sure that all dwelling houses and their surroundings are kept clean always. As a supplement to hygiene education, clean village competitions are used to motivate the public in this area. Prizes and certificates are given to the winning villages.

This involves the promotion of good housing, clean surroundings, use of kitchens, dish racks and bathshelters.

Unfortunatly, some donors are not in favour of clean village competitions and are, therefore, discouraging their continuation.

(d) Hygiene Education

Personal hygiene is emphasized in health education of the public, especially women. Messages include wash of hands before eating, after visiting the latrine and after attending to children excreta or soiled nampkins. Women are also educated in issues, such as, the importance of washing clothes; keeping themselves and their children clean; proper water handling and storage; cleaning of cups, utensils and containers; use of clean sanitary facilities, etc.

Hygiene education is important in changing peoples' unhygienic habits and practices into hygienic practices which will be instrumental in promoting good health.

(e) Community Mobilisation

Implementation of the HESP programme relies heavily on community participation. This is effected through the use of VHCs.

Formation and supervision of VHCs is, therefore, a major responsibility of personnel engaged in the implementation of the HESP programme.

Each target village has a VHC. Members of the VHC are expected to participate in all HESP activities from planning, through implementation to evaluation stages. This is essential for sustainability purposes of project activities.

(f) Training of Staff and Local Communities

Training is mainly conducted in order to equip staff and VHC members with skills for promoting sanitation, planning and conducting effective hygiene education. These training courses are mainly community based, although it is sometimes deemed necessary to conduct such trainings at a central point e.g. an area or district headquarters.

VHCs are a very important partner in training of local communities. Hence the need to polish up their knowledge and skills by exposing them to increased knowledge through regular training.

(g) Village Inspections

These are important for monitoring progress of HESP activities at community level.

They are conducted jointly by health staff and VHCs. Each target village must be inspected or visited at least quarterly every year.

Special forms have been developed for collecting data and reporting. All findings are discussed with the VHC members and possible solutions to any problems that may be identified are decided either jointly or by the VHCs and other local leaders.

SUCCESSES

1. HESP has established a very effective participatory bottom-up planning methodology. Planning for action is initially done at community level under the guidance of HSAs. The plans are then discussed at district level with HESP supervisions, and later at a higher level, if necessary.

2. HESP has established area and village health committees as local structures for effecting community involvement and participation. These committees mobilise local communities in implementing HESP activities.

3. HESP has instituonalised participatory training as a popular method for imparting knowledge and skills of both health personnel and community members.

4. HESP has developed and produced some posters, reference and training manuals for training health staff(HSAs) and community members (VHCs).

5. HESP has developed specific hygiene messages based on local practices of the communities. This has been achieved through knowledge and practices surveys which have been conducted locally.

6. HESP has developed tools for collecting and reporting data at all levels.

7. HESP has trained a substantial number of H/Is, H/As and HSAs and VHC members, including women, in constructional and hygiene education training skills, among other skills.

8. HESP has achieved a high level of sanitaion status. The average pit latrine status in HESP areas is 70% as opposed to 54% in non-HESP areas.

9. There are more model homes. villages and sanplat casting and installation activities in HESP target villages than non-HESP villages.

10. An average of 20% of the people wash hands in HESP areas after visiting the toilet as opposed to about 9% in non-HESP areas.

CONSTRAINTS

- There is shortage of staff at all levels. This is most prominent at Regional and National levels. There is nobody to coordinate the programme activities at the Regional level especially in Central and Southern Regions.

There is only one person responsible at National level, the National HESP Coordinator. In addition to HESP activities, he is assigned to do other activities within the Environmental Health Section.

- Delays in securing funds from donors. This causes a lot of delays in implementing activities.

- Transport is not adequate at all levels; this causes bottlenecks in supervision and distribution of materials.

- Inadequate training materials and teaching aids.

- Shortage of staff houses, especially at Regional and community levels.

- Lack of support from some senior officers deter progress.

- Inadequate implementation period for HESP projects affect sustainability of the project.

- Lack of coordination of HESP activities cause unnecessary duplication of resources.

RECOMMENDATIONS

1. Implementation of a HESP programme requires good supervision and regular follow-up of activities at all levels. In view of this it is imperative that the programme be adequately staffed at all levels.

2. HSAs spearhead the implementation of HESP at community level. In most cases, HSAs have been posted to their working stations depending on the availability of houses, and not necessarily based on need. Efforts should be made to post them where there is demand for them. The agency should assist them in finding accommodation at reasonable cost than relying on the community.

3. Implementation of HESP programme involves extensive travelling of staff and timely distribution of training and constructional materials, among other activities. This requires the availability of transport for supervision in form of light vehicles, motorcycles and bicycles. Lorries and pick-ups must be made available for transporting constructional materials.

4. Many times delays in implementing HESP activities have been caused by failure to acquire funds from donors in time. Such delays have made implementation very difficult; the implementer would be required to replan his or her activities and mobilise the communities again before using the funds. Donor agencies are requested to be flexible in their financial policies so that funds could be released in time to match with implementers workplans and timeframes.

5. Training of extension workers and local communities in HESP activities is usually conducted without training materials. This happens because teaching materials are not readily available. Although an attempt has been made to develop some, these have not been enough. Therefore, there is urgent need to develop more teaching materials and reproduce those which are already available. Users of these teaching aids should be properly trained in using them in order to discourage any possible abuse and under-utilisation.

6. Sometimes effective implementation of HESP activities has suffered because members of staff engaged in the programme have not been given adequate time to concentrate in the relevant activities. Therefore, officers incharge or heads of sections need to develop a supportive attitude and give more freedom to their subordinates to carry out HESP activities accordingly.

7. Various agencies are interested in implementing HESP as a component of their water development projects. Usually,

implementation has been rushed in order to meet their set targets and to respond to donor needs. HESP involves transformation of behaviour and habits. This being the case, implementation of HESP projects requires more time to get sustainable results.

Since HESP is implemented by various agencies or organisations, there is urgent need for more coordination of the various HESP projects. Coordination will discourage the various implementers to deviate from the basic principles.

CONCLUSION

In general terms, HESP has been implemented in Malawi with considerable success. Its approaches are simple and can be replicated in similar projects where selfhelp spirit is avialable or can be developed.

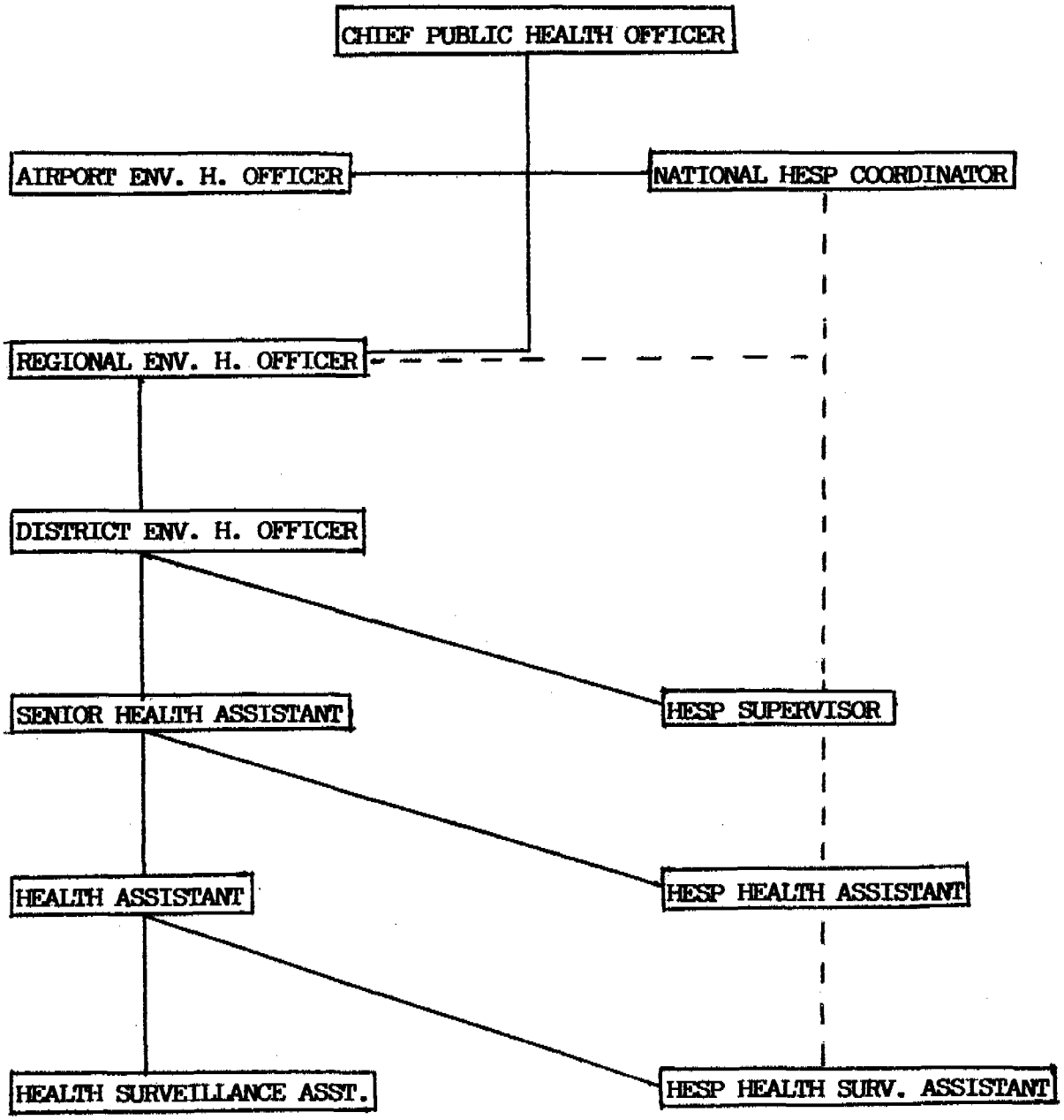
In spite of the successes, it has been difficult to sustain the activities without donor support. At the end of the projects handover to Government has been done according to plan. However, it has been observed that such handover arrangements have usually excluded any plans for future funding, by Government, to sustain the introduced activities.

The main aim of complementing a water development project with a HESP component is to maximise the health benefits expected from the provision of a potable and safe water supply. These benefits are required both for the short-term and long-term needs, therefore, they must be sustained.

One way of achieving this is by ensuring that there exists genuine partnership between the agency and the community. And that each of them should feel committed to this important partnership and fulfil their responsibilities as agreed.

ANNEX I

ORGANISATIONAL STRUCTURE OF ENVIRONMENTAL HEALTH SECTION-MINISTRY OF HEALTH-MALAWI



P 5-4

SAVE THE CHILDREN - BURKINA FASO
BACKGROUND PAPER ON HANDPUMP REHABILITATION PROJECT — BY GEERT KROON

1. INTRODUCTION

For the population in Burkina's arid sahelien provinces sustainable sources of clean water - for drinking, washing and animals - has been and remains a major problem. The problem is crucial both in terms of quantity and quality. It also became very apparent through SCF's experience in the Sahel that the maintenance of water sources, particularly water pumps was a crucial issue.

SCF has been working in the Sahel of Burkina Faso since 1974 in health projects in collaboration with the provincial departments of health. Initially SCF was involved in emergency programmes in response to the drought and famine in the early 1970's. SCF's health intervention over the years has evolved into more longterm interventions in the health sector.

During its contact with the villagers SCF was asked by village representatives to do something about their water supply, particularly by helping to get existing pumps functioning again.

In 1987, an SCF consultant carried out a survey for SCF in Séno, Oudalan and Soum provinces in Burkina Faso. The consultant's report proposed a range of possible activities, including Studies on water issues, health education, training for pump repairers, erosion control, rain harvesting ....

An appeal by the BF-Government through the CNCLES (national committee against drought-effects), led SCF-BF to start with an emergency water-pump rehabilitation project.

The emergency intervention consisted of an SCF mobile team, gathering information locally and carrying out repairs.

Although this gave SCF the opportunity to build-up good contacts with the local authorities and villages, it also became apparent that mobile emergency rehabilitation teams were not a long term solution to pump maintenance and rehabilitation.

It also became clear during this intervention that any sustainable approach to pump rehabilitation had to be paid for by the users and involve some sort of community control or management.

2. THE PUMP MAINTENANCE AND REHABILITATION PROJECT

In 1989, a three year project was drawn up by SCF.
The main objectives of this project were :

- to provide training and equipment with appropiate tools and follow-up of rural pump mechanics at departmental level for major pump repairs.
- establish one mobile team per province for the training and follow-up of rural pump mechanics and village pump caretakers and to assist rural pump mechanics during

difficult pump repairs
- train village pump caretakers (2 per pump) for pump maintenance and minor repairs, as well as for aide to and control of the rural pump mechanic
- carry out awareness-raising of user-communities on the importance of clean drinking water, encouraging communities to establish a village pump fund for the repair and maintenance of their own pump
- establish and maintain a security stock of pump spare parts and encourage the commercial availability of spareparts in the Sahel.
- establish contact and collaborate closely with local, provincial, regional and national authorities, as well as with other water projects and NGO in the area

3. PROGRAMME ACTIVITIES

The training of rural pump mechanics, chosen by the community or the retraining of already existing mechanics. After training, the mechanics operate commercially, with water-users paying for repairs.

The development of appropriate tools that could respond to repair needs and were sufficiently mobile to be carried on a bicycle. For example, improved vice and lifting tools.

After training, each team of RPM are offered a pump repair toolset. The RPM have to contribute CFA 45000 in Séno and CFA 35000 in Oudalan province (where the number of pumps/RPM team is lower) towards the cost of the toolset. The RPM can pay the sum over a period of 2 years. The actual cost of the toolset is about CFA 37000. They are also offered a set of common spare parts on credit from SCF. This involves a written credit contract with SCF.

Training of village pump caretakers. VPCs are capable of carrying out small repairs and can also ensure that pumps are properly used. They also can assist the mechanics in repairs. Because they have some knowledge about repairs and the price of parts, they can also control any "exploitative" tendancies by the mechanics. (Overcharging etc.)

Creation of an emergency stock of spare-parts and improvement of the commercial availability of spare-parts locally.

One mobile team provides support and back-up for the more difficult repairs. It was decided unnecessary to establish a second mobile team, particurlarly as the cost makes it unsustainable. Close cooperation was established with the regional Water Authorities. Activities such as water related health education and community mobilisation were not as successfully developed as the initial project had hoped.

The project was formally evaluated in March 1993 and final evaluation document is currently under preparation.

4. PROBLEMS/ISSUES ARISING :

- Ownesrship of the handpumps remains unclear in the villages.

- Certain members of the community have very little say (eg women).
- Weak community decision making structures.
- Conflicts and rivalries eg. semi-nomadism v sedentry farming, pastoral and human water use, community leadership, ethnic and historical conflicts etc.
- Economic situation in Sahel and difficulties of setting up funds.
- Difficult access to services and basic infrastructure.
- Weak participation of women.
- Weak links between water and health education.

5. CONCLUSIONS

The economic basket case situation in the Sahel, obliges government and agencies either to provide services at low cost or to heavily subsidise certain services. Either ways, there tends to be a large dependency on external intervention and aid.

SCF has so far chosen a low cost approach with the added aspect of encouraging a commercial sector, both in terms of repairs and spare-parts. This raises issues of economic feasability for the rural mechanics.

At the moment, SCF Burkina Faso is defining the next phase of the programme.

Ouagadougou, August 1993.

P. 7-3

WORKSHOP ON RURAL WATER SUPPLY
OPERATION AND MAINTENANCE - MALAWI
20-24 SEPTEMBER 1993

OPERATION AND MAINTENANCE EXPERIENCES FROM A RURAL WATER SUPPLY PROJECT IN ZAMBIA

MAURICE K. SAMANI
01-08-1993

SUMMARY

The International Drinking Water Supply and Sanitation Decade (IDWSSD) recorded extensive construction of improved water supplies world-wide. It is recognised that the excellent achievement must now be consolidated by keeping the facilities working and in use.

The initial improvements to water supply were treated as purely technical problems requiring technical solutions rather than as a process of social change necessarily requiring the full participation of the target communities. The result of this has been inappropriate technology choice, neglect of operation and maintenance aspects, failure to include health education and sanitation improvements, tendency to plan from above on a large scale with little or no consideration for local social conditions and finally has created a dependence relationship.

The first handpump maintenance systems emerged in response to unexpected breakdowns and were directly linked to and paid for from external Donor sources.

Four systems currently in practice are:-
- The centralised conventional system
- The three-tier system
- The preventive maintenance system
- The village level operation and maintenance (VLOM) system

The evidence in favour of different maintenance systems has been conflicting and undoubtedly most systems functioning at present are not efficient and are too costly to be sustainable in the long term. Probably for a long time to come arguments will continue about the best way to assure a pump's continuing maintenance.

2.0 BACKGROUND

The Government of Zambia is giving high priority to Water Supply and Sanitation Development. An important aspect of improving the living conditions in rural areas is the provision of an adequate supply of portable drinking water and satisfactory sanitation to the communities.

Rural Water Supply Development is the responsibility of Department of Water Affairs (DWA) under the Ministry of Energy and Water Resources. The water development programmes depend to a large extent on external funds by Donor countries and organisations. In most cases Donors have concentrated on regional (Provincial) programmes, being involved in planning and the actual implementations, in this way there has been supposedly efficient use of external funds resulting in increased provision of water supplies in the rural areas.

The necessity of involving the rural community in the development of water schemes in Zambia had been widely recognised but the question of how to operate in practice had remained a problem for a long time.

Involvement in most cases had been confined to the construction phase when local people were called in to provide unskilled, free labour, so as to reduce some of the construction costs of the designed project.

Community participation should mean more than just contribution of unskilled free labour. It has to be understood as the involvement of the villages in all phases of the development of the project. In the past local communities regarded the installation and their operation and maintenance as the responsibility of the Government.

3.0 WESTERN PROVINCE RURAL WATER SUPPLY PROJECT - ZAMBIA

Norway has assisted Zambia in developing the water supply sector (both urban and rural) in Western Province since 1977. The programme is now into the fifth phase (1990-93)

The programme had been established for a few years before Health Education and Community Participation came to be recognised as essential elements of rural water supply. The difficult task was to introduce Community Education and Participation (CEP) into an existing project.

3.1 PROJECT REORIENTATION

The programme in Western Province took its first steps to change in 1984 with its integration within the Governmental structure of Department of Water Affairs and t he addition of a CEP component. The programme was renamed WASHE, an acronym for Water Supply, Sanitation and Health Education.

The WASHE Programme is coordinated by the Provincial Steering Committee (P-WASHE) chaired by the Provincial Permanent Secretary. Each District has established a District WASHE Committee headed by Council Secretary and the committees report to P-WASHE.

3.2 OPERATION AND MAINTENANCE PRACTICES

From inception of the programme, completion of a well was more important than its sustainability, so that up to 1986, one in four wells had been written off for poor construction and also many wells constructed had become unusable as a result of breakdowns which remained unrepaired for several years.

A system, as more or less practised in Western Province is as follows:-

3.2.1 PROVINCIAL/DISTRICT LEVEL RESPONSIBILITY

Department of Water Affairs/Provincial Water Engineer is responsible for overall planning of operation and maintenance, for building up the capacity of and providing support to District officers. Specifically this includes:-

- Insuring that the District Offices are organised and adequately staffed to take care of rural wells operation and maintenance.

- Providing necessary training, both technical and managerial for operation and maintenance staff in the District offices.

- Providing support and facilities for training of Village Caretakers in pump maintenance.

- Providing adequate supplies of material, tools and equipment for handpump operation and maintenance.

- Establishing maintenance inspection and reporting procedures for rural wells operation and maintenance and make regular checks that these are followed.

- Providing necessary vehicles/transport capacity, specifically assigned to rural operation and maintenance.

- Communicating and cooperating with Ministry of Health and other Provincial authorities.

3.2.2 INTERMEDIATE LEVEL

This level comprises the Extension staff and is the least developed so far. It has not been involved much in repairs and maintenance, except in remote areas.

The intermediate level therefore is more important in the transmission of health education ideals, to cause a gradual increase in the number of people who adopt better water use practices, and to retain pressure on Village Water Communities to keep up standards. Ministry of Education School Education Programmes for water use and health form a part of the curriculum for Homecraft Teachers and the project continues to hold District level workshops to discuss important aspects with them. In this way school children are assured of receiving regular education on water use and care of a well. The project employs two Teachers who go round schools not covered by Homecraft Teachers.

3.2.3 VILLAGE LEVEL

The idea of devolving responsibility onto community is partly to reduce the need for outside inputs in repairs and maintenance- thereby avoiding delays, but even more important it is meant to improve the care given to the well by the users as they realise that neglect leads them to incur unnecessary expenses. Thus the village is required to assume responsibility for the basic village level maintenance duties and reporting of breakdowns to Department of Water Affairs in the Districts.

Previous experience points to the absolute necessity of participation by the villagers to give them a sense of ownership. It involves participation in the planning, implementation and assuming responsibility for operation and maintenance.

4.0 DISCUSSION/RECOMMENDATIONS

The long term success of rural water development depends on critical assumptions which include the following:-

- that Rural Water Supply systems being affordable to both Government and the consumers.

- that Government will include community education and participation as a necessary part of rural water supply development and support intersectoral cooperation, especially between Health and Water authorities.

- that Government will include community education and participation as a necessary part of rural water supply development and support intersectoral cooperation, especially between Health and Water authorities.

It is important to note that all improvements to water supply call for money and other resources, not only for the initial investments but perhaps more importantly for operation and maintenance and repair.

For water supplies to be sustainable, there is clearly a need for continuing as well as an initial financing source and commitment.

Operation and maintenance must therefore be thought of and planned as a system of related activities which comprise the following key elements:-

- Institutional/Organisation
- Handpump maintenance
- Record keeping
- Spareparts/Supplies
- Logistics
- Training
- Finance and cost recovery
- Monitoring and evaluation

Thus the success of any handpump in providing reliable water supply depends on an effective maintenance and repair system. Installations put in places with active community involvement are much more likely to survive than those in which the community has neither been consulted nor involved in decision making, mostly it is not clear whether they are willing, able or can afford to maintain the facilities.

In general, accepting the responsibility for maintenance requires a clear understanding and a firm commitment on the part of the community. Community participation therefore is an essential element if sustained development is to be achieved and hence the long term functioning of the facilities invested in can only be secured if sufficient priority is given to operation and maintenance. Procedures for community participation and health education which have been proven effective cannot be established over night. They need to be developed gradually in the field and where necessary be sanctioned legally and politically.

It is worth noting that cost recovery of recurrent costs can be limited by low payment capacities of the users as there is an increasing demand on low income rural households to contribute to health care and education. It should therefore be agreed that the actual means of financing and cost recovery should not negatively affect the heath and welfare conditions of the people, more especially that this has to be carried out in a situation of severe economic crisis and in the context of attempts at structual adjustments.

Finally the role of Non Governmental Organisations (NGO s) in water development must be supported and strengthened. This can be achieved through stronger links between the NGOs and Department of Water Affairs.

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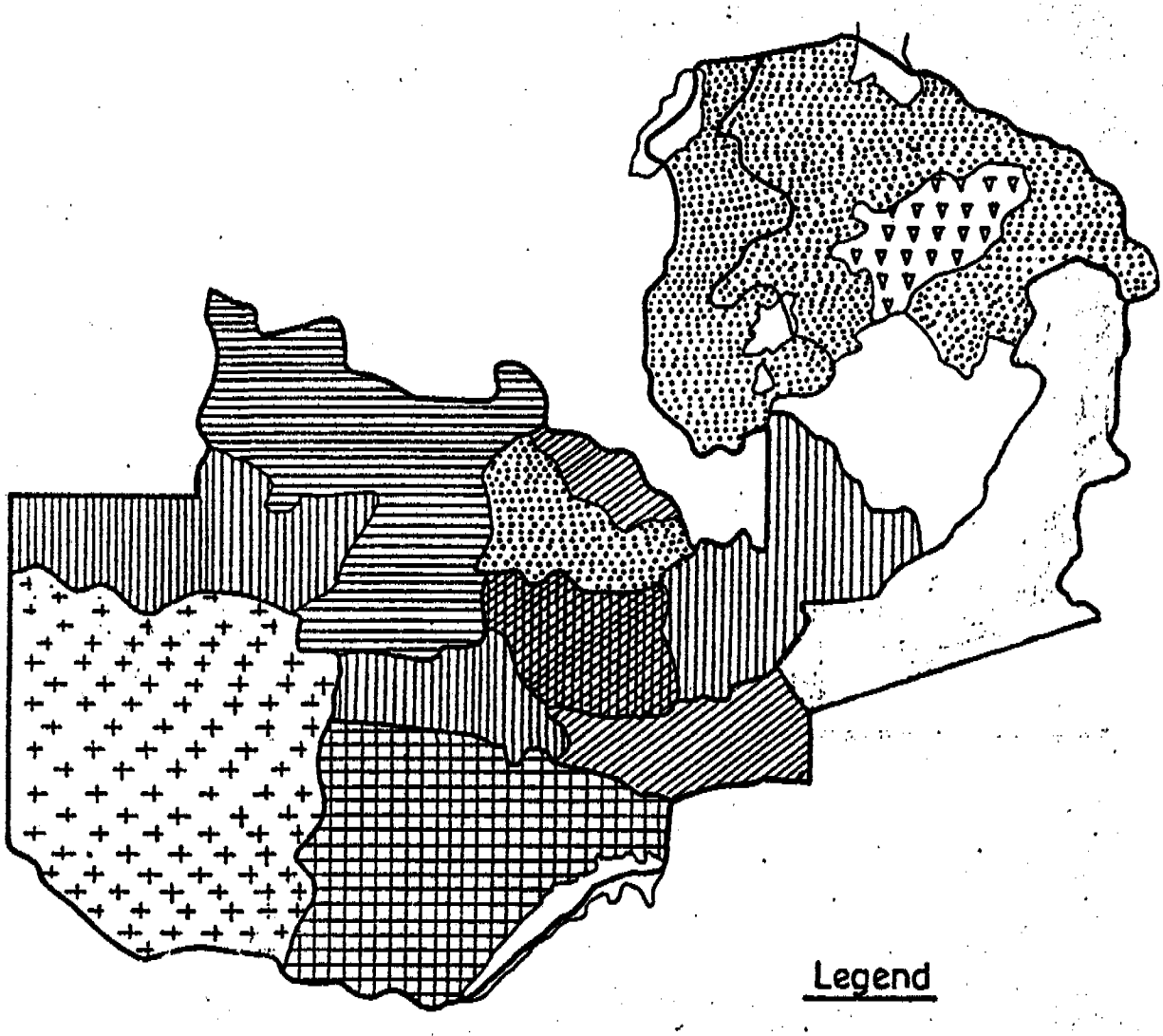
DEPARTMENT OF WATER AFFAIRS
RURAL WATER SUPPLY PROGRAMMES



Legend

- IDA
- KFW/GTZ
- DUTCH
- NORAD
- IRISH
- JAPAN
- ROTARY

SAVE THE CHILDREN FUND- REGIONAL WORKSHOP ON OPERATION AND MAINTANANCE OF RURAL WATER SUPPLIES-BLANTYRE, MALAWI, SEPTEMBER 1993.

"APPROACHES FOR SUSTAINABLE DEVELOPMENT OF RURAL WATER SUPPLY"

Peter Wurzel, UNICEF, Maputo.

Introduction

Africa is often perceived as a 'basket case' and is finding external donor funding more difficult to attract. It has been devastated by drought and Aids and fraught with war. Yet perhaps the single most important factor in turning the continent around is the will to find a political consensus. Only once this is achieved in any particular country can that country hope for the stability to enable it to provide for the needs of all its citizens.

Two of the most basic needs, water and sanitation, when accessible, properly utilized and linked with health and hygiene education, are an important index of development. Creating the right conditions for accelerated progress in providing for these needs will often involve profound institutional, economic and social changes, as well as a reallocation of resources and responsibilities at all levels.

In Africa to-day 300 million people still lack access to safe water while 400 million lack adequate sanitation facilities. De Rooy and Doyle (1990) note that.. "if we continue 'business as usual' by using the same policies, strategies, resource allocations and implementation rates of the 1980's, it would result in a widening of the gap between the served and unserved by as much as 30% by the year 2000". Attempts to increase the pace of providing improved rural water supplies have often been frustrated because the technology used has proved impossible to sustain in the village setting. Thus, to make a lasting impact rural water supply strategies must be based on sustainable programmes and must take account of the pace at which resource constraints can be overcome. A successful Community Water Supply (CWS) programme must involve a combination of hardware and software technology and institutional/organizational support elements matched in such a way that each community recognizes the benefits of the improved supply, can afford at least the cost of operating and maintaining it, and has the skills, spare parts, materials and tools available to sustain it. Arlosoroff, et al. (1987), stress the importance of a package with:

improvements of the promoting agencies, providing technical assistance and support services as needed. The community's needs and wishes have to be reconciled with its capacity and willingness to pay for the level of service planned, and also with the technical aspects of the water facility.

(b) Provision for recurrent cost recovery for the support of capital (construction) costs for poorer communities off-set by full recovery for higher service levels.

(c) Maximum involvement of in-country industry in the supply of services and material, project construction and maintenance (e.g., supply of pumps and spare parts, servicing and repairs) with the important proviso that quality control and reliability should be assured and that costs are competitive.

(d) Technology chosen to match the resources available to sustain it.

(e) Institutional and manpower development programmes matching the needs of the planned water supply system.

(f) Parallel programmes in Health Education and Sanitation improvement.

These are well known 'maxims' to progress in the Sector. Indeed while they were enunciated in the mid-eighties, the conclusions of the New Delhi conference in 1991 at which sector representatives from 130 countries met to analyze and synthesise the lessons of the 'Water Decade' were, apart from emphasising the gender issue, little different from the 6 points above. This paper will focus on aspects of underground water as the major resource but also on software components to ensure sustainability of Rural Water Supply Systems.

Rural Water Supplies

Groundwater will remain the primary water source for rural areas for the future with the choice of well or borehole being of paramount importance. There will be greater emphasis on matching the water source to the water lifting device which should reduce technology costs significantly. The handpump will constitute and remain the primary water lifting device which will require a heavy emphasis on training office, field and training personnel to achieve a massive grass roots transfer of knowledge so that the pumps can be properly maintained by the villagers themselves. The VLOM concept (village level operation maintenance) is fundamental to a sustained rural water and sanitation programme, with health and hygiene education an essential component if there is to be a successful interruption of the disease transmission cycle.

New thinking, however, suggests that with the handpump as the primary lifting device in the rural setting for the foreseeable future, the far too slow implementation rates during the Decade and the need for a massive acceleration in coverage, a new philosophy must govern the exploration of groundwater and the construction of boreholes and wells **specifically** for handpumps. The definitive departure point for radical change in the sector is the realisation that the well or borehole need only yield a maximum of 1m3/h, this being the maximum yield of a handpump. Traditionally the drilling fraternity all over Africa have produced boreholes blatantly over-designed creating a gross mis-match between the cost of the water source and the lifting device, the ubiquitous handpump.

The ground rules for an economic optimisation of borehole design and thus revised drilling strategies for low yielding handpump mounted boreholes are simple; SCALING DOWN the diameter, depth, and ancillary investigations such as geophysical techniques. With a maximum potential yield of 1m3/h; the maximum diameter can be 6", boreholes need be no deeper then 60M (usually first water struck plus 10 m) there is minimal need for development, in hard rock no need for a gravel pack, no need for expensive casing and screening, no need for extensive and costly pump tests and no need for geophysical investigations. All the above apply to NORMAL conditions and in groundwater hydraulics 'normal' takes care of a wide envelope of transmissibilities, storage coefficients, soils, climate, topography and aquifer size.

Ideally, all groundwater development should be preceded by proper hydrogeological exploration in order to locate the optimum amount of groundwater. At the beginning of the Decade it was recognised that in many areas the construction of wells and boreholes had proceeded without any detailed insight into the hydrogeological parameters which determine the presence and location of groundwater and had mainly been based on user convenience of distance to site, ownership of plot, etc. However, conventional wisdom in the mid-eighties dictated that expanding water demand, especially in marginal areas, would require the application and proper use of groundwater investigation techniques. Geophysics (the electrical resistivity method in particular) was commonly used in rural water supply exploration for shallow underground water. Clearly this paper sets out low yielding and thus low cost handpump mounted boreholes do not require sophistecated exploration and construction techniques.

These are radical changes in water resource exploration and construction, (low cost and simplicity); changes however that need to made if the goals of the present Decade are to be met.

The Handpump Option

By far the most important rural water supply technology is the handpump option which has been admirably expounded by Arlosoroff et all. (1987), upon whose work most of the following is based.

Once a community has decided to avail itself of groundwater supplies (and in 80% of Africa this will be the case), choices have to be made between handpumps, public standpipes and yard-taps to the ultimate house connection, assuming that equal system reliability can be achieved. The dilemma is that while, for improved health people should be encouraged to use copious quantities of water, i.e. house connections, in terms of water mining and ultimate budgets they should be encouraged to conserve supplies by the use of low service levels.

The three main technology options, handpumps, stand-pipes and yard taps generally represent progressively increased service levels and call for increasing financial and technical resources for their implementation and maintenance.

The aim is that the technology chosen should give the community the highest service level that it is willing to pay for, will benefit from and has the institutional capacity to sustain, concommitant with environmental issues. The choice of appropriate technology for a particular project can only be made when resource constraints have been taken into account, including the capability of the users to operate and maintain the alternative systems.

In CWS, one of the most important influences on system reliability is the length of time for which pumps stand idle when they break down. If an improved water supply system breaks down people resort to traditional sources such as ponds, water holes and rivers which are often polluted. In such instances any health benefits resulting from an improved supply are lost during such breakdown periods. The response times of centralized maintenance organizations covering dispersed communities can stretch to several months. Handpump maintenance carried out by an area mechanic within a week of breakdown makes a pump which breaks down on average every eight months more "reliable" than one which lasts for an average of 18 months before it breaks down but then must wait two months for the mobile maintenance team to arrive. It is evident that a reliable handpump supplying 30 litres per head per day for 95% of the year will be providing a higher level of service than yard-taps designed for 150 litres per head per day but working for an average of only two hours a day because of leakage, breakdowns, fuel shortages or limited water available at the intake.

Financial Implications

Arlosoroff, et all. (1987) also consider the financial implications and provide some interesting and determinative figures when they compare three types of technology based on groundwater:

TABLE 1 Community Water Supply Technology Costs
(for a Community of 400 People)

	Low			High Technology		
	Hand-pumps	Stand-pipes	Yard-taps	Hand-pumps	Stand-pipes	Yard-taps
Capital Cost (US $)						
Wells*	4000	2000	2500	10000	5000	6000
Pumps (hand/motor)	1300	4000	4500	2500	8000	9000
Distribution**	None	4500	16000	None	10000	30000
Sub-Total	5300	10500	23000	12500	23000	45000
Cost per capita	13.3	26.3	57.5	31.2	57.5	112.5
Annual Cost (US$/year)						
Annualized capital***	700	1500	3200	1400	3000	6000
Maintenance	200	600	1000	400	1200	2000
Operation (Fuel)	None	150	450	None	300	900
Sub Total (Cash)	900	2250	4650	1800	4700	8900
Haul costs (Labour)****	1400	1100	None	3000	2200	None
TOTAL (including labour)	2300	3350	4650	4800	6900	8900
Total Annualized Cost Per Capita						
Cash only	2.3	5.6	11.6	4.5	11.8	22.3
Cash + Labour	5.8	8.4	11.6	12.0	17.3	22.3

* Pumping water level assumed to be 20 meters. Two wells assumed for handpump system (200 persons per handpump).
** Distribution system includes storage, piping, and taps with soakaway pits.
*** Capital costs with replacement of mechanical equipment after 10 years annualized at a discount rate of 10% over 20 years.
**** Labour costs for walking to the water point, queuing, filling the container, and carrying the water back to the house. Time valued at US$ 0.125/h.

Capital costs of these three technologies generally range from US $10 to $30 per capita for wells equipped with handpumps to US $30 to $60 for motorized pumping and standpipes and US $60 to $100 or more for yard-tap services. In global terms that means cost estimates for meeting rural water supply needs to the year 2000 range from US $50,000 million to US $150,000 million depending on the choice of technology. With the obvious difficulties of mobilizing financial resources for this scale of investment, rapid progress in meeting basic needs can be achieved only if a large proportion of the population in need receives services at the lower end of the cost range. Upgrading to a higher service level may then be financed by the community later as benefits from the initial investment and from other sources increase available resources.

One of the primary criteria in the design of the pump is ease of maintenance. During the 'Decade' a robust, community maintainable handpump which obeyd the principles of VLOM, named the Afridev, was developed by a UNDP/WB team under Arlosoroff based in Kenya. From the beginning of the Afridev development the UNDP/WB team coined and promoted the concept of VOLM, (village level operation and management of maintenance). This is now recognised as one of the fundamental tenets of handpump design in rural water supply system planning. The VLOM concept seeks to avoid the high cost, long response time, unreliable service and other operational difficulties in the repair of handpumps through central maintenance systems.

The Afridev has become the 'model' VLOM pump, made possible by the use of new plastics for bearings and down the hole components. The bushes allowing movement of the fulcrum are made of 2 different materials, one of polyester, the other of polyamide and the two bushes snap together to form one self-contained unit that can be fitted into the pump without special tools. Experience from extensive field trials in Pakistan, Kenya and Nigeria reveal minimum wear of the plastic bearings. The down the hole components, plunger and footvalve are also made of new third generation plastic and can be replaced by 2 villagers in half an hour, even at depths of 40 meters. One of the reasons for such rapid and easy replacement is the advance in the design of the pump rods. Conventional pump rods using threaded connections with relatively light-weight stainless steel rods joined by a system of hooks and eyes which allow the rods to be joined quickly and easily without tools.

An important aspect of any handpump is the discharge rate versus pumping effort. In the case of the Afridev, the decision was taken for all pumping lifts, that the Afridev will use a standard 50 mm diameter cylinder. The operative force needed to pump from different depths is varied by offering different mechanical advantages in the handpump.

A crucially important concept in regard to the Afridev is standardization. In developing countries the scarcity of skilled mechanics and a lack of available correct spare parts have been prime reasons for rural water supplies breaking down. Recognising the need for standardization the major UN Agencies WB/UNICEF/UNDP involved in the Sector have nominated the Swiss Centre for Appropriate Technology (SKAT) to act as the co-ordinating body for all things to do with the Afridev design and development. SKAT have recently issued revised global specifications for the Afridev handpump and imposed a moratorium on design changes. This means that monitoring of field performance of the Afridev and Research and Development on the Afridev is global in nature and clearly benefits the evolution of the Afridev into the 'perfect' product.

We thus have in theory a potentially 'standard' global handpump. At least two countries in Africa have opted for the Afridev as the standard handpump. This means that in a country like Mozambique with at least 10 different handpump models in the field, an untenable situation, (20 in Ethiopia), one and only one pump will in future be installed, either by Government or the multitude of NGOs working in the sector. (when a VLOM direct action pump is available this too will become a standard). This is an important step forward towards sustainability of the handpump option.

In summary, the guidelines for the VLOM design are:-

(a) Ease of Maintenance -- The pump design takes care of this.

(b) Robustness -- The pump design and rigorous quality control procedures ensure this.

(c) Local Manufacture -- In-country manufacture is promoted.

(d) Standardization -- at present the major Afridev manufacturers in U.K., Kenya, Pakistan and India are manufacturing to a set of global specifications issued by the Swiss Appropriate Technology Centre (SKAT).

(e) Costs -- Targets costs should be USD 300-400 for a pump complete with rods and rising main to 25 metres; which are being met in the Indian sub-continent.

Sanitation and Health and Hygiene Education

At both the macro and micro level water, sanitation and health and hygiene education must be integrated. At the macro level improved linkages between technical and health programmes are

essential and this often implies greater commitment and formal agreement from central government and departmental staff. This is needed because it may require resetting of national targets and sector plans and reconsideration of responsibilities and tasks of the various departments. At the micro level communities are more likely to benefit from the advantages of improved water and sanitation if health and hygiene education is promoted along with the hardware. Health and hygiene education goes a long way to ensuring product acceptability and proper usage. Without it water sources may be potable but by the time the water gets to the home it may be polluted; latrines may be built under pressure but collapse due to poor building or else may not be used. More water may create more waste water which, without proper planning and knowledge of the dangers of pooling, may create more health problems than it solves. Lack of research on the human component may lead to the installation of unacceptable lifting devices. If people are unaware of the health benefits of increased quantities of water usage they will not bother to pump enough.

Rural sanitation technology is well established: simple, low cost and appropriate latrines have been designed for different cultures and different topographies with the following guiding principles:

(a) People often require a reason or motivation for using a latrine.

(b) Any type of latrine needs cleaning and maintenance.

(c) The latrine must be suitable in terms of technical, social and economic criteria.

The need for health and hygiene education in any water and sanitation programme is not in doubt but large-scale monitoring and on-going research to establish the most suitable methods of implementation is essential. The participatory approach where both the community and the educators embark upon joint problem analysis and problem solving is probably the most likely to succeed but it places high demands on the social and technical skills of the staff.

Schools are an important focus point for any sanitation and health and hygiene programme since they can reaffirm or help to modify attitudes and habits established at home. They can also introduce pupils to new facilities, such as protected water supplies and sanitary latrines and help to establish policies for proper use and maintenance. A favourable condition for school hygiene education is that in developing countries the budget for primary education is often three to four times higher than that for health services. There is also a wider distribution of schools and teachers in proportion to the population than most health services. Thus schools may provide the necessary infrastructure for hygiene

education, otherwise lacking.

Whilst it can be difficult to find space in the school timetable for health education it can be built into other subjects without difficulty. Vernacular and language classes can be used for reading and writing about health, art classes can include painting on health topics, and mathematics lessons provide many opportunities for exercises counting malaria breeding sites, for example.

The role of women as the pre-eminent decision makers in relation to water, sanitation and health education on the ground must be enhanced and supported at all levels. Yet it must never be forgotten that many women need both the physical and financial support of their husbands for specific hygiene improvements in the home or at the water source. Exclusion of husbands and fathers from hygiene education programmes also does not take into account their feelings of responsibility and pride in their families and children. Both men and women (and particularly husbands and wives working together) have proved to be excellent pump caretakers and maintenance personnel as well as disseminators of information on a variety of social interventions which can be introduced with water as an entry point. Family spacing is a case in point. Next to civil unrest, rapid population growth is the single most important constraint to universal coverage in both water and sanitation. If couples are confident that whatever children they elect to have are likely to survive and are provided with the knowledge and means to space their families uncontrolled population growth and the misery it brings can be halted. It is both a human and a political imperative.

Conclusion.

The success or failure of the rural water supply and sanitation revolution is very much in political hands and it is up to those of us in the sector to recognize that we have not only a technical role to play but also a role in promoting social awareness at all levels. This is the crux to a sustainable approach in the sector. The sector must be seen as more than a matter of nuts and bolts. By humanizing it and by our informed advocacy with those in government we can influence policy to the benefit of the disadvantaged. Let us not miss this opportunity.

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Mrs Angelina Xavier

REPUBLIC OF MOZAMBIQUE
MINISTRY OF CONSTRUCTION AND WATER
NATIONAL DIRECTORATE OF WATER
NATIONAL RURAL WATER SUPPLY PROGRAMME

RURAL WATER SUPPLY IN MOZAMBIQUE

1. INTRODUCTION

In Mozambique about 80% of the population lives in the rural areas equivalent a approximately thirteen millions of the inhabitants. We estimate that only 26% of them have access to safe drinking water. It is so low as many rural areas were isolated because of the war and many infrastructures were destroyed.

2. RURAL WATER SUPPLY PROGRAMME

The National Rural Water Supply Programme (PRONAR) was created in 1987. It is the central level structure responsible for promotion, coordination, and technical assistance for all rural water supply activities in the country including: shallow well and borehole construction, handpump installation and maintenance, small piped water systems and the Community Participation and Education Programme.

As shown in diagram I, PRONAR is integrated into the National Directorate of Water Affairs "DNA" of the Ministry of Construction and Water "MCA". The implementation of the National rural water supply programme is under the responsibility of the Provincial Governments through the Provincial Directorate of Construction and Water "DPCA".

Each DPCA has a production unit called the Provincial Rural Water Workshop "EPAR", which carry out their rural water supply programme through one or more district Workshop. When a district does not have its own workshop, its rural water supply activities are carried out by a mobile team from the provincial workshop.

The principal tasks of the EPAR are:

- Construction and recuperation of shallow wells
- Construction of manual and mechanical boreholes
- Installation and maintenance of handpumps
- Recuperation extension and assistance to maintenance and operation of small piped water supply systems
- Implementation of the community participation and education in rural water supply programme

3. THE PROGRAMME POLICY

To simplify the execution of the programme, PRONAR decided to establish a unique policy in rural water supply activities in the country. The established policy is one source of potable water for 500 people or 100 families within a distance of 500 metres from the their residence areas.

Another important policy is the standardization of hand pumps throughout the country to ensure ease of maintenance, repair and access to spare parts as well as to introduce the decentralised maintenance. Thus PRONAR has encouraged, the local manufacture of the " VLOM " hand pump in this case AFRIDEV. VLOM means Village Level Operation and Maintenance.

To guarantee the success of its rural water supply programme, PRONAR has designed and introduced as policy, a community participation and education component. This ensure that the community participates in the planning, construction and maintenance of the new sources of water and thus gains a sense of ownership of them.

4. SOME EXPERIENCE ABOUT DECENTRALISED MAINTENANCE

PRONAR had planned to start the introduction of the AFRIDEV handpumps in small pilot areas. Based on the results, extension to other parts of the country would follow. However, this approach failed.

Due the recent severe drought, it was decided to import in mass AFRIDEV handpumps to be installed on waterpoints which up to than never had been equipped with pumps, on new waterpoints and to replace existing obsolete handpump.

As much as possible, it was tried to train field (community) workers in installing, and in training the community to

maintain the pumps, a complete new approach for the field workers.

Although with difficulties, in certain provinces this decentralised maintenance system, has shown to be successful: the community is able to maintain the pump. However, in terms of distribution spare parts and organization within community for collecting and managing money for maintenance, no system exist yet.

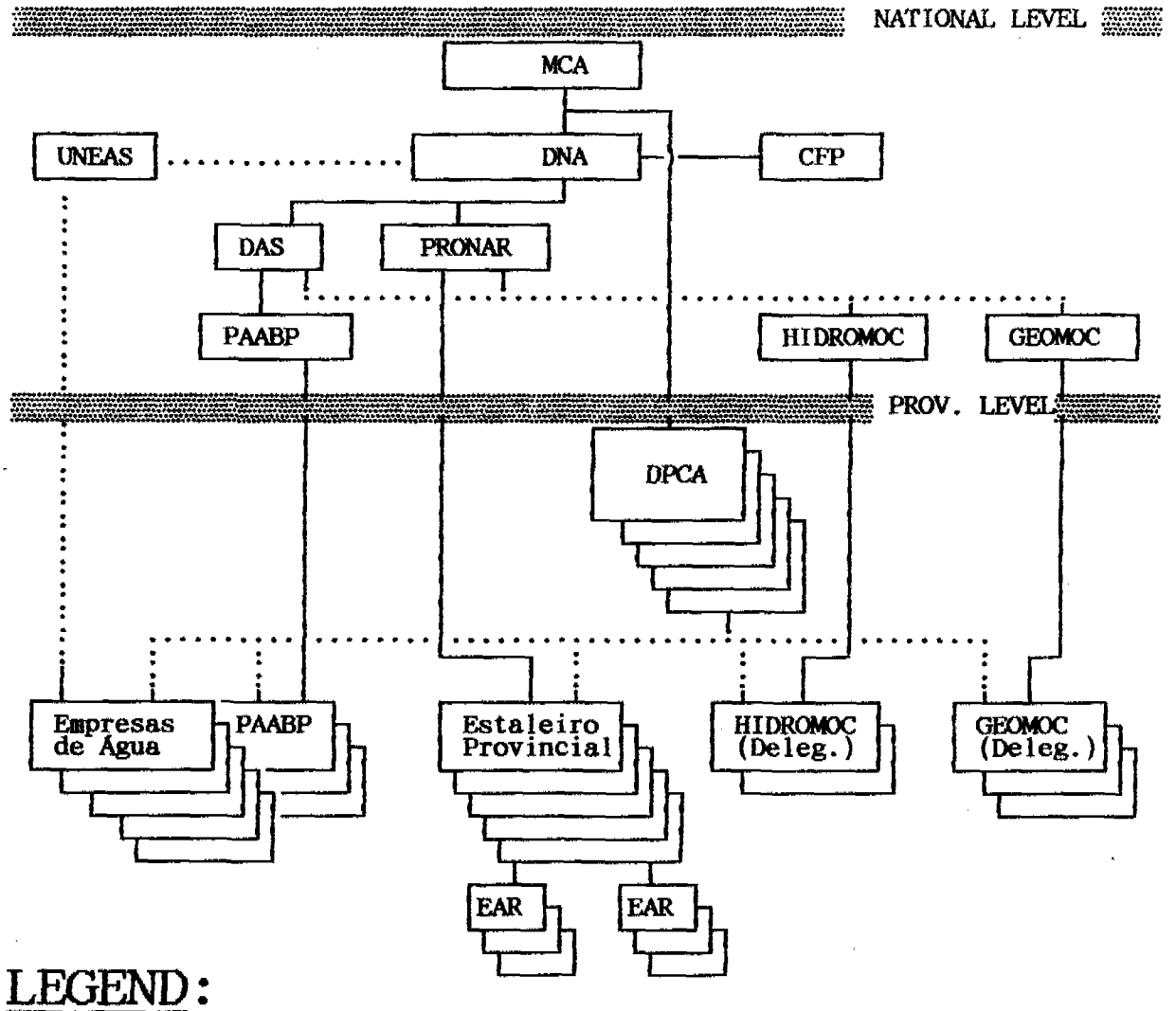
It is difficult to establish a fixed system just like that. The system should fit in the local traditions and possibilities. The community workers have an important role in collecting information and stimulating the community in organising themselves.

More than ever, the community workers need time to work together with the communities to get the best results: feeling of ownership and therefor the willingness to maintain the well with pump and pay for it.

Because of the economic pressure (= no work no pay), the tendency is to speed up construction, leaving no time and attention for quality and community workers.

Today, the major battle within the programme is to get a sound balance between the needs of the community and the construction speed. Once established that balance, the Programme can continue to introduce a complete decentralised maintenance system including a community based management and operation of maintenance and a nationwide distribution network for spare parts.

THE WATER SECTOR IN MOZAMBIQUE
ORGANIZATION CHART



LEGEND:

MCA - Ministry of Construction & Water
DNA - National Directorate for Water
CFP - Professional training centre of DNA
HIDROMOC - State Hydraulic Equipment Company
GEOMOC - State Water Drilling Company
UNEAS - Association of Water Companies
PRONAR - National Rural Water Supply Program
PAABP - Program for Peri-urban Water Supply
DPCA - Provincial Directorate for Construction & Water
E. de A. - City Water Supply Company
ESTALEIRO PROVINCIAL - Provincial Rural Water Workshop
EAR - District Rural Water Workshop

—— direct control
... indirect control

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KEFINCO

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REGIONAL WORKSHOP ON O & M OF RURUAL WATER SUPPLY

INTRODUCTORY PAPER ON

Village Level Operation Maintenance Strategies in Western Kenya

Mr. P. Sarkkinen,
Kefinco,
Sept. 1993.

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RURAL WATER SUPPLIES DEVELOPMENT IN KENYA

SECTOR INSTITUTIONS CONCERNED WITH WATER SUPPLY AND SANITATION IN KENYA

1. Ministry of Land Reclamation, Regional and Water Development

   - Is in charge of overall water development, catchment protection, and water pollution control.

   - Also responsible for O&M of over 400 gazetted piped schemes.

2. National Water Conservation and Pipeline Corporation

   - Is a parastatal body established in 1989 whose role is to compliment the functions of MoLRR&WD.

3. Ministry of Health

   - Assists in financing rural sanitation development, hygiene education and primary health care

3. Ministry of Culture and Social Services
   - Coordinates and registers community activities

4. COMMUNITIES

   - Responsible for the O&M of over 3000 water points in Western Kenya.

EXTERNAL SUPPORT AGENCIES

5. Non Governmental Organizations

   - Assist in financing community water supply and sanitation projects

6. Kenya-Finland Western Water Supply Programme

   - Compliments the role of Ministry of Land Reclamation Rural and Water Development by providing improved water supply for rural communities in Western Kenya.

KFWWSP OVERVIEW

- Started in 1981
- Has been implemented in Phases
- Present Fourth Phase being CONSOLIDATION PHASE.

. Investigation & Planning Phase	-	1981 - 1983
. First Implementation Phase	-	1983 - 1985
. Second Implementation Phase	-	1986 - 1988
. Third Implementation Phase	-	1989 - 1992
. Consolidation Phase	-	1993 - 1995

The key sectors of activities during implementation of phases have been:

- Water supply development plan
- Physical improvements
- * OPERATION AND MAINTENANCE *
- Training and manpower development
- Community involvement
- Implementation Support

1 ADMINISTRATIVE STRUCTURE

Water development activities are well represented in the district in conformity with the district focus for rural development. The ministry in charge of water development (Ministry of Land Reclamation, Regional and Water Development) is responsible for water development and supplies control. However, there are other ministries and organisations in water supply development.

The general administrative structure adopted in the programme area is as follows:

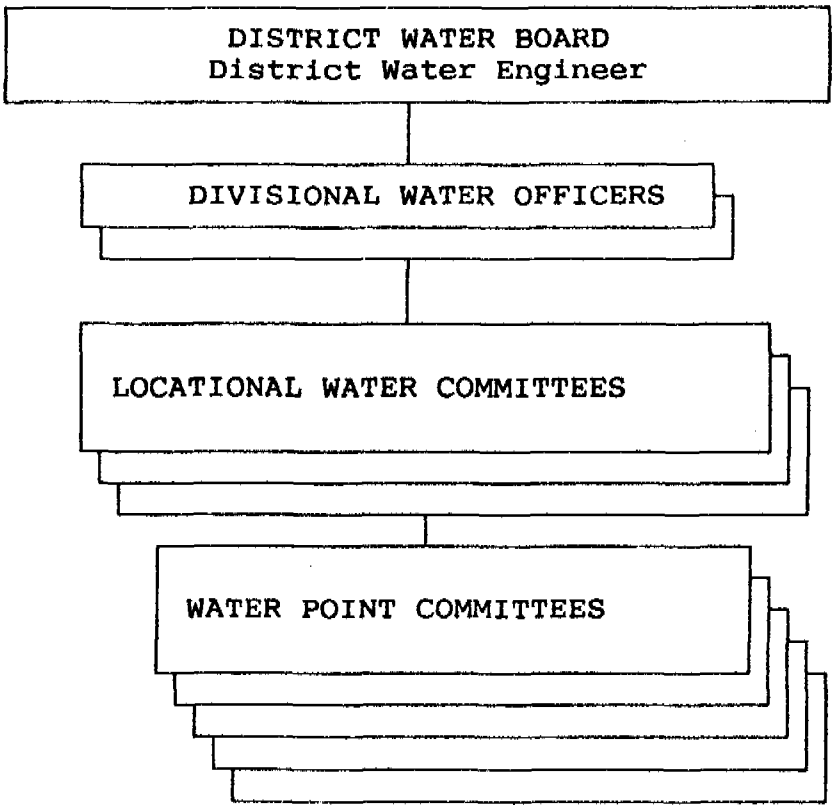


Fig 1: Administrative structure.

The District Water Board:

This consists of the District Commissioner as the Chairman and the District Water Engineer as the Secretary. The Board has the following responsibilities:

- Protects, conserves and preserves all water catchment areas within a given district.
- Partitions allocations and authorizes all water bodies within the district.
- Is in charge of water quality and controls and coordinates all water related activities in the district.

Divisional Water Officers.

These are newly created positions and the persons are in charge of water related activities in their respective divisions. The locational water committees report their activities to the officers.

The Locational Water Committee.

This comprises of a Chairman, Secretary, Locational Repairman and Community extension workers and members from given water point committees. The committee is responsible for the overall coordination of water activities in the given location.

The Water Point Committee.

It comprises of a Chairman, Secretary, Treasurer, Hand pump Attendants and some members of the community using the water point. The committee is normally in charge of the running and maintenance of the water point. The committee collects funds from the users on monthly basis and pays from the same for routine maintenance of the facility.

2 IMPLEMENTATION PROCEDURE

Implementation of any water point is currently being done according to the "Demand driven approach". This refers to a development strategy where the people themselves are expected to take the initiative and the responsibility of improving their water supply situation instead of being **"quiet recipients"** of the services. Development support is given to activities that are required and requested by the expected beneficiaries.

This approach is intended to make the beneficiaries realize that the water facilities belong to them and therefore they need to make them sustainable.

The following steps are used in the development of the facilities under the approach:

- The beneficiaries must first realize the need for clean and safe water. With this in mind, they elect their officials at community level to form a water committee.
- The elected committee approaches the Programme through the District Water Engineer and applies for construction of the water point. Once this is approved, the committee is asked to provide for part of material and labour costs towards the construction. This helps them to realize that the facility is theirs and not for the programme.
- The facility is finally constructed and the hand pump attendant is trained on how to carry out preventive maintenance. The elected officials must show willingness to be responsible of running and managing the facility.

3. MANUFACTURE OF HANDPUMPS AND THEIR DISTRIBUTION

Afridev, Nira AF 85 and India Mark II are the most commonly used handpump models within the Programme area.

Manufacture of the spares.

The Afridev and India Mark II hand pumps have a number of manufacturers within the country and even within the project area. The pumps are locally manufactured by WECO in the programme area and on large scale by the East African Foundry Works in Nairobi. However the Nira Af 85 hand pumps do not have any manufacturer locally and are thus imported. The Nira AF 85 have their import agents, "Aquatech" stationed in Nairobi and it is from them that the spares are procured.

Sparepart procurement.

The spares are currently being procured from the manufacturers by the Programme. These are then bought by the dealers who stock them in their hardwares for the consumers to buy. The businessmen are currently being encouraged to procure the spares directly from the manufacturers so that the community can become self reliant when the Programme winds up its activities.

Identification of dealers:

The easy availability of spares is a crucial factor in the survival of any water supply system. It is appreciated that new pumps that are installed do eventually experience breakage or wearing of parts. Much as it is essential to have trained personnel to service the pumps, the spares also have to be available at convenient centres and at prices that are within financial reach of the consumers.

The sparepart dealers that have been selected are those that have business premises particularly dealing with hardwares. Those within the Programme area have had advantage over the other businessmen. They are also supposed to take care of their premises and meet the consumers demand.

In order to boost the dealers morale towards the business, they are allowed to make a fixed profit over any consignment of spares that they sell out to the consumers. However, the Government has been left with the responsibility of providing legal provisions and controlling of the taxes so that the prices are not high while at the same time the quality of the spares is maintained.

4. MAINTENANCE STRATEGY AND LOCAL FABRICATION OF SPARES

Each location within the project area has at least one hand pump mechanic, referred to as "locational repairmen". In addition each water point has at least two handpump attendants. The pump attendants are trained women who can carry out preventive maintenance and other light duty repairs on the pumps. The locational repairmen are trained to carry out both preventive maintenance as well as do major handpump repairs.

In order to make the locational repairman also earn a living, they normally do repairs and are paid according to standards set by the programme. The payments for the repairmen are obtained from the users. In order to effect such payments and expenses towards the purchasing of spares, the water points committees collect a fixed amount of money from each household per month. This amount is deposited on a bank account and is only used whenever need arises.

In order to reduce reliance on the purchase of new spares in case of need, the programme has come up with the idea of refabricating spares that can easily be manufactured locally. Such are the spares like the hooked piston rods for the Afridev pump which are often welded whenever they break. The fulcrum bracket repair kit is also made locally and used with the afridev pumps. This technology has been transferred over to the repairmen through training.

5. HAND PUMP PERFORMANCE

Monitoring of handpumps' performance has been on-going from the beginning of the Programme. Computer aided monitoring started in the last quarter of 1992 and all the three types of hand pumps are being monitored.

MECHANICAL PERFORMANCE

The performance of the pumps has been quite good with over 95% in production and 60% of the pumps monitored being in acceptable conditions. Much problems mainly are observed for the overground components of the pumps. This is mainly due to the components exposure to much wearing because of external interference by the users. All the three types of pumps have had problems with the nuts used for fastening them. These become loose and fall away if nobody attends to them.

Afridev:
The bearings are observed to be the cause of most problems. The bearings wear out before the other parts of the pump due to friction in the moving parts of the pump. Affected by the movements are the fulcrum and hanger pins as well. Hooked rods break quite often, mainly near the welded joint and end up dropping in the wells. There are occasional pipe leakages or bursts in boreholes fitted with Afridev pumps. This is mainly due to possible excessive

pressures in the system. On the whole Afridev pumps are observed to have a pump population of over 60% problem free and is doing quite well at village level since most of the repairs are either done by the attendants or the repairmen.

Nira Af 85:
This make of pump is mainly used on hand dug wells. It has been reliable apart from problems of the pipes and cylinder dropping in the wells. The pump population monitored has given a 64% of the pumps as having no problems, and is easily maintained at village level.

The main problems associated with these pumps is that they are fitted on shallow wells which often dry up or have low yield in dry weather. The water quality has also been affected in some cases due to low aquifers which makes the water be susceptible to contamination.

India Mark II:
This is mainly used on deepwells of over 45m depth. These type of pumps are being phased out gradually. This is so because it is a bit hard to maintain these pumps at village level. From the little sample monitored, the percentage performance was the poorest among the three with only 28% of the pumps being problem free.
The pumps have mechanical problems with the rods which either get broken or disconnected. The cylinders are observed to have leakages after sometime and this is followed by leakages in GI pipes if these are initially used in the construction.

COMMUNITY PARTICIPATION

The community has shown great interest in looking after and maintaining their water points. Out of the monitored 1776 water points, over 1420 committees had good pump impression and clean water point surrounding as well as clean well covers. This represented 82.4%. On the contrary, 5.2% of the total committees monitored had the above ratings as poor. On average rating 220 committees were fair with 12.4%

6. PROBLEMS OBSERVED IN THE CURRENT O&M SYSTEM

The maintenance strategy adopted has worked well for sometime now. However, the following problems have been observed:

- Some beneficiaries do not contribute towards the maintenance of the facilities. This makes it hard to maintain the pumps whenever there are breakdowns.
- The hand pump attendants and committee members for the water points are not given any benefits for looking after the pumps. A good solution would be to exempt them from paying the monthly contributions.
- The cost of spares has gone up due to inflation. Which results hand pump dealers having low sales. The low sales are threatening the existence of the sparepart dealers within the Project area.

- There have been cases of repairmen removing some pump parts from given water points and using the same to repair others.
- Some consumers have no sparepart shops within their locality. This has made them to travel long distances in order to get the spares for the handpumps. In order to counter this effect the Programme is making efforts to identify more dealers to satisfy the consumers needs.
- Prospective hardware dealers have been reluctant in investing in spares since they are not sure of whether they can recover the invested money or not. Even so, the few that have managed to invest have got low returns and are discouraged to carry on with further investment.

7. ANNEXES

The tables and graphs below give the monitoring information obtained for the first half of this year.

The table below gives a random sample of handpumps monitored in the first half of this year.

PUMP TYPE	NUMBER MONITO-RED	PROBLEM FREE	PIPE PROBLE-MS	UNDER-GROUND PROBLE-MS	OVER-GROUND PROBLE-MS	OTHER PROBLE-MS
Afridev	720	432	13	44	190	41
Nira Af 85	958	612	11	11	120	204
India Mark II	98	28	19	26	11	9
Total	1776	1072	43	81	321	254

Fig 2. Monitoring observations made.

The above, if put in percentages are as in the table below:

PUMP TYPE	PROBLEM FREE	PIPE PROBLEMS	UNDER-GROUND PROBLEMS	OVER-GROUND PROBLEMS	OTHER PROBLEMS
Afridev	60.0	1.8	6.1	26.4	5.7
Nira Af 85	64.0	1.1	1.1	12.5	21.3
India Mark II	28.7	19.4	26.5	11.2	9.2
Average	60.4	2.4	4.6	18.1	14.3

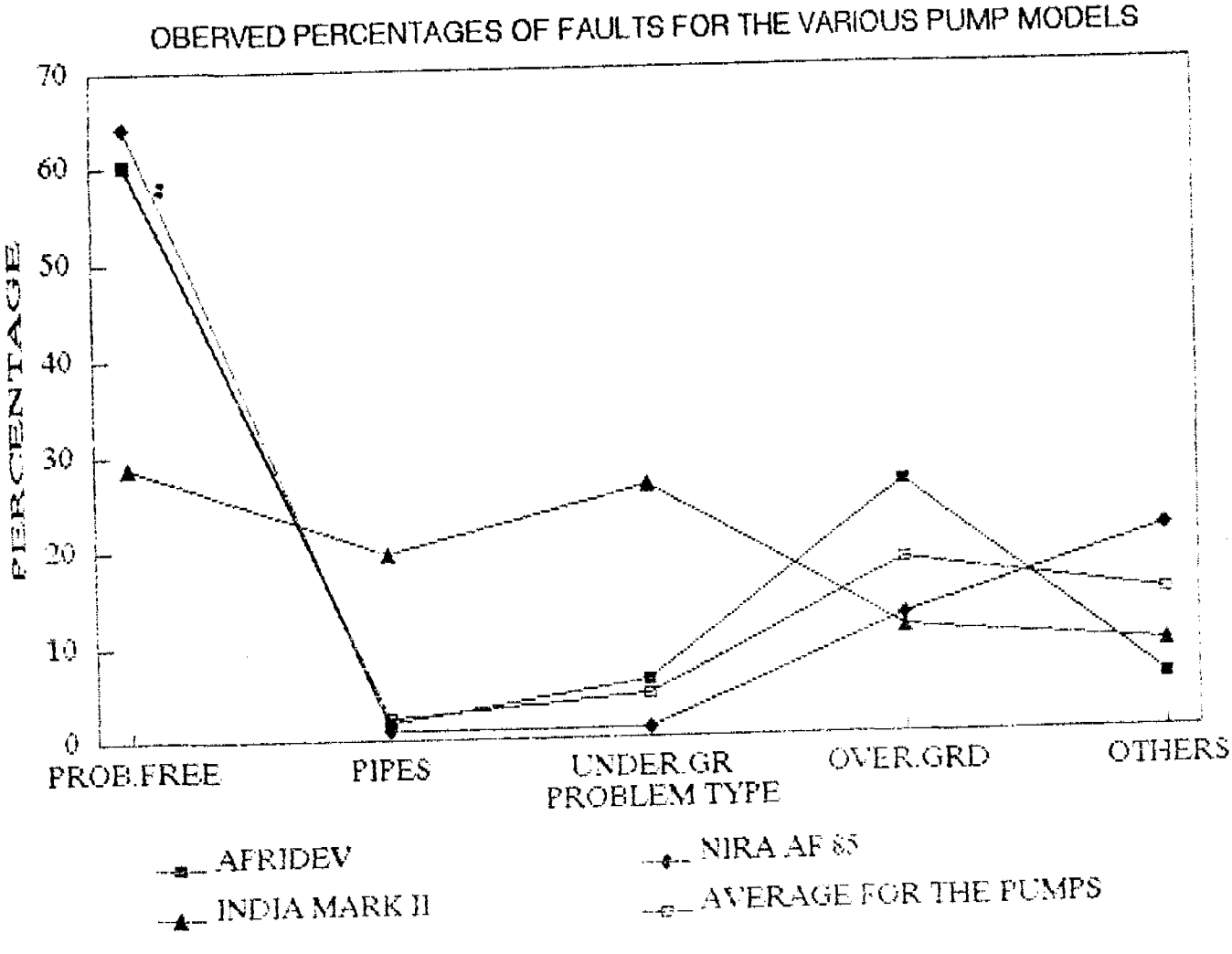
Fig 3. Monitoring observations made changed to percentages.

	NO OF PUMPS		
	GOOD	FAIR	POOR
WELL COVER	1517	169	90
WELL SURROUND	1450	210	116
PUMP IMPRESSION	1421	281	74
AVERAGE	1463	220	93

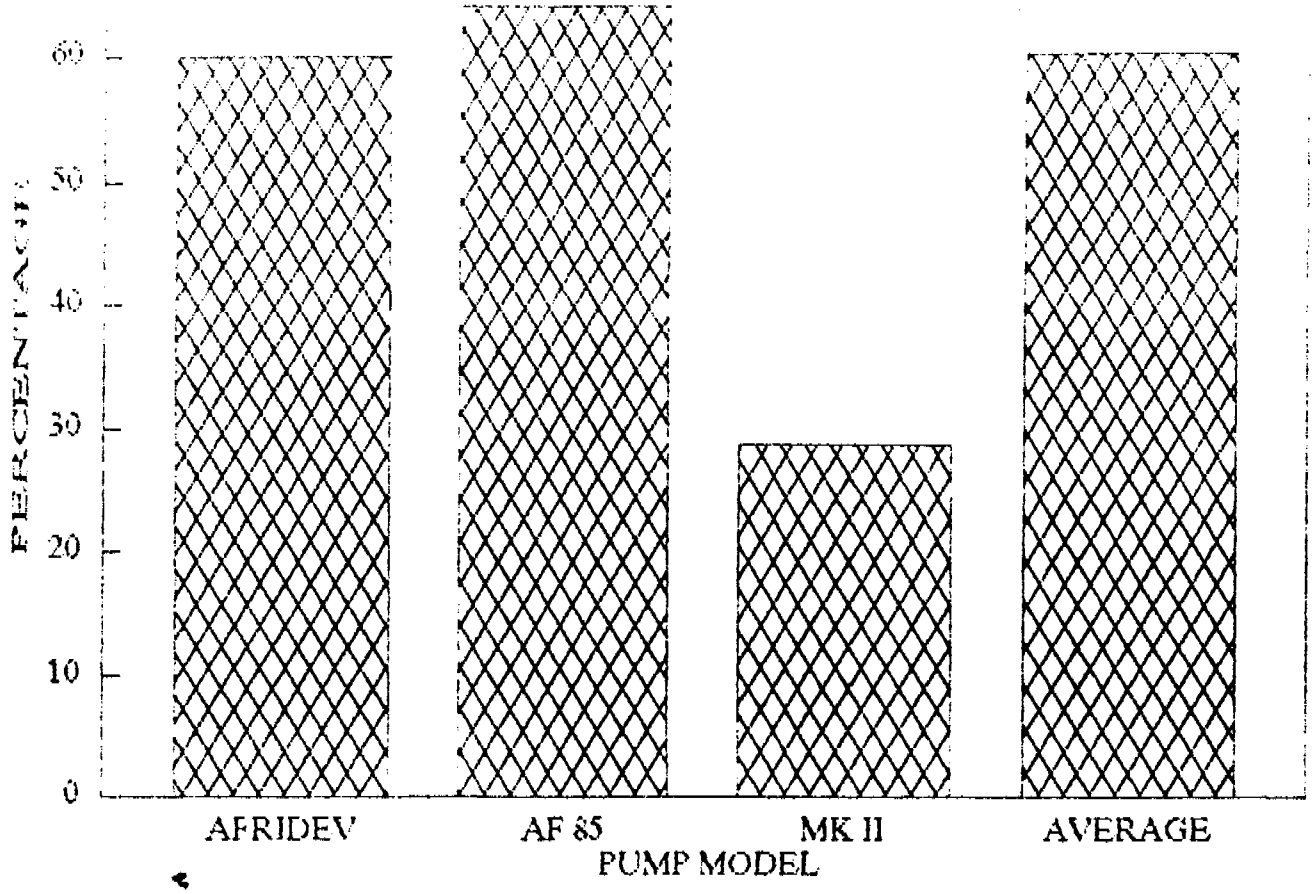
Fig. 4 The observed conditions for the well cover, well surround and general pump impression.

MONITORING PROCEDURE:

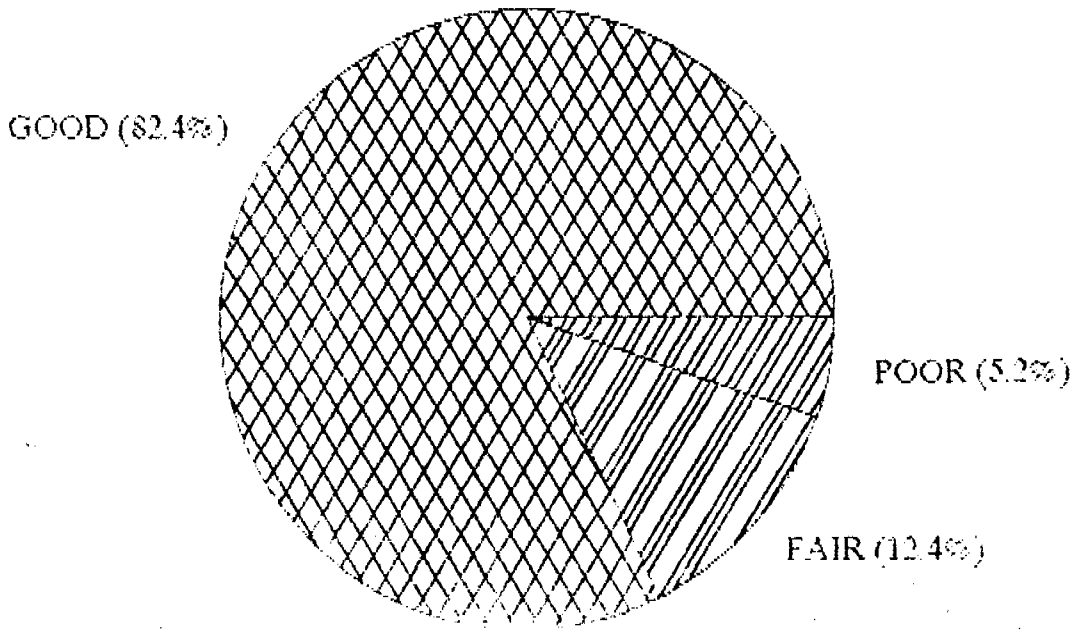
Monitoring is done through the locational repairmen in conjunction with the Programme staff. There are two kinds of monitoring forms which are given out to the repairmen who complete and return them to the Programme on monthly basis. The repairmen are paid Ksh. 10.00 for every form that is genuinely completed. The monitoring forms are as in the annex. In all about 80,000 Kenya Shillings were used to maintain the 1776 hand pumps in the purchase of spares and paying for labour.

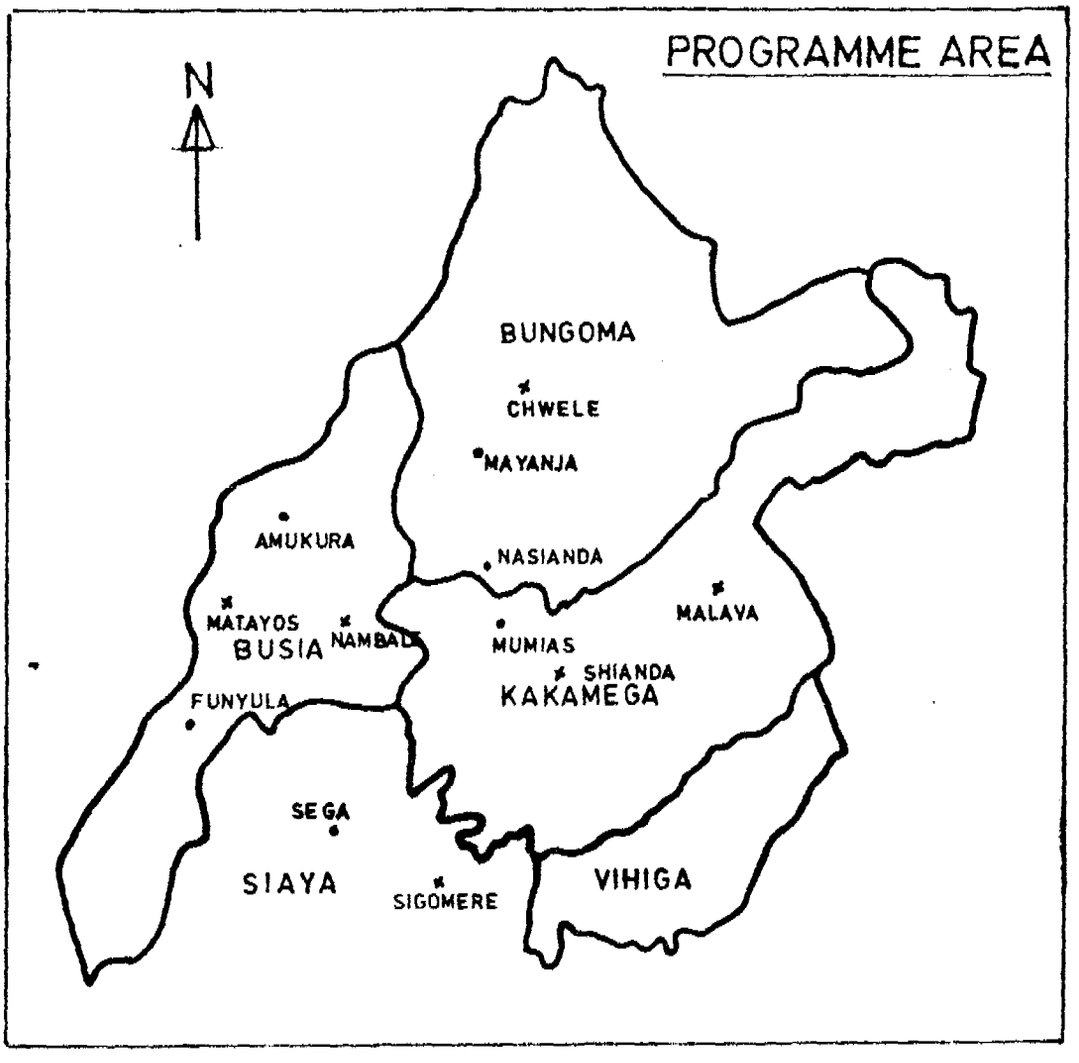


OBSERVED PERCENTAGES FOR THE VARIOUS PUMP MODELS THAT WERE PROBLEM FREE



OBSERVED WATER POINT CONDITIONS
(1776 WATER POINTS WERE MONITORED UP TO MID 1993)





Scale

10 20 30 40 50 60 70 80 90 100 km

Key:

- EXISTING SPAREPART DISTRIBUTION CENTRES.
- × POSSIBLE CENTRES TO FOLLOW THE EXISTING ONES BASING ON CONCENTRATION OF HANDPUMPS

P 6-2(5)

KENYA-FINLAND WESTERN WATER SUPPLY PROGRAMME

FINANCIAL ANALYSIS OF BOREHOLE AND HAND DUG WELL WITH

AFRIDEV & NIRA AF 85 HAND PUMPS

(FEBRUARY 1993)

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FINANCIAL COST ANALYSIS OF WATER SUPPLY FROM THE AFRIDEV AND NIRA AF 85 HANDPUMPS

Introduction

1. The purpose of this analysis is to see what inferences can be drawn from comparing the costs of water production from two systems using the above named handpumps within the project area.
Afridev, installed on a deep borehole is a relatively high capital cost system whereas the Nira AF 85 installed on a hand dug well is a low capital cost pump.

   The money used for this project is borrowed and interest is charged at a rate of 12% Per annum on the reducing balance on initial capital, redevelopment costs and handpump replacement costs. For purposes of this study it is assumed that cost recovery begins as soon as the first drop of water leaves the well. Maintenance costs are adjusted for inflation as are the costs of subsequent handpump replacement and borehole redevelopment.

   A "normative" or baseline cost scenario is provided with different design and cost of each system.The findings based on the existing monitoring system within the project area are given in table 1 for Afridev and table 2 for the Nira Af 85 hand pumps.

   Four additional cost scenarios are generated for each of the two baseline scenarios by changing one of the four variables while all other conditions are kept constant.The following variables are used to produce the other four curves:

   -Downtime is increased twentyfold.
   For the Afridev pump downtime is increased from 3 days to 60 days (from 0.8% to 16.5%) thus reducing availability of the pump in a year from 99.2% to 83.5%.
   For the Nira AF 85 hand pump downtime is increased from 2 days to 40 days (from 0.55% to 11%) thus reducing availability of the pump from 99.5% to 89%.
   -The drilling costs are reduced by half.
   -Inflation is reduced by half and the interest rate is taken as four points above inflation.
   -Maintenance costs are doubled.

2. This analysis assumes that the users of the system are the ones who repay the loans and are responsible for maintenance.The analysis concentrates on the issue of the magnitude and costs of water production and the consequences of system failure at any point in the working life of the system.Inferences are drawn by analyzing the resulting curves.

Deep borehole (Afridev Handpump)

Table 1: AFRIDEV IN DRILLED BOREHOLE

ASSUMPTIONS BASED ON MONITORING	VALUE	UNIT
Population served	250.0	Persons
Water demand	10.0	litre/person/day
Depth of water	28.0	metres
Depth of borehole	50.0	metres
Drilling rate	94.0	$/metre
Borehole working life	30.0	years
Redevelopment cost	800.0	$ each
Redevelopment interval	10.0	years
Number of hand pumps	300.0	units
Hand pump cost (Complete)	710.0	$ each
Hand pump installation	256.0	$ each
Training of community	296.0	$ each
Hand pump working life	9.0	years
Average spare part cost	35.0	$/pump/year
Average labour	3.0	person day /pump/year
Labour rate	2.5	$/person day
Average labour cost	7.5	$/pump/year
Average down time	3.0	days/pump/year
Inflation index	1.2	per year
Interest rate	12.0	percent

3. The baseline scenario for the Afridev pump approximates a moderately expensive borehole.
The borehole will be cleaned and redeveloped after 10 years and its lifetime is assumed to be 30 years. The borehole will be fitted with an Afridev hand pump (including rising main, pump rods and pumping elements) whose working life is assumed to be 9 years after which it is replaced entirely. A one time initial cost for training a pump attendant and the cost of a sparepart is assessed at the installation of the pump. Maintenance is carried out by the locational repairmen and handpump attendants, all of whom are trained by and

whose labour charges are approved by the programme. Spareparts are obtained from hardware shops at prices approved by the programme.

4. Figure 1 gives a plot for the deep borehole baseline scenario showing the average cost per megalitre of water delivered up to that point. This gives the total financial cost of failure of the system at the point in time selected. If the system is maintained and operated continuously through the last year of assumed lifetime of the borehole , the fully amortized system will have delivered water at an average cost of $9.215 per cubic metre. However for the ½ inflation scenario the corresponding cost is $1.64 per cubic metre.
5. Capital costs dominate the cost picture. Borehole redevelopment and handpump replacement increases the average cost of water considerably. The high level of inflation (20%) has a severe impact on capital costs. A twenty fold increase in downtime, increases the cost of water production by about 15%, while reducing the drilling costs by a half lowers total costs by a small factor. A reduction of inflation by a half (and an interest four points above inflation) has the greatest long term effect. The lowest average annual cost to operate the system is the lower inflation and interest scenario, while the highest annual costs are experienced when downtime is increased twentyfold.

6. The following inferences can be drawn from the curves:

- The cost curves tend to shoot up at irregular intervals when new capital investments are made in the form of handpump replacement costs (every nine years). After this, they tend to form gentle slopes, downwards, actually reducing the cost of water production. This indicates that:

(a) The system failure shortly after redevelopment or handpump replacement is the most expensive.

(b) Rehabilitation of existing and non-functional boreholes is a better use of capital than drilling new boreholes.

- Because capital costs dominate and drilling costs are the largest component of the capital costs, the financing agency should concentrate on reducing drilling costs.

- Doubling the maintenance costs has a negligible effect on the cost of water in the short run. Long term maintenance costs are affected adversely by the high inflation. Since spareparts are the larger component of maintenance costs, these should be bought in bulk and stored so as to shield them from the effects of inflation.

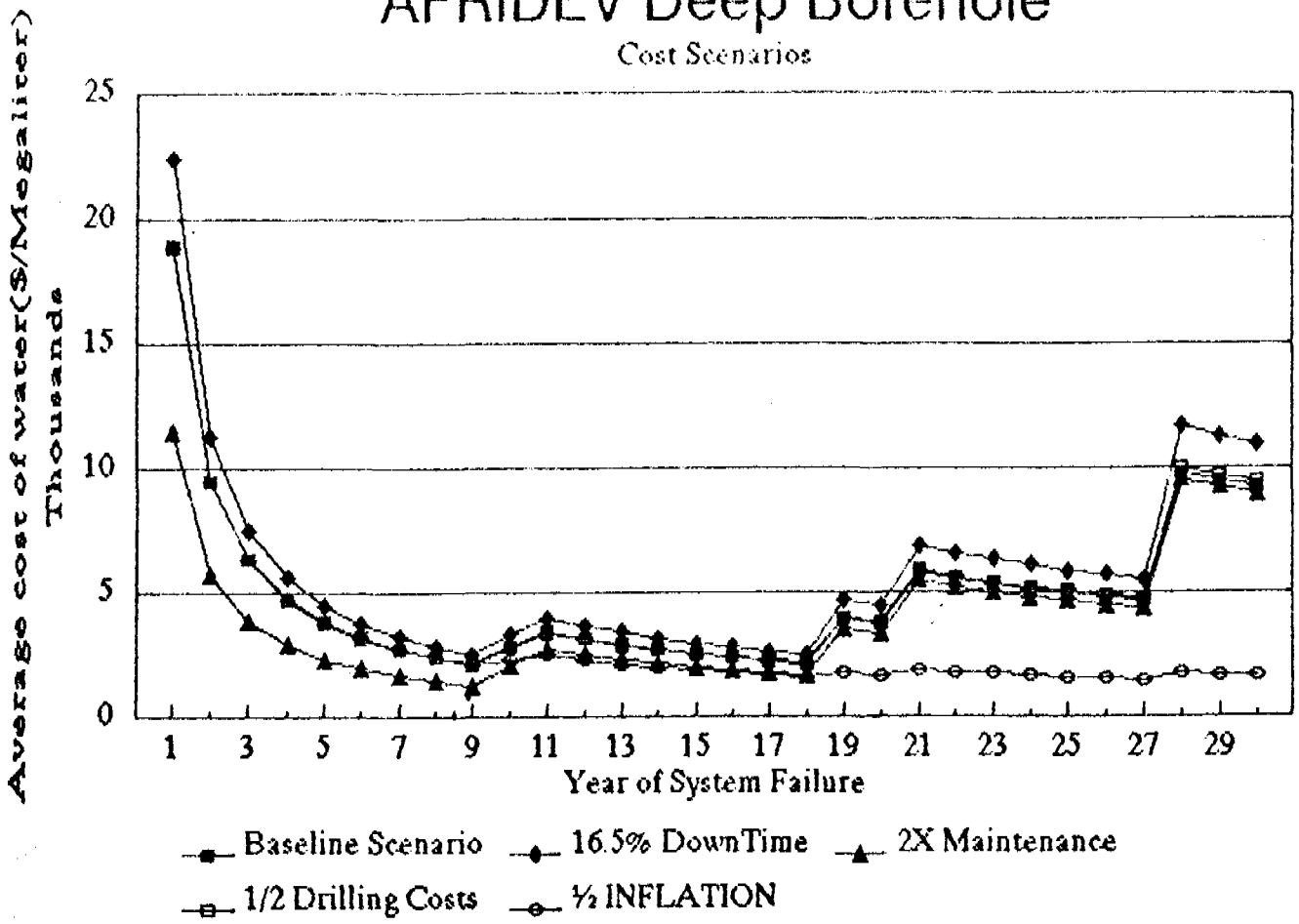
AFRIDEV Deep Borehole
Cost Scenarios
Average cost of water($/Megaliter)
Thousands
25
20
15
10
5
0
1
3
5
7
9
11
13
15
17
19
21
23
25
27
29
Year of System Failure
Baseline Scenario
16.5% DownTime
2X Maintenance
1/2 Drilling Costs
½ INFLATION

Figure 1

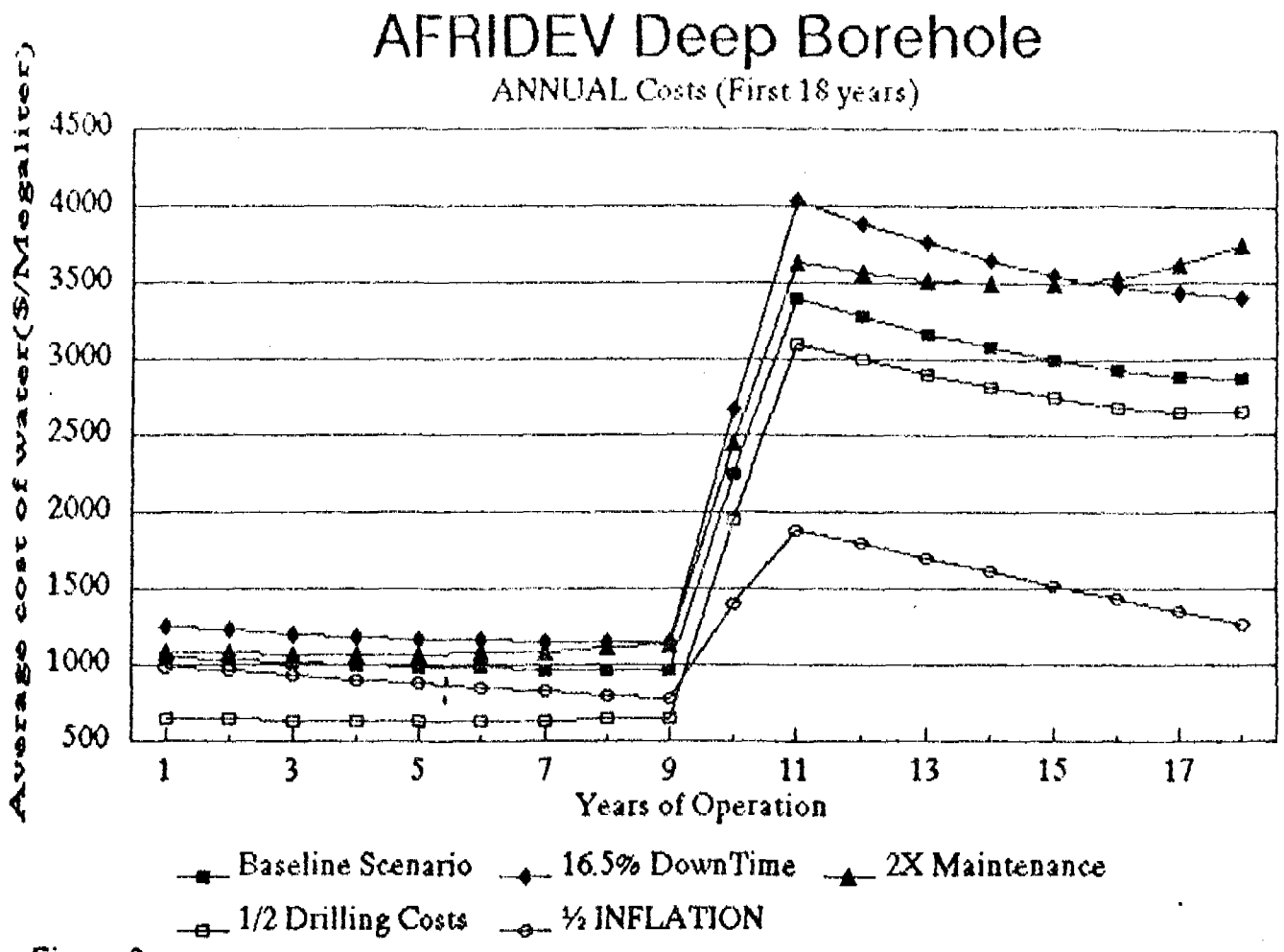
AFRIDEV Deep Borehole
ANNUAL Costs (First 18 years)
Average cost of water($/Megaliter)
4500
4000
3500
3000
2500
2000
1500
1000
500
1
3
5
7
9
11
13
15
17
Years of Operation
Baseline Scenario
16.5% DownTime
2X Maintenance
1/2 Drilling Costs
½ INFLATION

Figure 2

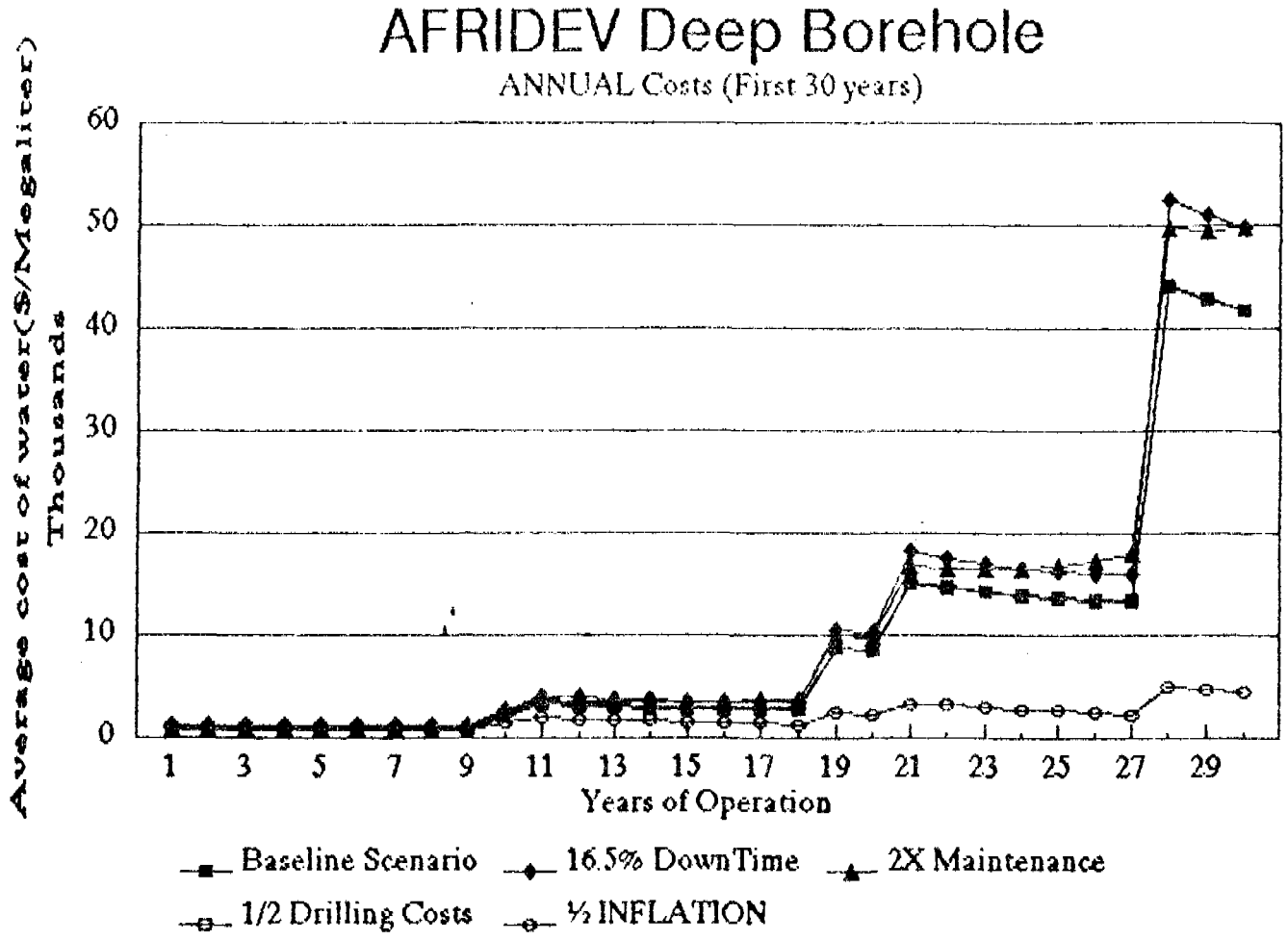
AFRIDEV Deep Borehole
ANNUAL Costs (First 30 years)
Average cost of water($/Megaliter)
Thousands
60
50
40
30
20
10
0
1
3
5
7
9
11
13
15
17
19
21
23
25
27
29
Years of Operation
Baseline Scenario
16.5% DownTime
2X Maintenance
1/2 Drilling Costs
½ INFLATION

Figure 2

SHALLOW WELL (Nira AF 85)

Table 2: NIRA AF 85 IN HAND DUG WELLS

ASSUMPTIONS BASED ON MONITORING	VALUE	UNIT
Population served	250.0	Persons
Water demand	10.0	litre/person/day
Depth of water	8.0	metres
Depth of well	12.0	metres
Construction rate	126.0	$/metre
Hand dug well working life	20.0	years
Number of hand pumps	300.0	units
Hand pump cost	513.0	$ each
Hand pump installation	256.0	$ each
Training of community	296.0	$ each
Hand pump working life	15.0	years
Average spare part cost	23.0	$/pump/year
Average labour	1.0	person day/pump/year
Labour rate	2.5	$/person day
Average labour cost	2.5	$/pump/year
Average down time	2.0	days/pump/year
Inflation index	1.2	per year
Interest rate	12.0	percent

7. The NIRA AF 85 handpump selected for this analysis is the standard for the programme area. The assumptions based on monitoring data are given in table 2 above. Figure three shows the consequences of system failure at any year up to the last year of assumed working life of the system. The handpump has a working life of fifteen years after which it is replaced. After the initial ten year period the cost of system failure tends to flatten out, indicating that this is the most critical part of the investment period.

8. The following are the implications of the NIRA AF 85 handpump scenarios:

   - Doubling the maintenance costs increases the cost of producing water much more significantly than the savings accrued from the lowering of the drilling costs. Therefore the pump replacement parts need to be cheap.

   - Lowering inflation considerably reduces the cost of water with time.

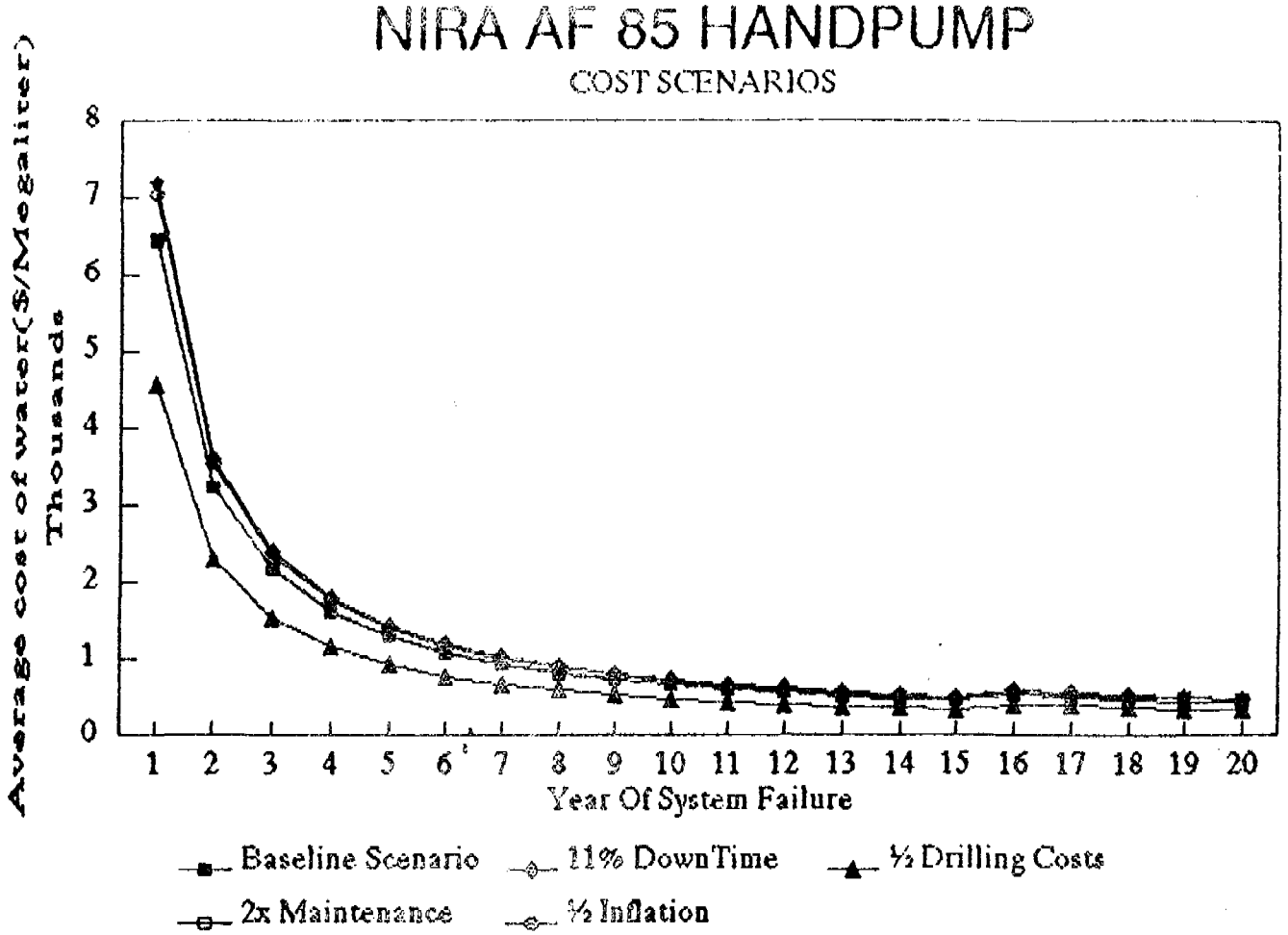
NIRA AF 85 HANDPUMP
COST SCENARIOS
Average cost of water($/Megaliter)
Thousands
8
7
6
5
4
3
2
1
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Year Of System Failure
Baseline Scenario
11% DownTime
½ Drilling Costs
2x Maintenance
½ Inflation

Figure 3

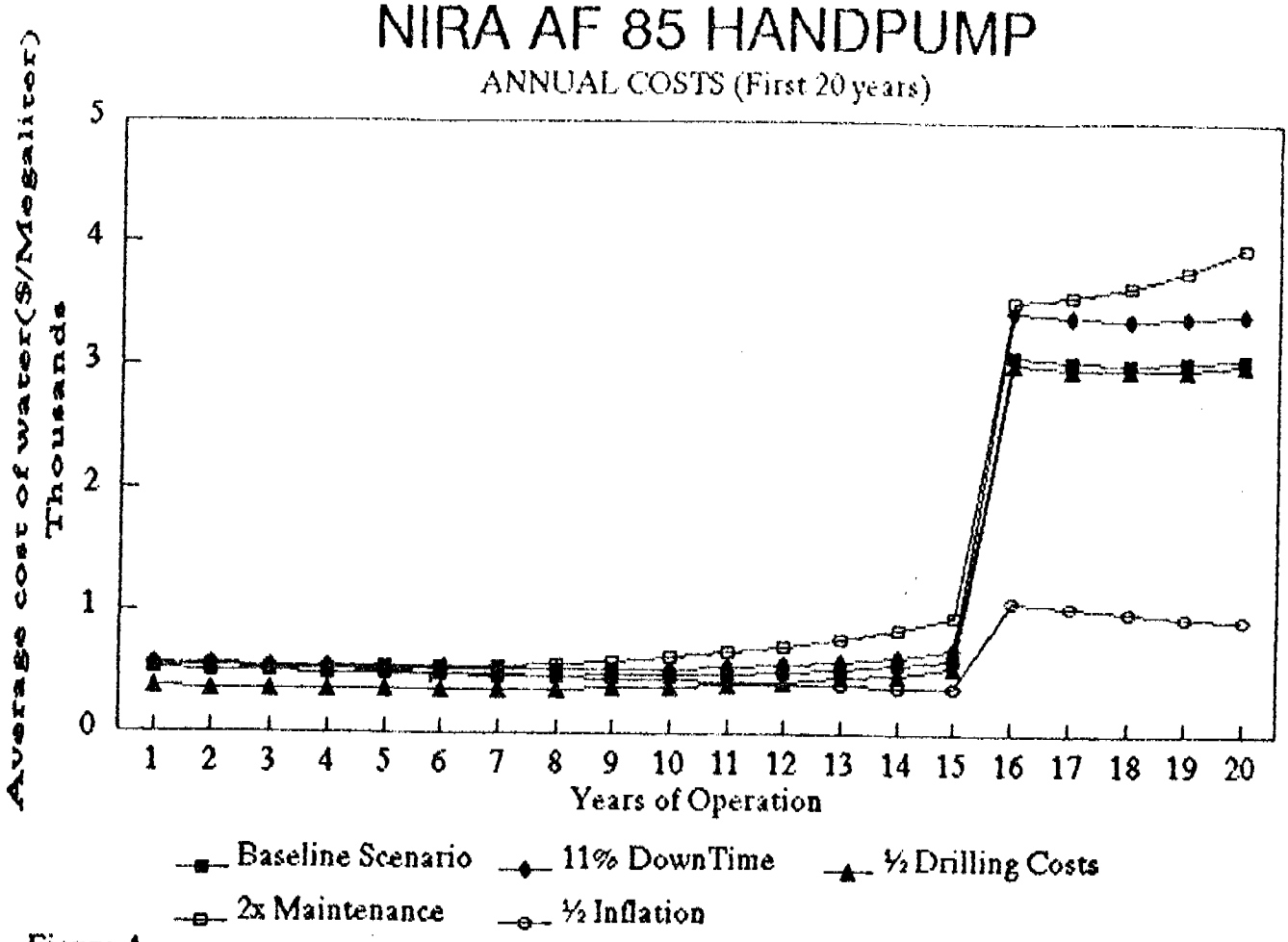
NIRA AF 85 HANDPUMP
ANNUAL COSTS (First 20 years)
Average cost of water($/Megaliter)
Thousands
0
1
2
3
4
5
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Years of Operation
Baseline Scenario
11% DownTime
½ Drilling Costs
2x Maintenance
½ Inflation

Figure 4

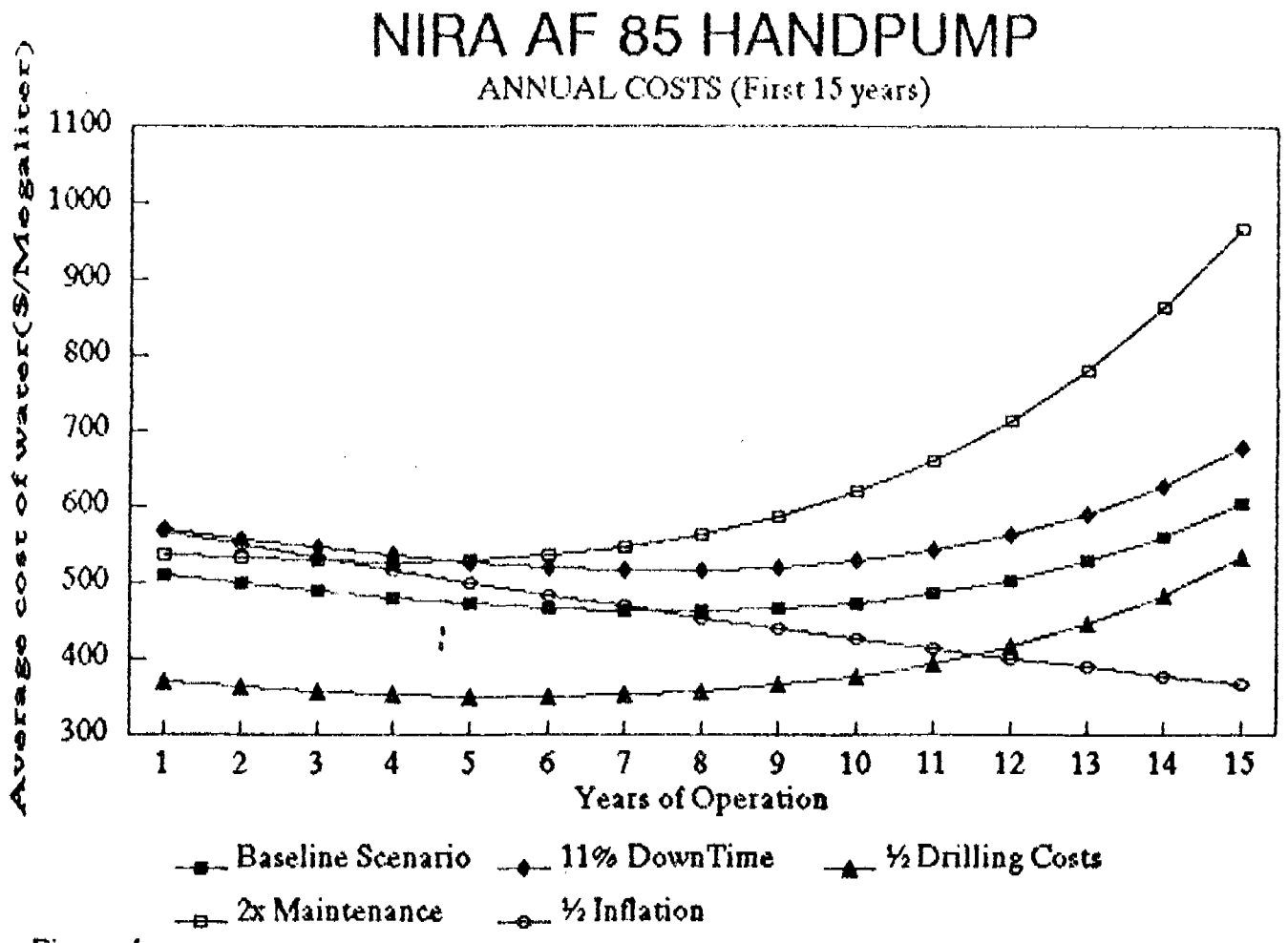
NIRA AF 85 HANDPUMP
ANNUAL COSTS (First 15 years)
Average cost of water($/Megaliter)
1100
1000
900
800
700
600
500
400
300
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Years of Operation
Baseline Scenario
11% DownTime
½ Drilling Costs
2x Maintenance
½ Inflation

Figure 4

WORKSHOP ON OPERATION & MAINTENANCE OF RURAL WATER SUPPLIES LILONGWE MALAWI 20TH - 24TH SEPTEMBER 1993

A PAPER ON OPERATION & MAINTENANCE OF RURAL WATER SUPPLIES IN THE DANIDA ASSISTED REGIONS OF MBEYA, IRINGA AND RUVUMA IN TANZANIA

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INTRODUCTION

Before and after Tanzania independence in 1961 many water schemes in the rural areas have been constructed. It is obvious, if all these schemes had been functioning and delivering water to the rural communities as they were intended to and designed for, then more than 70% of the present total rural population in Tanzania would be enjoying adequate and safe water supply. Thus we would have had less problems than we have now. Unfortunately many schemes built in the period mentioned above are either abandoned or functioning far below their intended capacities resulting in few people enjoying this necessary service. Hence a large percentage of the population in Tanzania do not have adequate and safe water supplies. The detrimental effects of this as we all know are the high child mortality rate, high rate of water related diseases such as Cholera, Amoebic dysentry, Blood Diarrhoea and others.

The root cause of projects being abandoned or operating below capacities among others have been peoples lack of understanding for proper operation and maintenance. Poor design may also be a cause for schemes not operating or delivering services as intended. The improper management of the completed schemes through the institutional set ups or day to day communication procedures for operating purposes should also not be forgotten. Others include bad water sources management such as poor environmental protection of the water sources and inadequate training at the most appropriate level.

During the early 1980's for example emphasis was put to Operation and Maintenance and rehabilitation of the old existing schemes. It was in this period the funds set aside by the parliament to the Ministry of Water and Energy increased from Tsh. 96 million in 1980/81 to Tsh. 138 million in 1983/84 budget. These funds however covered only 20% of the actual requirement for operation and maintenance of water schemes. Despite the decentralization exercise of 1977 where District Councils were required to be responsible for the Operation and Maintenance of rural water supplies which existed in their respective districts, still that was not a solution as funds allocated to the water sector was very inadequate. In some cases the money were used or spent for other commitments which had higher priority than water, for instance health, hospitals, education, communication facilities such as roads as well as administrative recurrent costs.

In 1985 a study on Operation and Maintenance in Tanzania was conducted by IRC (International Reference Center) and WASH (Water and Sanitation for Health) with an intention to help the O & M personnel in the concerned Ministry and the country as a whole to set strategies and how to start the implementation of them. The report of the above two international organizations helped the government to decide on the new approach to be followed for the water supply sector, and more important to enable the policy making level in government decide on the formation of the National Water Policy that eventually became approved in 1991.

A workshop on national strategies on Operation and Maintenance held in Morogoro in 1986 gathered people from different governmental, non governmental organizations and donors in the country in order to formulate a uniform O & M procedure in the water sector that would lead to a successful VLOM (Village Level Operation & Maintenance).

This paper therefore tries to present the actual concept of village based Operation and Maintenance as viewed in the country, and in the National Water Policy and the actual implementation of VLOM for rural water schemes in the three Danida assisted regions of South West Tanzania. Further more it mentions the success, and the problems that have been encountered while trying to implement VLOM and highlights causes of the problems and the strategies that have been laid in order to alleviate them.

WHY TO IMPLEMENT VLOM?

It was before 1986 the government through its different reports from different organizations and donors highlighted some problems that were being faced. These included unsystematic approach to Operation and Maintenance activities in most water projects, projects being operated on crisis basis due to lack of transport, spareparts and funds for operational purposes. Inputs that were in a form of trained manpower was also lacking while the technology that was chosen in some cases became too expensive or complicated to run putting into consideration the level of education and understanding of a normal villager. Based on above problems the government of the water sector decided and embarked on the community involvement in projects. This means the users right from the beginning of the projects takes part in (planning) actual construction in a form of contributory labour manpower. Training as regards to operational aspects is provided during construction period. Finally they would own the schemes and run them on a self help basis. This approach would increase the sense of responsibility and improve the life span of the water supply installations in the rural communities. The villagers being OWNERS of their water supply scheme would be required to create committees (water) consisting of both sexes that would coordinate water operational issues in a village while by contributing funds from the users would maintain a water fund. Through properly kept book keeping it would enable them to bear the maintenance costs themselves and therefore reducing the already too big burden on the government side.

The villagers would need to be educated and trained in many ways in order to obtain the necessary financial resources for their water funds, depending on the economic situation, culture and habits of the particular area. It is only through the basic method and approach mentioned above that most rural communities in Tanzania can run with a minimum of external support. The National Water Policy has clearly emphasized and adopted the VLOM as the comerstone of O & M in the country where all schemes under construction or already handed over will have to adopt for the better future of its citizens.

THE NATIONAL WATER POLICY AND LOCAL GOVERNMENT ACT

As described in the earlier chapters the Water Policy officially adopted in 1991 is now the country's key guiding element in the planning, construction, Operation and Maintenance of our rural water supplies in the country. The Water Policy emphasizes on three key issues:

- Division of responsibility between sector agents as far as the Operation and Maintenance is concerned.
- Participation of village councils and villagers in planning and management of water supply and it's environment.
- Cost recovery/sharing through users contribution to construction and operation and maintenance of the water supply.

The above three issues however are discussed with a clear objective that the water user at the village level is the one to run and maintain the scheme in question. All other higher levels such as Ward, District, Regional and National are only considered in a form of support to the village if only needed.

The Local Government Act of 1981 is considered also as a guiding document to the implementation of the village level operation and maintenance because it deals mainly with the administrative and management structure at all levels in a district. It is from district down to the village level that most if not all communication, monitoring as well as supportive roles are played towards enabling the villager or user maintain and operate the scheme successfully. The district is given the responsibility of ensuring the supply of spareparts to the villagers through cash administrative, if not available in the open market, while the continuous training through the community departments is done at the ward, division and district level. The Operation and Maintenance monitoring for the completed and handed over schemes is also done through the community development sector at ward, division and district level and have been operational in accordance to the 1981 Local Government Act principles and administrative guidelines.

IMPLEMENTATION OF VLOM FOR RURAL WATER SCHEMES IN THE DANIDA ASSISTED REGIONS

During December 1979 the Danish government agreed to finance the preparation of Water Master Plans inclusive of socio-economic studies in the 3 regions of Iringa, Mbeya and Ruvuma situated in South Western part of Tanzania. Later on Water Master Plans were prepared over the period 1980-1982 where more than 600 high priority villages were earmarked for supply of water in the 3 regions mentioned. The experiences and recommendations given by CDR (Centre for Development Research) in collaboration with IRA (Institute of Resources Assessment under the University of Dar es Salaam) were used and accommodated in the Water Master Plans volumes 38 in numbers, that were prepared during the study.

During Phase I and II of the water project the project objectives were **"Implementation of a reliable supply of clean water sufficient in quantity all year around with the objectives of reducing time consumed in collecting water which is specifically the task of women; and to lay the foundation for improved health conditions in the area supplemented with activities related to sanitation and education".**

Up to the end of Phase II which was extended up to June 1990, a total of 257 villages in the 3 regions of Iringa, Mbeya and Ruvuma had been completed and handed over. The population covered were about 800,000 persons. In July 1990 (a five year third phase) of the project was started. The principle objective was to develop village based Operation and Maintenance system for water supplies. The foundations of which had been laid during the previous phases of the project. In addition to the above objective an additional 155 high priority villages were also to be constructed in the 3 regions.

VILLAGE PARTICIPATION IN THE CONTEXT OF VLOM IN THE DANIDA ASSISTED REGIONS

During the implementation of the rural water supplies village participation have been taken and considered as a very important element in the whole set up. It is taken as the means of achieving the highest degree of involvement in all matters pertaining to Planning, Design, Construction and Management of the water supplies by the rural population. Though villagers are in one way contributing to the scheme cost reduction through the unskilled labour provision, it is more important that people who have been involved in all stages of a project and have invested hard labour in it are prepared to take good care of it. As a summary the following are the reasons why Danida as well as the Water Policy insists on village participation:-

- The villagers who are the beneficiaries and eventually owners of the scheme, works together with the trained personnel and professionals in the process of planning, construction, operation and maintenance of their improved water supplies.

- Rural population get the opportunity to become involved in decisions concerning their own welfare. A concept which is in line with Tanzania's self help and self reliance policy.

- To use the existing government (local) administrative set up to improve communication between the involved parties.

- To build up the sense of self responsibility among villagers. This is badly needed in the management of their rural water supplies.

- To give an opportunity to women, whose water collection burden have been existing for a long period, to participate directly on matters having direct impact on their lives.

Having explained the reasons of why village participation was embarked upn the following are the achievements in that aspect for the three phases of implementation of the project:-

- Villagers have managed to participate in all construction activities without receiving payment. Selection of a village water committee consisting of 3 men and 3 women at the beginning of construction and camp mobilization have established good coordination between the implementers and the villagers. Also together with the village water committee two scheme attendants in each village are selected in order to participate and be trained for future operation and maintenance of the scheme.

- Each individual village have created an account named village water fund the purpose of which is to accommodate funds collected yearly for spareparts procurement as well as scheme attendants remuneration during and after construction.

- Villagers have through seminars conducted, at sites as well as at specified places in the project area, managed to receive the necessary basic concepts on financial book keeping and general scheme management. The idea behind was to minimize the 'crisis' period when break down occurs.

- DP users in each village have managed to be informed on the proper operation of their taps/installation and importance of environmental cleanliness.

- In few cases it has been possible to coordinate planning and implementation matters between more than one village ward and division and hence making a starting point for the water user cooperatives an idea still under investigation.

Problems Occurred and Strategies Laid Down to Alleviate Them:

- It has not been very easy in some areas of implementation to have villagers participate in the construction work such as trench digging and backfilling due to planning from both parties going against each other's interest. In some cases villagers become pre-occupied with cultivation work while they are also supposed to fulfill their water obligations. That being the case schemes tend to remain behind original schedule therefore increasing the cost compared to original planned budget. Remedies taken have included ensuring that construction schedule goes in-line with the actual seasonal activities of the area in question. Weather conditions in the respective areas must also be accommodated in the planning.

- Fund raising exercise is done right from the start of the construction. It has been noted in many cases that the amount raised does not correspond to the population due to either economic conditions or awareness. As a solution training, user seminars and leadership seminars have been proposed to be intensified so that the understanding can be improved. Less emphasis has been put on using higher authorities to solve participation problems as they are not thought to be of long term effects, particularly the O & M period. Proper fund collection using existing government sectors such as the cooperatives procedures have been encouraged for sustainability reasons.

initial funds to show preparedness - TMS 50000

- The project has decided to prepare an operation and maintenance processes of village water supplies in the 3 regions which is also currently in line with the National Water Policy.The primary users of the framework are expected to be relevant personnel at district level, ward and of course the village level.This framework is made or proposed in such a way that the village will have to run the O & M with a minimum of external support while also dependance on the government institutions such as water sector is lessened by involving the private sector for issues such as spareparts and technical experts.

- Training has been earmarked in the project as a continuous process.This is especially the case at village level, ward and if necessary divisional and district level, in order to improve the present awareness with regards to the project and government objectives whose emphasis is village based operation and maintenance through self help basis.

- A consultancy which was conducted in 1991 and culminated in a Draft Plan for Training for the Project phase III has been a guiding document towards training at all levels.

Very special emphasis has been given to beneficiary training which includes government leaders, VWC, Group Scheme Committees, and all other project related personnel with an objective of enhancing sustainability of the rural water supplies.

POST CONSTRUCTION PERIOD/OPERATION AND MAINTENANCE

Up to the end of 1992 in which phase III is under implementation a total of 263 villages were completed and their schemes handed over to the beneficiaries in the 3 regions of Iringa,Mbeya and Ruvuma.The responsibility for Operation and Maintenance in these schemes is with the respective village water committees (VWC), under the village government (VG), assisted by scheme attendants/handpump attendants and supported where required by technical and managerial experts from district level or the private sector.

It is generally now clear that the villagers are aware of their obligations in O & M and have a positive altitude towards participation and fund raising for their village water fund (VWF). It is to be noted that the villagers have different approaches in raising water funds such as by household, by able bodied person, by village shamba, by tax collection from whatever revenue activities going on in the village such as liquor shops etc. Most of the already handed over schemes having VWC have opened bank accounts some with in between 50,000 Tsh.to 1000,000 Tsh. Some villages prefer to contribute to their VWF when there is a problem. local flexibility however is very much encouraged depending on the circumstances which prevail, as long as proper O & M is secured.

Beneficiary training of members of village governments and village water committees in their roles and responsibilities has a high priority.It is to be noted that training of the treasures, many of whom are female, has been carried out with assistance from the Department of Cooperatives.Scheme attendants/handpump attendants are trained partly on job during construction and partly through workshops organized at sites after hand over. SA/HPA are remunerated in a number of ways such as cash, work exemption, execution of tax payment depending on the local conditions and suitability of the village in question.

In the Tanzanian administrative hierarchy monitoring of the performance of the village water facilities and of the VWC is through ward CDA's. Each CDA covers an average of 10 - 15 villages and sends monthly reports to district level. Water is only one of a larger number of subjects reported on. It is clear from them that emphasis is on implementation rather than on functioning of facilities. District authorities (DWEs and DCDOs) scrutinize the reports and take actions on some issues while others are left to be solved at ward level.

Project monitoring at Regional level is presently carried out in each region by one Project Monitoring Unit (PMU) which is project financed. The PMU visits the handed over water facilities on a routine basis at least once a year and fills a questionnaire/check lists dealing with technical and managerial matters, VWF, administration of funds,source protection measures and general awareness raising. In addition there is a Back Stopping Unit (UBS) which is mainly involved in training seminars for scheme attendants as stated earlier. There is therefore considerable experience available on O & M over several years. Some activities have been experimental but altogether with a richness of flexibility suitable for community based sustainable O & M systems.

Problems Encountered in the implementation of VLOM in the Project:

- A very large amount of data is collected but is not so far being analyzed in a systematic manner with the purpose of e.g. indicating trends in facilities in use or level of costs of spares used per year for an average scheme.

- Some of the project areas have been lacking the required personnel attached to the Community Development for Operation and Maintenance of handed over schemes.

- The task of awareness raising and upkeep of the ownership idea is not an easy task as it requires continuous training in a form of meetings and discussions in the villages.

- Due to some cases where lack of financial transparency has been noted ability of the villagers to strengthen their O & M fund has not clearly been known or monitored.

- A lot of efforts are still needed in order to convince and make the villagers perform the preventive maintenance of their schemes.

- The women in the community are not yet given the necessary chance/opportunity to decide on the water issues, O & M being one of them.

- Since the two scheme attendants repairing the scheme are paid sometimes irregularly they leave their jobs for better opportunities else where.This is quite risky for the villagers as far as VLOM is concerned.

- The management and organization of group schemes operation and maintenance has been a problem for schemes which are above two villages in number. Discussions are still going on regarding the possibility of involving the private sector in the matter.

- It is not yet clear how villagers react practically to schemes handed over but suffering due to unexpected population influx in semi urban located villages. Such schemes do not deliver enough quantities of water as per designs.

- The present frequency of breakdown and magnitude of repairs villagers have to face is not yet indicative of the capacity of the villagers to repair their scheme in the future. This is so because most handed over schemes are still operating within their first five years.

- Though the project policy do not encourage in house private water connections to individuals due to high scheme costs implications, it has not been possible to avoid the issue completely due to practical and social reasons. The management of such connections at village level is a problem and non transparent.

Even though we are aiming at a village based O & M there will be a need of supportive institution, namely the district. The district fails to fulfill this supportive role in most cases,due to their poor financial situation.

DPM/asha.

WORKSHOP ON OPERATION AND MAINTENANCE OF RURAL WATER SUPPLY

TO BE HELD IN BLANTYRE-MALAWI 18TH-28TH SEPTEMBER 1993

PAPER PRESENTED BY:-

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WATER DEVELOPMENT DIVISION
SONGEA-TANZANIA

INTRODUCTION:-

It is the experience all over the world that surface water sources do not satisfy all the requirements of the people. In some cases the source may be available but may have other problems in relation to distance, quantity and land terrain not confirming with the Law of gravitation for facilitation of the discharge to the people. Pollution of surface water is quite significant and has been in some cases an obstacle towards selection of such source for the supply of water for human consumption.

The technology selection of surface water sources has been observed to be very complicated and costly in the initial investment and subsequently forcing the one maintaining the schemes incure more costs in terms of purification, treatment, conduit materials and finally more costs for the operational and maintenance purpose. That being the case, efforts have been developed to try to establish other sources namely ground water with the idea of eliminating the above mentioned problems and also taking into consideration cost of initial investment, O&M and the quantity aspects of it.Leaving aside the areas with saline water most of the ground water is clean and safe.

This kind of water can be obtained through handdug or augered shallow wells or drilled medium or deep bore holes, which use pumps which are either hand, electric or diesel operated ones. Or those which use other sources of energy such as solar and wind energy.

The role of appropriate technology in the village based operation & maintenance (V.L.O.M.) is of high importance since it has all the strong elements while considering sustainability of water projects. The elements being referred to are but not limited to, low initial investment, low operation & maintenance cost, availability of the spares and its acceptability to the users.

WHY APPROPRIATE TECHNOLOGY?

Appropriate technology is a phenomena used when considering the water sources in a particular area and the easiest means of extracting such resources putting into account the capacity available both financial,human, materials and technology of the day.

In the Tanzanian Water Policy whose aim [illegible] to supply clean and safe water for human consumption within a reasonable distance of four hundred metres [illegible] of every villager, it is emphasised that technology selection should be given its importance while selecting sources and implementing schemes in general.

Simple technology involving shallow or deep wells, which use hand pumps wind mills or biogas will be used whenever possible. Improvement of traditional water sources using ring wells covered with slabs for better hygenic condition has also been emphasized. Other simple technologies whose use is being encouraged to be developed includes rain water harvesting using corrugated iron sheets roofs, bamboo wooden pipes and wood stave tanks. Masses are therefore encouraged to use these technologies wherever possible using the available locally produced tools and materials.

Guiding principles in technology selection:

The selection of any system or technology in our water sector is to be based on compromise between performance and economic merits. Technology which is selected is normally determined by the users needs and in this case beneficiaries (villagers), the selectors experience of the technology, the availability of materials,the investment cost, efficiency in operation and finally operational and maintenance costs after installation or completion of the project.

Any of the above factors considered may be or become the cause of changing the technology under consideration.

However when different choices done deliver equal results with respect to output then selection or preference is to be given to systems/technology with the lowest operation and maintenance cost.

THE HANDPUMPS:

As discussed in the paper on O&M of Danida Assisted Regions of Tanzania the question of technology selection bearing in mind the long term sustainability has been emphasized. Among the 600 villages earmarked for been supplied with water in the 3 phases of implementation, about 1/3 one third of the schemes are fitted with hand pumps. These hand pumps have been either fitted on traditionally developed ground water sources, shallow wells either handdug or using hand augers and in some cases shallow wells dug with an assistance of a mini-rig used for the purpose of easy penetration through hard formations experienced between 3 - 10m below ground level. Some of the old traditional ground water sources which were initially hand dug by villagers have during phase three of the project been fitted with concrete rings and slabs at the top for easy water collection through hand pumps instead of bucket.

The type of hand pump under usage in the project (covering the three regions namely Ruvuma, Mbeya and Iringa) are mainly SWN-80 (75%) and NIRA (25%).

In 1985 - 86 there was a vigorous experimentation of various hand pumps which were available in the market by then. Among the pumps tested within the project area included the Afridev pump manufactured in Kenya with an assistance of UNDP/World Bank,The NIRA pump manufactured in Finland but lately having opened a branch in Tanzania called TANIRA, fabricating and selling Nira pumps and pump parts. Other pumps tested included SWN-80/81 manufactured in Netherlands, but also having an assembly plant in Tanzania.Also the Wavin handpump manufactured by Wavin company in Denmark was among the tested pumps.

The following is a brief report on the performance of these pumps

Afridev .

The pump was installed at a well whose depth was 15 meters;

Pump cylinder intake was placed at a depth of 13.5 meters

It was subjected to vigorous pumping continuosly for a period of three months.

Findings:-

- Difficult both in installation and dismantling
- O-ring and Lip seal within the valve bobins indicated quick wear especially in sand areas
- Chances of foot valve being trapped into the silting were high
- quit a big number of tools are used for dismantling and installation such as Files,nylon ropes Hacksaw,24mmsocket spanner,Fishing tool,Oil can,Pipe wrench and sand papers.
- Discharge was about 1500Lts/hr.

Nira Pump

The first installation was undertaken in 1988 in more than 20 wells with depths not acceeding 15 meters.

Findings :-

- Easy installation and dismantling
- High rate of water discharge to about 2000Lts/hr
- Beinga direct action pump some wearing parts such as pump head bearing and regular lubrication have been avoided
- Most of the parts comprising this pump are made of plastic materials thus making it easer to handle especially during reassembly.
- Discharge range from 1800 to 2000Lts/hr.

SWN 80-81

At present these pumps are widely installed all over Tanzania and to a great extent in Danida financed projects. These pumps are suitable for installation at depths ranging from 25-50 meters. They are and they have been operating for a period of more than 10 years.

Findings:-

- Their operating handle facilitates easy pumping by both women and children.
- Assembly, installation and dismantling are all within villagers capability
- These pumps coupled with stainless steel Grundfos cylinders made in Denmark have proved to be more sustainable and durable for quite a long period.

Beakdowns experienced:-

- The origional pvc cylinders supplied with this types of pumps, have proved to operate for operiod less than six months especially in areas where siltings cannot be avoided.
- Breakdown of steel pump rods at the joints is a common feature.
- Ocassional disconnection of foot valves has been taking place .
- Rising main threads needs periodical re-threading.
- Wornout pumphead bearings have necessiated replacement.

During selection of an appropriate pump technology, regardless of the technological factors encountered during testing such as

- Difficulty of installation and dismantling
- Breakage of steel rods at the joints in SWN-80.
- Worn out threads in the plastic rising mains

- Worn out pump head bearing at the fulcrum within the pump head.
- Faster wearing of pvc cylinders and disconnection of the foot valves encountered in SWN-80.
- Shallow depth pumping capacity of NIRA pumps etc.

The preference was still given to the two varieties ie. SWN-80 and NIRA - pumps being that spare parts supply is vital to effective operation and maintenance

Hence in 1987 it was agreed that the two types of pumps technologies would be utilized within the Danida project area but with a condition that only one variety would be used in one particular scheme where the condition favoured the technology so as to avoid carring of a bulky number of tools during repair.

Advantages & Disadvantages:

After now a number of years of installation of SWN - 80 type and NIRA pumps, the following are some of the advantages:-

- Pump parts are easily available without involving the acute foreign currency.
- Nira pump being of direct action type and double acting has a higher discharge capacity and has no problem of fabrication
- Ease of installation & dismantling especially NIRA pumps facilitates to a great extent V.L.O.M.

- Use of plastic parts such as rising main and pump cylinders in both technologies have solved to a great extent the problem of corrosion.
- SWN-80 can pump water from a depth beyond 25m depth.
- Overall cost of NIRA pump is 189,440/= and being that an average of 250 people use the pump within a village then the actual cost/head of replacing the pump is 757/=Tanzanian shillings the amount which villagers can afford.

Disadvantages

It is believed that when there is no problem to solve then there is no progress and lack of problems is a big problem in itself. By saying so I mean if there was a pump which is problem free, then we wouldn't be struggling to develop more cheaper and durable ones. Likewise the disadvantages of SWN-80 and Nira pumps exists and have been observed to be:-

- PVC cylinders of SWN-80 have their plungers and cylinder bore which are wearing faster to an extent of requiring a replacement within 6 months of installation.
- Nira pumps can only work efficiently to a depth of max of 15 meters only and not beyond that.
- Steel pump rods gets broken especially at the joints thus causing disconnection of the parts below.
- Plastic raising main threads gets worn out at an average of once every year in every well.

Present Experience in the Project

Our experience as regards to pumps,users and future operation and maintenance costs is as follows:-

Pumps;-

- The pumps in use are either locally fabricated/sold and does not require foreign currency.
- Periods of breakdowns have been minimised to a great extent following easy availability of spares which does not involve foreign procurement procedures
-The fewer the types of pumps used the easier it becomes to train the users

Users

Users involvement both in decision making and physical participation, have a notable impact in operation and maintanance.

Within the Danida assisted projects, villagers have contributed not only free labour during water scheme construction, but also have identified

the problems associated with source selection, type of technology, selection of appropriate domestic points location as well as showing their ambition by contributing in advance the to the water fund for future operation and maintenance and finally their acceptability of being handed over the schemes after construction.

Future operation and maintenance

During all this period villagers and in particular Hand pumps attendant who are normally selected prior the start of scheme construction have been trained on SWN-80/NIRA depending on the selected pump. Tools necessary for repair work as well as manuals showing fault finding procedures have been provided to the villages to ensure that pumps are properly maintained, breakdowns are short and reported for the purpose of analysis and feed back to the manufucturers.

Having handed over the completed schemes to the villagers /users, both operation and maintenance is being exercised by themselves. Datas showing at least a step towards V.L.O.M is the attached village water fund status, number of handpumps in a village, present population and the worked out operation and maintenance costs experienced during the period starting from 1985 to 1993. Check list forms and fault finding procedure manuals for scheme/handpumps attendant are attached in this report.

The o&m costs, mainly of swn-80-81 pumps coupled with stainless steel grundfos pump cylinders have been observed to be:-

- Replacement of pumpcylinder after 10 years 71666/10 = 7,166/=per yr
- Replacement of cylinder repair kit after 3 yrs 6000/3= 2,000/=per yr
- Pump head lubricating grease 2kg/year @ 1500/= = 3,000/=per yr
- Re-threading of rising main plastic pipes 200/=per yr
- Change of broken pumprods 1,000/=per yr
- Replacement of anchor bolts and nuts 150/=per yr
- pump attendants salary 5500*12/6 = 11,000/=per yr
- Miscelleneous expences, fare for purchase of spares, = 10,000/=per yr

Total cost /year /pump = 34,516/=take 35,000/=

In average every handpump is serving about 250 people. Hence cost for operation and maintenance which should be incured by a villager/year is 35000/250 = 140/= which is within V.L.O.M. in Tanzania.

VILLAGE WATER FUND, HANDPUMPS AND POPULATION STATUS INCLUDING O&M COSTS PER YEAR IN TZS.

VILLAGE	NO.OF HPS	POPULA-TION	VWF	SPARES PURCHASED	O&M COST PER YEAR
Lilambo	10	6392	82,000/=	69,601/=	350,000/
Lipaya	12	3769	53,220/=	17,400/=	420,000/
Mlete	21	1500	81,001/=	1,800/=	735,000/
M'Mbole	17	1200	80,290/=	1,800/=	595,000/
Lumecha	14	4191	6,000/=	59,736/=	490,000/
Msindo	13	3138	12,825/=	15,375/=	455,000/
M'layoyo	22	3545	21,291/=	96,000/=	770,000/
M'kanini	6	1990	62,000/=	10,400/=	210,000/
Nakawale	6	2269	13,750/=	1,290/=	210,000/
B'barani	23	14468	11,500/=	3,400/=	805,000/
Lilahi	23	6498	18,000/=	6,000/=	805,000/
Majala	6	738	15,000/=	975/=	210,000/
Mchuluka	5	956	22,300/=	4,500/=	175,000/
Mwongozo	4	1400	-	1,800/=	140,000/
Msechela	6	1830	14,249/=	11,290/=	210,000/
Mwenge	6	1111	11,645/=	725/=	210,000/
Mchesi	11	1762	8,520/=	-	385,000/
Lkumbule	12	2782	15,228/=	-	420,000/
Majimaji	10	3483	47,960/=	1,800/=	350,000/
Mindu	5	1250	4,270/=	1,400/=	175,000/
Ngapa	6	1517	8,525/=	400/=	210,000/
N/panya	11	2674	-	1,800/=	385,000/
Lukala	6	1079	19,215/=	1,800/=	210,000/
Chikomo	6	2136	24,635/=	1,350/=	210,000/
Machemba	6	1310	28,181/=	4,605/=	210,000/
Mitomoni	7	2528	200/=	1,500/=	245,000/
Luhimba	18	4500	31,500/=	1,800/=	630,000/
Litapwas	20	5280	108,000/=	1,800/=	700,000/
M/ngindo	21	2445	104,069/=	1,800/=	735,000/

INSTRUCTIONS TO HAND PUMP ATTENDANTS

WEEKLY ROUTINE CHECK

1. HAND PUMP OPERATION:

Check that all Nuts are tight.
Check that the Main Bearing is in good condition.
Check that the Anchor Bolts are tight and the.
Compribend Gasket is in good condition and the sealing satisfactory.
Check that the Concrete Structure is without cracks (If necessary repair and inform the VWC).

2. WATER FLOWING AND CLEAN:

Check that water is flowing after the first few strokes.
Check that the water is clean.
(If necessary inform the VWC and arrange repair).

3. SOAK PIT AND DRAIN FUNCTION:

Check that the Soak Pit and Drain are clean and able to drain away the waste water.
(Instruct the Well Attendant to clean up if necessary).

4. WELL SURROUNDING CLEAN:

Check that the Well Apron and surroundings are clean and tidy (Instruct the Well Attendant to clean up if necessary).

ooooo0000ooooo

MAJI/DAMIDA

OM/HP 05

MRADI WA PAMPU: MAM[redacted]YA KUCHUNGUZA KILA WIKI. HANDPUMP SCHEME WEEKLY ROUTINE CHECK LIST 1988

KIJIJI/VILLAGE: _____ NA/REG. NO. _____ TAREHE/DATE: _____

CHECK: CHUNGUZA	WELL NO: NAMBARI YA KISIMA: 21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	WEEK/ WIKI	ACTION TAKEN/ HATUA INAYOCHU KULIWA.
1. Handpump Operation Utendaji kazi wa Pampu																					1	
																					2	
																					3	
																					4	
																					5	
2. Water flowing and clean Maji yanatoka ipasavyo na kama ni safi.																					1	
																					2	
																					3	
																					4	
																					5	
3. Soak Pit and Drain function Mfereji na shimo la maji yanayomwagika - inafanya kazi sawa - katika unadhifu																					1	
																					2	
																					3	
																					4	
																					5	
4. Well surrounding clean Usafi wa mazingira ya pampu.																					1	
																					2	
																					3	
																					4	
																					5	

MAINTENANCE UNIT WILL ISSUE NEW LIST WHEN THIS IS FILLED OUT.

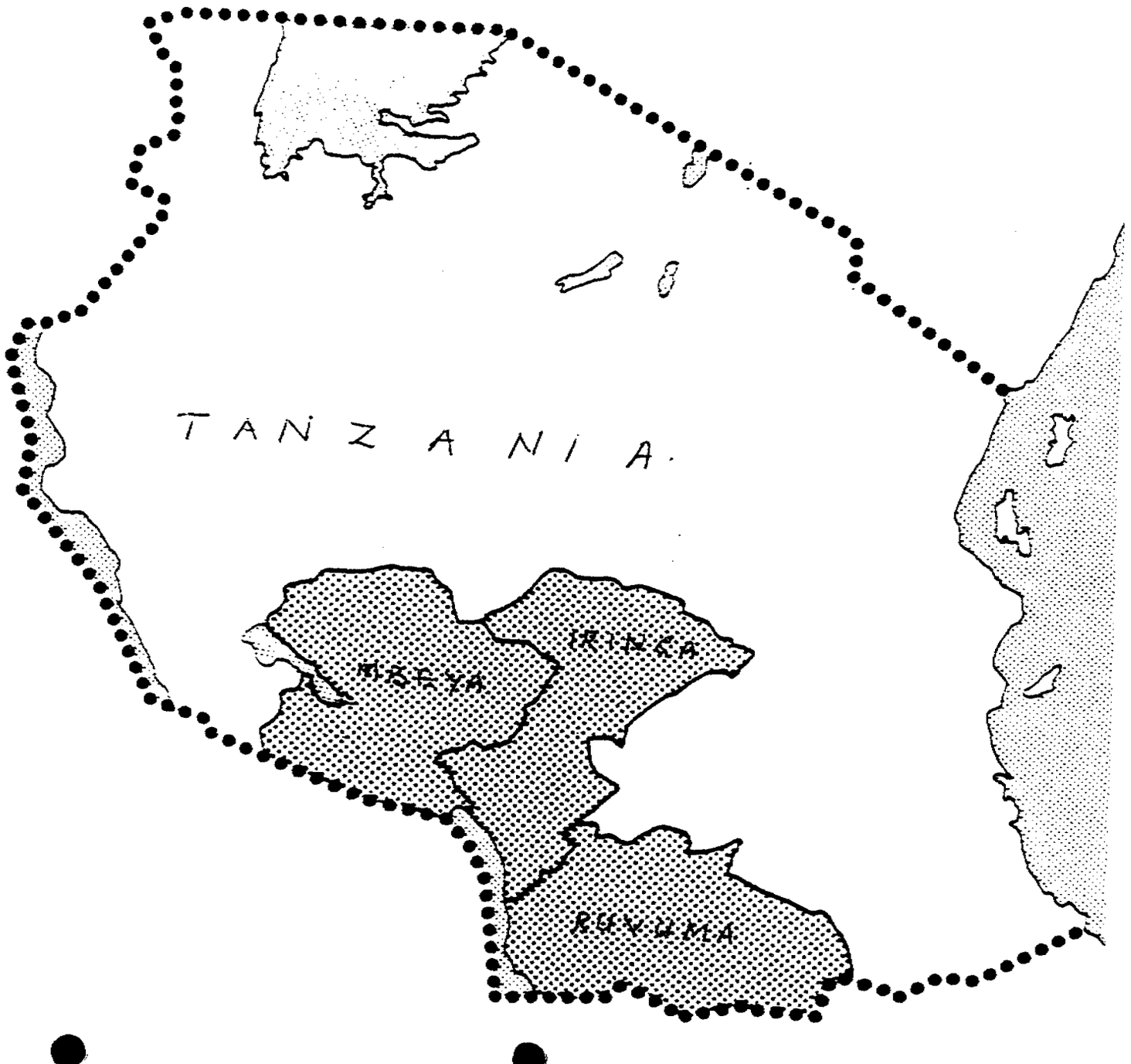
Idara ya utunzaji miradi itatoa fomu mpya baada ya kujaza hii.

HAND PUMP ATTENDANTS' FAULT FINDING PROCEDURE.

OBSERVATION	POSSIBLE CAUSE	ACTION TO BE TAKEN
1. Normal pumping action, but no water flows on the first few strokes.	Rising Main leaking. Foot valve leaking. Piston rubber worn out.	Check Rising Main connections and check for possible holes. Replace if broken. Check and clean pump cylinder. Replace if not repairable. Check fully on the spot what the reason for the malfunction is. (If cylinder fault it may be due to sand or gravel collected in the well without showing in the pumped water).
2. Normal pumping action, but reduced yield.	See 1	See 1.
-If combined with large draw down	Screen clogged.	Call Maintenance Unit for assistance. (Use surge plunger to develop the well).
-If combined with low water level	Aquifer over-exploited.	Accept lower yield until recharge takes place.
3. Very easy pumping action and no water flowing.	Pump Rod loose or broken.	Tighten connectors if loose, replace if broken.
4. Heavy pumping action	Bearing worn out. Piston stuck in cylinder. Mud or sand in cylinder.	Check Bearing, replace if necessary. Check Piston Rubber, replace if necessary. Check cylinder and continue at 5 or 6.

HANDPUMP ATTENDANTS' FAULT FINDING PROCEDURE.....continued

OBSERVATION	POSSIBLE CAUSE	ACTION TO BE TAKEN
5. Fine sand or silt in the pumped water	Gravel pack not properly installed or developed.	Call Maintenance Unit for assistance (Measure well depth and compare with original depth. Clean well with Membran pump).
6. Gravel in the pumped water	Screen damaged.	Call Maintenance Unit for assistance (See 5. If gravel continues to appear, repair or abandon the well).


TANZANIA.
MBEYA
IRINGA
RUVUMA

REPUBLIC OF ZAMBIA

OPERATION AND MAINTENANCE OF RURAL WATER SUPPLIES IN ZAMBIA

*****

PRESENTED BY:- A. HUSSEN
SENIOR WATER ENGINEER

SAMANI: M.
HYDROGEOLOGIST

VENUE : BLANTYRE MALAWI
DATES : 20TH SEPTEMBER TO 26TH SEPTEMBER 1993

OPERATION AND MAINTENANCE OF RURAL WATER SUPPLIES IN ZAMBIA

1. INTRODUCTION

1.1 General Background information

Zambia covers an area of 752.614 square kilometres situated south of the Equarter in Central Africa. The country lies within the tropics. The country constitutes a portion of the Central African Plateau with an average general elevation of about 1.200m above mean sea level. However, the elevation varies from 329m to 2,664m.

The tropical climate of Zambia is characterised by wet summers and dry winters. The rainy season extends from October to March, and it is generally dry from May to early October. The annual rainfall decreases from 1200-1600mm in the Northern parts of the country to 600-800mm in the South.

The 1990 census estimated a population of Zambia to be about 8 million people; about 52 percent live in the rural areas. The population density varies from 2.4 to 40.0 per persons per square kilometre with an average of 7.6 persons per square kilometre. The majority of the people in rural areas live in small villages with average population ranging from 100-500.

1.2 Objectives of Rural Water Supply

The main objective of rural water supply in Zambia is to provide water, easily accessible, in quantities adequate for drinking, food preparation, personal hygiene, and sometimes small live stock, at a cost in keeping with the economic level of the communities and through facilities which can be easily operated and maintained at the local level. The facilities to be installed should be appropriate to the local conditions and acceptable by the users.

1.2.1 Types of Rural Water Supplies

(a) Point Supplies

A community with less than 500 people is normally supplied by point supplies:-

(i) Handdug shallow wells equiped with

- Hand pump
- Windlass and bucket

(ii) Boreholes equiped with
- Hand pump
- Windmill

(iii) Springs

(b) Small piped Water Supplies

For communities with more than 500 people normally piped water supplies are adopted.

Preferably boreholes are chosen as source in favour of surface water mainly because they are easy to install, operate and maintain. Surface water is more liable to pollution. A piped water supply scheme include public stand posts.

2.0 NATIONAL POLICY ON OPERATION AND MAINTENANCE OF RURAL WATER SUPPLIES

In accordance with the policy, operation and maintenance of Rural Water Supplies is the responsibility of respective district councils or user institutions or organizations. However, due to lack of technical manpower within the councils and other institutions the department of Water Affairs have been asked to operate and maintain the facilities. With increasing facilities and varying technology coupled with limited manpower, its been observed that the task is too huge for the department to handle. Therefore, inorder to address the issue of sustainability of various rural water supplies, the following principles which were recommended at a National Workshop held in 1991 are now being applied in various rural water supply programmes in the country. These are:

- Management of water supplies are to be entirely community based.

- User in rural areas, especially women, are to be involved in the Planning implementation and operation stages of water supply systems.

- Choice of technology is to be appropriate to the ability/ affordability of the community.

- Users are to contribute in cash/in kind to the construction of facilities. O and M are to a large extend be done by the users.

- Technical, financial and training support for construction and some elements of maintenance to be provided by the Government .

2.1 STRATEGY FOR O AND M OF RURAL WATER SUPPLIES

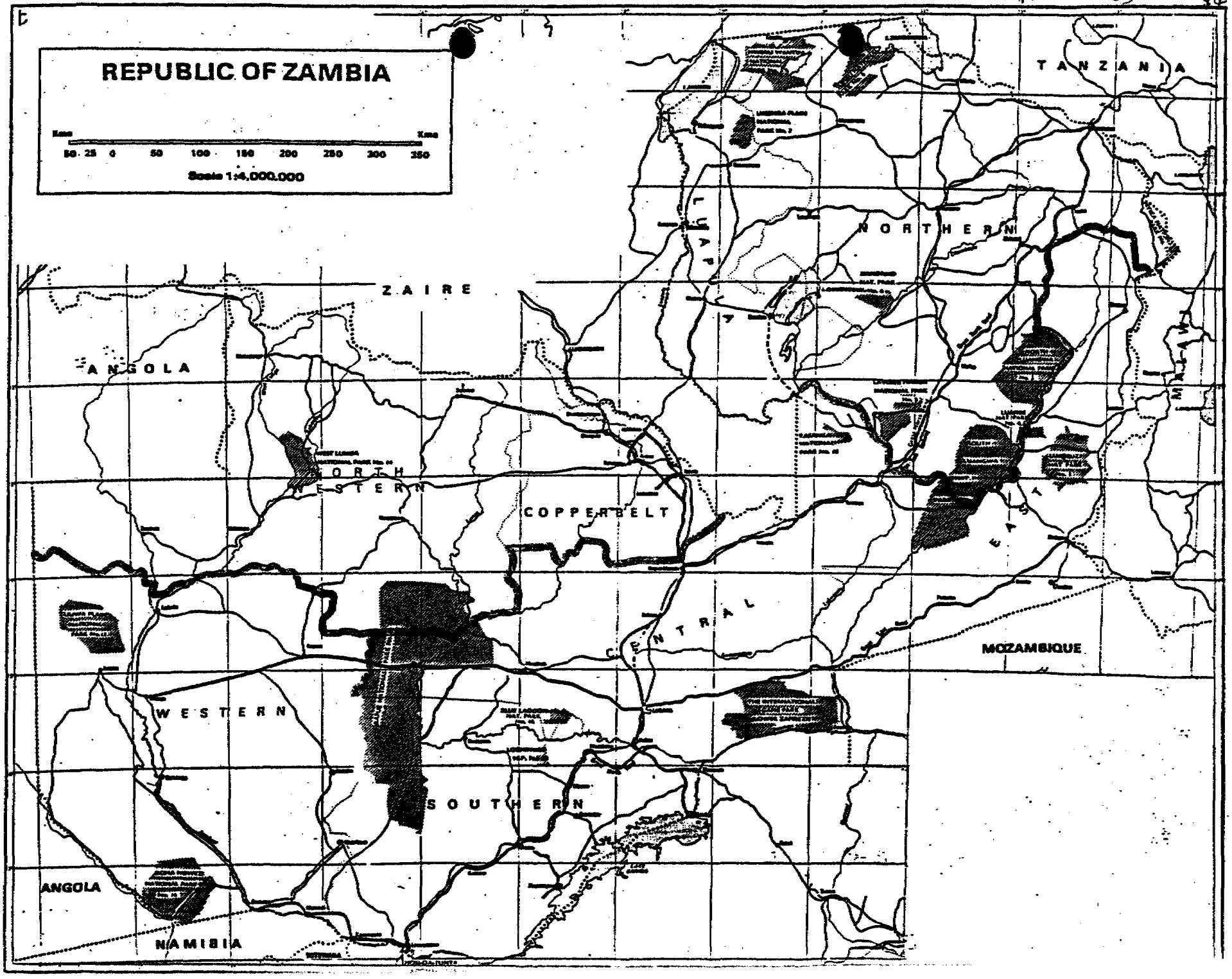
In order to monitor whether the aforementioned principles are being applied or not a Unit called community management and monitoring Unit (CMMU) has been established within the Department of Water Affairs. The Unit among otherthings will setup a data base for planning and monitoring and creating and developing community responsibility for rural water supply.

The Unit will promote more effective maintenance systems and thus enhance the efficiency of investimetely made in the rural water supply sector. It will also make an assessment of existing community based water supply systems, development of educational and information materials and provision of indepth outreach training to communities which will hopefully result in the rural community fully recognising the costs and benefits of water supply and the need for the community itself to sustain such a supply. Thus, as part of a move to enhance the sustainability of rural water supplies, the Unit will be involved in designing education materials for schools and the communities to promote an environment in which water is seen to have real value and users increasingly take on many of the managerial, technical and financial responsibilities for the operation and maintenance of their own water supplies. The Unit will encourage Co-ordination among rural water supply executing agencies inorder to have a uniformity in the approach to these programmes.

3.0 ON-GOING RURAL WATER SUPPLY PROGRAMMES

Over the years Zambia has been implementing major rural water supply programmes throughout the country with financial and technical assistance from Donor Agencies. One of them with notable success with regard to operation and maintenance concept is the NORAD supported programme in the western province of Zambia.

4. NORAD PROJECT IN WESTERN PROVINCE OF ZAMBIA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