HANDPUMP STANDARDIZATION WORKSHOP

FEBRUARY 17'th AND 18'th, 1993

WORKSHOP REPORT

Venue: Department of Hydrology.
The Water Managemnent Office
Teuk Thla

UNICEF Handpump Selection Project OXFAM

Workshop Report:

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Workshop Report:

1. ACKNOWLEDGEMENTS:

The organisers would like to thank the following organisations for their help and support in making this Project and Workshop a success:

Ministry of Agriculture
Ministry of Health
Department of Hydrology
Lutheran World Service
Danish Church Aid

The organisers would also like to thank all participants for their contribution to the discussions, with special thanks to the interpreters, without whom it would not have been possible.

2. AGREED RECOMMENDATIONS:

The Plenary group made the following recommendations regarding pumps for standardization:

1.1 The No. 6 pump should be the pump for public water supply in the suction lift range.

2.1 The TARA pump should be the pump for public water supply in the medium lift range.

3.1 The Afridev pump should be the pump for public water supply in the deep lift range, with the condition that spare parts are available locally or are produced in Cambodia.

3.2 For specific areas such as Kompong Cham where the depth to water is more than 40 m, the UPM pump should be used.

with the following supplementary recommendations:

1.2 Possible replication of the Prey Veng concept in future, but Government, UN-organisations and NGO's to focus on public water supply at present.

1.3 A future workshop should look at well design for storage capacity.

1.4 A future workshop should look at progress in development of a fabricated steel suction pump.

2.2 Other pumps such as the India Mark III, could be studied as a medium lift pump.

3.3 Until the condition in Recommendation 3.1 is met, the India Mark III is considered as suitable and should be used.

and with the following general recommendations:

1.5 Independent quality control of production of pumps and spare parts must be carried out.

1.6 Ground water levels should be measured at time of installation and monitored thereafter.

2.3 When introducing new pumps, a detailed and thorough introduction programme should be implemented. At the same time detailed monitoring of the performance of the new pump should be initiated. Coordination is essential.

3. INTRODUCTION:

This document will present the outcome of

THE HANDPUMP STANDARDIZATION WORKSHOP.

and it will include:

- a summary of the speeches given by Mr. The Lim Thong, Acting Director, Department of Hydrology, Mr. Som Lim Pich, Vice-Minister, Ministry of Agriculture and by Dr. Chea Chhay, Director of CNHÊ and representative of the Ministry of Health, during the opening and closing sessions,
- the agreed recommendations,
- a summary of the discussions as they took place in the three groups,
- copy of the discussion paper as it was circulated to the Workshop participants (english version), and
- a list of all participants, guests etc.

The workshop consist of a discussion of its objectives, a short introduction to the rural water conditions here in Cambodia now and in future, a presentation of the shortlisted pumps, followed by group discussion of performance etc. of these pump, and finally a plenary session where the recommendations where drawn up.

The process of standardization was initiated based on a request from CNHÊ of the Ministry of Health and Department of Hydrology of the Ministry of Agriculture, to the Danish Cambodia Consortium (DCC) asking DCC to coordinate such a process. For practical reasons the request was taken over by LWS/DanChurchAid, which financed the coordination function by providing a consultant (Bent Kjellerup) for a three month period. In Cambodia LWS provided the necessary logistic for this consultant. For preparation of the standardization process a project given the name "The Handpump Selection Project" was launched.

The reason for the introduction of standardization is based on the experience and knowledge realised world wide that sustainability will only be achieved if certain requirements are fulfilled, one of which is that installed pump will be able to meet the Village Level Operation and Maintenance requirement. Furthermore it is essential that the number of type of handpumps is kept at a minimum. The latter will make training of mechanics etc. and stock keeping of spare parts much easier to manage.

The discussion paper attached as annex no. 1, will provide more details about the history and reasons for standardisation.

4. PREPARATION OF THE WORKSHOP:

The actually initiation of the standardization process was recommended in the joint UNICEF/OXFAM Evaluation report. Subsequently the authorities responsible for rural water issued the mentioned request, and later the standardization

initiative was presented at two Water Supply and Sanitation Group meetings and at an introduction meeting held on December 17'th, 1993. As a part of the preparation of this workshop, departments, organisations and NGOs involved in the sector were asked to propose pumps to be considered for standardization, based on which a shortlist was prepared.

One of the main tasks of the coordinator of the standardization process was to draw up a general picture of the current handpump situation in Cambodia and also to project the conditions under which the pumps will have to work in future. Another task was to prepare a presentation of the shortlisted pumps. The findings etc. of these activities has been included in the discussion paper, see annex no. 1.

Invitations to the workshop were extended:

- to the CNHÊ (The Central Water Base), Staff of the Ministry of Health and selected provincial representatives of the Ministry of Health,
- to the Central Department of Hydrology, Ministry of Agriculture, and selected provincial representative of Department of Hydrology,
- to all NGO members of the Water Supply and Sanitation Sectoral Group, and
- to UN organisations (UNICEF and UNDP).

The workshop took place at the premises of the Water Management Office, Department of Hydrology, Tuek Thla.

The preparation of this Workshop was steered by an informal working group from the W + S Sectoral Group which consisted of representative from UNICEF, OXFAM, GRET, AICF and the coordinator of the Handpump Selection Project. This group held 4 meetings during the preparation of the Workshop.

5. OPENING SESSION:

Welcome: Mr The Lim Thong, Acting Director of the Department of Hydrology - chaired the Opening Session and cordially welcomed the Vice-Minister of Agriculture Mr Som Lim Pich and all participants to the workshop. He hoped that with the collective effort of all the participants the workshop would proceed smoothly and achieve the desired goal.

Inauguration: Mr Som Lim Pich, the Vice-Minister of Agriculture in his inaugural address gave a brief analysis of the present situation in the water sector in Cambodia. When compared with other developing countries in the region, the situation in Cambodia is far different from others. The living standards of the people are low. The population increases rapidly by 2.8 per cent per year. He felt that there is an urgent need for increased food supply and potable water. He acknowledged the commendable work being done by various NGOs and international organizations to improve the situation in Cambodia, and expressed that the government is also very keen to cooperate with all organizations in order to find a solution to the water problem. As of now in Cambodia various kinds of handpumps have been used, some for a long time, some

for a shorter time. Hence it is all the more important to have some kind of a standardization of handpumps for Cambodia. If it is achieved, he added, there won't be any problem in obtaining spare parts as it could be made available locally. He is very optimistic of the outcome of the workshop and wished success and good luck.

On behalf of the Ministry of Health, Dr Chea Chhay, Director of the Central Water Base welcomed all participants. He spoke about the progress made in the sector. Lack of standardization has been giving enough practical difficulties. People from the commune level have been coming up with their problems, which to a certain extent is a result of many kinds of handpumps installed. It has been found very difficult to supply spare parts, train mechanics and repair them. He also felt that there is not much coordination between agencies. There are many projects concentrated at some particular place, and in certain areas there is none working. He felt the need to avoid many organizations working in one place.

6. OBJECTIVES OF THE WORKSHOP:

Mr Pierre Thevenot, GRET chaired this session, he mentioned that although the objective and the aim of the standardization process has been discussed on several occasions the steering group decided to have this point on the agenda as well. Main purpose of including this point is to ensure there be absolute no doubt about the objectives of the Workshop and also the consequences of recommendations issued.

The objectives of the Workshop was presented to the participants as follows:

1 TO AGREE ON A SET OF HANDPUMPS WHICH WILL BE ABLE TO MEET THE REQUIREMENTS OF PUBLIC WATER SUPPLY IN RURAL CAMBODIA.

2 TO RECOMMEND TO RESPONSIBLE AUTHORITIES, THAT INSTRUCTION IS ISSUED THAT IN FUTURE ALL PUBLIC HANDPUMPS WILL HAVE TO CONFORM WITH THE SELECTED HANDPUMPS.

3 TO RECOMMEND THAT SIMILAR WORKSHOPS SHOULD BE ARRANGED WHENEVER AMENDMENTS OF STANDARDS IS FOUND NECESSARY.

During the discussion of the objectives it was clarified that a set of handpumps means one handpump in each of the 3 categories. It does not mean that one set of handpumps for each category. The major objective of the workshop is to recommend to the responsible authorities about the consensus reached at the workshop. With a rural population approximately 7 million people, more than one pump in each lift category will most probably result in batch sizes too small for optimal operation and maintenance of installed handpumps. The whole idea of standardization will fall apart if there are two pumps in each category. Some participants felt that if the choice is limited to one pump then that will lead to monopoly, although it was not explained how monopoly would a problem. The chairman asked for an indication from the floor, regarding who could support and who could not support the aim of only one pump

in each group. It turned out that a large majority was for only one pump in each group. If the situation changes in due course, it will then be necessary to have another workshop for any possible revision. After the recommendation is made then it is for the government to take suitable follow-up action for its successful implementation. The above recommendations were finally accepted by the Workshop.

7. EXISTING SITUATION AND FUTURE WORKING ENVIRONMENTS FOR HANDPUMPS.

This session was chaired by Mr. Bhai Raja Sakya, UNICEF, and he requested Bent Kjellerup to present his findings.

The presentation more or less followed the discussion paper, in addition the following were presented:

- Based on the census report received from UNTAC, as of October, 1992 the rural population of Cambodia has been estimated by district, by following a definition where the rural population in all provinces, except Phnom Penh province, is defined as the total population in the province minus the population within the province town. In Phnom Penh the districts Don Penh, Chamkar Mon, Prampi Makara and Toul Kork are regarded as urban areas, and the remaining districts are regarded as rural area. The total population of Cambodia according to UNTAC is 8,861,150 people and the rural population has been estimated to 7,730,600 people.

  Annex no. 6 provides an idea of where the rural population is located by district. One dot point represents 1000 people. Table no. 1 shows the estimated rural population by provinces.

- The Handpump Selection Project has collected information regarding the number of existing pumps. Likewise table no. 1 presents is information by province and by type of pump. In order to present an overview of an assumed coverage by these pumps, if each pump will cover 250 persons the current handpump coverage will be 1.5 mill. persons. It should be noted that the above is only concerning handpump installations.

- The total demand for handpump installations in Cambodia is difficult to estimate. Anyhow if it is assumed that the existing number of pumps cover a population of 1.5 million people the required number of additional installations will be in the order of 25,000, estimated under the assumption that a total coverage is to be achieved and existing open wells are not included in this estimate. However, the general exclusion of existing and future open wells in such an estimate is not correct.

- Information regarding the static water level has been provided by UNICEF. Included as annex no. 7 is a map showing static water levels

Province:	Population Oct.92	Existing number of Handpumps by type.			Total number of pumps	Coverage: if 250 persons per pump
		IM II	NO.6	PAT		
BANTEAY MEANCHEY	340621	34	0	15	49	12250
BATTAMBANG	431392	171	16	15	202	50500
KAMPONG CHAM	1307586	469	65	44	578	144500
KAMPONG CHHNANG	270707	391	151	27	569	142250
KAMPONG SPEU	438333	717	53	0	770	192500
KAMPONG THOM	432812	1	0	0	1	250
KAMPOT	377648	237	142	0	379	94750
KANDAL	808864	833	490	62	1385	346250
KOH KONG	60438	2	1	0	3	750
KRATIE	197748	3	0	0	3	750
MONDUL KIRI	15224	0	0	0	0	0
PHNOM PENH	268199	163	536	53	752	188000
PREAH VIHEAR	77462	3	0	0	3	750
PREY VENG	840380	162	124	28	314	78500
PURSAT	213058	69	0	0	69	17250
RATANAK KIRI	58100	4	0	0	4	1000
SIEM REAP	485158	41	28	0	69	17250
SIHANHOUK VILLE	54783	15	2	0	17	4250
STUNG TRENG	45248	0	0	0	0	0
SVAY RIENG	397600	168	0	0	168	42000
TAKEO	609240	734	240	43	1017	254250
TOTAL:	7730601	4217	1848	287	6352	1588000

Table No. 1

by district and divided into four different levels. As mentioned, the draw down is often seen as the determining factor when selecting handpump lift capacity, therefore the use of static water level information should be done with some caution.

- Organisations involved in rural water have provided certain information regarding their present and future activities. The discussion paper - annex no. 1 shows by provinces which organisations are active or plan to become active in installation of handpump water points. The planed installation programme for 1993 and for the two year period 1993 - 1994, is shown in table no. 2. It can be seen that the annual installation programme for the mentioned two year period is 3110 installations, in other words equal to half of the total installation so far.

Mr Bhai Raja Sakya, summed up as follows: There is a demand for more pumps. Community involvement in maintenance is so far not good. There is an urgent need to have more community involvement. But this will depend on the following:

- people's attitude towards the pump,
- type of pumps,
- methods of training,
- need for spare parts,
- design/proper construction,
- local production,
- availability of cast-iron pumps, and
- family pumps produced locally.

INSTALLATION PROGRAMME		
Organisation:	1993	1993-1994
ADRA	120	240
AICF	200	
CARE		30
CIDSE	15	
CONCERN	50	80
COR	20	100
DoH see OXFAM		
GRET		
MCC	35	200
MoH - CNHE	2100	5100
OXFAM - BATTAMB.	180	360
OXFAM - SVAY RIENG.		
Redd Barna	20	
UNDP/OPS	60	110
UNICEF see CNHE		
Total:	2800	6220

Table No. 2.

8. INTRODUCTION TO THE HANDPUMP PRESENTATION:

The two following sessions were chaired by Mr Veng Sakhon, Vice Chief of the Water Management Office in Department of Hydrology. The chairperson introduced the various pumps in the three different categories. They are:

Suction:	No.6
	Lucky
	Prey Veng pump
Medium:	NIRA AF 85
	TARA
	Dempster
Deep:	Afridev
	India Mark II
	India Mark III
	UPM

A sample of each pump was on display.

Bent Kjellerup gave a brief introduction into how summaries of the individual handpumps have been established. The main source of information is the UNDP/WORLD BANK Handpump Option Report. The HSP has also requested organisations like ADB and the UNDP/World Bank, Regional Water Supply and

Sanitation Group in New Delhi to forward the latest performance information regarding the considered handpumps.

The summaries are the work of the Coordinator, and do not necessarily represent the views of the Steering Group.

The issued current standard specifications for some of the pumps considered are listed in annex no. 2.

9. HANDPUMP PRESENTATION:

Apart from what has already been mentioned in the presentation paper, the following were added:

SUCTION PUMPS:

The No. 6 Pump - Presentor: Jeremy Ockelford.

Mr. Waldemar Pickardt mentioned that in 1988 MOH/UNICEF ordered these pumps from Bangladesh. Unfortunately the quality was no good, and subsequently they were replaced by Vietnam produced No. 6 pumps. The Vietnamese pumps were able to perform according to expectation, even when the user group size is in the range of 250 persons. The pump is designed for a user group size of 150-200 persons.

The Lucky Pump - Presentor: Foort Bustraan:

It was pointed out that the casting work of this pump in some cases is of a very poor quality. Leakage in the cylinder body has been observed just as an example. Furthermore, it was expressed that if the flange bolt is tightened too much it will result in breakage of the flanges, and the pump has difficulty with lifting water from a level beyond 4 to 5 meters. In certain areas the pump is popular as a family pump although it requires frequent attention. The Lucky is to regarded as a family pump only.

The Prey Veng Pump - Presentors: Mr. Sok and John Coats:

Mr Sok, the inventor and manufacturer of this pump gave a demonstration of the various parts and their functions. It is basically a family pump. The design of the pump is based on using easily available material. He buys most of the material for the manufacture of this pump from the local Prey Veng market and from Phnom Penh. However, as already pointed out it is a family pump which will have difficulties in coping with a larger user group and also the pump requires someone to look after the pump and arrange that any problem is rectified immediately.

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MEDIUM LIFT PUMPS:

The TARA and The NIRA Pump - Presentor: Bent Kjellerup:

Bent Kjellerup explained how this two types of pumps use a light weight plastic pipe pump rod, where the buoyancy is used to distribute the pumping force between the up stroke and the down stroke.

The NIRA AF 85 recently introduced a deeper setting cylinder with a lift capacity, but performance experiences of this cylinder is not yet available.

The standard design of the **TARA** is such that the rising main also serves as the casing pipe, making repair of the cylinder impossible, but on the other hand this arrangement reduces the drilling and installation cost. Alternatively the pump is also available with separate rising main and casing pipe.

After the presentation the mode of operation for these two pumps were discussed. The chairperson suggested that this point be discussed during the group discussion and the plenary session tomorrow.

The Dempster pump - Presentor: Waldemar Pickardt:

Waldemar Pickardt explained about the back ground for introducing the Dempster and that initially the feed back from the field gave performance indications which were not based on a real life situation. This misleaded the modification and subsequent installation programme. In fact what happened was that only one family was using the pump and kept it safe for checking by UNICEF. When UNICEF went to check the pump it worked perfectly. After 10 months another 500 pumps were made. 250 were installed. After installation a lot of problems were faced. Later the whole piston was changed and produced locally in cast iron something like India Mark II and III. Collected information on its performance indicate acceptable performance, however in the meantime the price has increased to the level of an India Mark II, a pump which the Dempster under no circumstances can compete with.

DEEP LIFT PUMPS:

The UPM PUMP - Presentor: Jeromê Rihouey:

Apart from presenting the pump, some details related to installation in other countries were highlighted. The pump was tested in West Africa. 1600 pumps have been installed there and UNICEF has chosen it for Togo. The pump was tested for 5 years and there was no breakdown. The pump is also installed in Mali and Nigeria. The maintenance is not difficult to learn.

The India Mark II and III - Presentors: Sam Bonal and Waldemar Pickardt:

The reason for the recent shift from the IM II to the IM III was explained as a way of solving the problem with the Mark II that it cannot be repaired by

the community easily. A special maintenance team is required to lift the cylinder. Though a deep lift pump, many India Mark II pumps are installed in Cambodia in suction and medium lift areas because it was the pump available at the time of installation. The majority of these pumps installed in Cambodia are in working order.

India Mark III is the modified version of India Mark II and was developed in order to enable user communities to carry out the repairs themselves. The installation is cumbersome which requires special tools. But the advantage is that when the rising is in place it is not expected to be touched for at least five years. It is expected that the community can take over the maintenance of the India Mark III.

The Afridev Pump - Presentor: Bent Kjellerup:

The Afridev handpump is to be regarded as the state of the art. When developing the pump, major focus was on the use of modern technology like plastic bearings and also of coming up with a design which will make it possible for the community to carry out all maintenance themselves. The fact that the Afridev is the chosen of some many organisations etc. gives an indication of the reliability of this pump.

10. INTRODUCTION TO THE GROUP DISCUSSIONS:

After the demonstration of all the pumps in the three categories Mr Jeremy Ockelford explained about the arrangements being made for the next day's group discussions, distribution of participants into the discussion group etc.

Guidelines for the Discussion Groups and the reporting back to the plenary group, were presented and explained (see annex no. 3)

11. GROUP DISCUSSIONS:

GROUP No. 1:

Chairperson: Jean Francois Vidal, AICF

Minutes and Rapporteur: Dr. Simon Batchelor, COR

The Discussion Group had two main subjects for discussion, a) selection of a handpump for the suction lift and b) discussion of ways to promote the family pump concept.

Public Handpump Selection:

The Group decided to go through task a) by covering each evaluation criteria for all three pumps before moving on to the next. Initially the samples of each of the three pumps were studied in details.

The following is a summary of the outcome of the Group Discussion:

Subject: Ease of Maintenance:

The No. 6, has proved to be a pump users themselves can repair by using a simple tool. When installed on top of a covered hand dug well, maintenance of the pump plinth can create problems.

The Prey Veng, is likewise an easy pump to maintain, but because Mr. Sok (the designer and manufacturer) is available in the area, generally he is called whenever repair is needed. However, evidence from the field indicates that if required user level maintenance is possible. Even self-production of a piston seal and a flap valve is possible.

The Lucky, needs more care and sensitivity in maintenance than the two other pumps. It was mentioned that breakages of flanges etc. due to over-tightening of bolts is often seen.

Subject: Reliability

The group discussed the correlation between user group size and frequency of break down. It was the general opinion that the frequency of break down is related to the number of families drawing water from the pump i.e. the quantity of water pumped. However, a pump used by 2-3 families will be taken relatively much better care of, than a pump serving 10 - 20 families. Figure no. 1 illustrates the relationship between number of

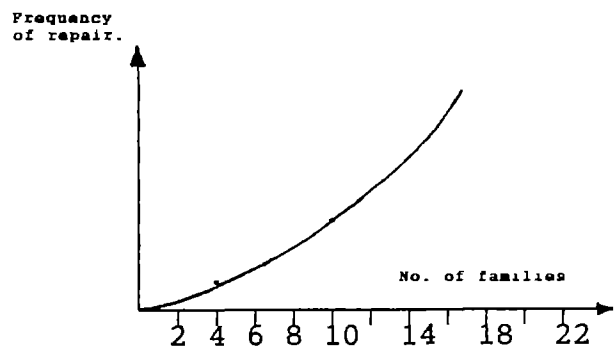

Figure No. 1.

families using the pump and frequency of break down, as a curve rather than the straight line which would be expected.

Availability of spare parts is also an important factor in connection with assessing reliability. Currently spare parts are supplied free of cost for public handpumps.

Priming of suction pumps can not be avoided in practice . This is a significant draw back with the suction pumps, because often a polluted water will be used for priming.

The No. 6 was regarded by the group as easy to maintain, and together with the free supply of spare parts gives the pump a high degree of reliability. Supply of spare parts through the private sector is also a possibility seen more and more often, and should be encourage. The expected number of break downs and the time taken to rectify such problems is within what is acceptable to a normal user community.

The Prey Veng is mainly being repaired by Mr. Sok. Among the user community there is only limit experience of how to repair the pump. This does not mean that they cannot repair the pump, only that currently it is not necessary to do so. Its degree of reliability very much depends on Mr. Sok, although recently the establishment additional repair capacity has been initiated.

If used as a public pump, it is to be expected that the number of break downs will increase to a level where the user community will not regard this pump as a reliable source of safe water. The group therefore decided not to consider this pump as a public handpump.

The Lucky is a pump which is mainly used as a family pump. The experience of frequent breakdowns under such conditions is within the acceptable limited, but if used as a public pump where 10 to 20 families or even more is to be served the number of break downs will rise to a level where users will not consider the pump as an option. The group therefore decided not to consider this pump as a public handpump.

Subject: Running Cost

No. 6 Evidence from the field indicates the piston seal will need replacement app. every 3 month if the cylinder is not lined by a PVC pipe, until the cylinder is worn in. The life of the piston seal should then increase. If a PVC lining is used the life time will increase to app. 9 month from the beginning. It is expected that the lining will have a lifetime of 1 to 2 years. During the discussion it was not possible to draw up a clear picture of the average life time of the cylinder lining. If the running cost of a lined cylinder is compared with that of a pump with a proper polished surface, over a long period the running costs will most probably be equal.

The Prey Veng, when working as a family pump the running cost will probably be similar to the No 6 pump, but if it should function as a public pump

running costs would become unacceptably high.

The Lucky pump, the same comments as for the Prey Veng pump apply.

Subject: Discharge Rate,

In all three cases the discharge rate will be enough to satisfy the community.

Subject: Lift Capacity

All three pumps will be able to lift water from app. seven meters, although there are some evidences that the Lucky can have difficulties in coping with this maximum.

Subject: Manufacturing Needs

The No. 6 and the Lucky The group found cast iron production very much within what should be a possibility in Cambodia, and had no reservation in recommending this material for handpumps. However it was pointed out that cast iron products cannot be are not possible to repaired except by replacement of the parts.

The Prey Veng as a fabricated pump has the advantage that parts can easily be repaired in the village.

Subject: Cost Price

The group found no significant difference in the cost price, but if compared with the number of families the Prey Veng in particular appear to be relative high.

Recommendation:

1. The No. 6 pump be selected as the pump for public water supply in the suction lift.

2. Quality control of supplied pumps and spare parts to be carried out.

The Family Option:

The group briefly summarised the key elements which encourage households to establish their own water supply. They are:

- An entrepreneur who responds to a demand, by providing an affordable product.

- Promotion of the family option as a package where one entrepreneur supplies a complete installation.

- The presence of the entrepreneur within the commune is most probably

important for potential consumers.

If these factors are fulfilled there should be good possibilities for a demand for a family handpump option. It was the opinion of the group that:

- the demand would be high in areas with similar hydrogeological conditions to Prey Veng.

- poor families should have access to some form of credit if they want to establish their own water point.

- NGO's focus currently should be on public water supply points.

- the Prey Veng story should be documented for replication.

A general opinion throughout the discussion of the family option concept was that interferences from outside should be kept at a minimum.

Recommendations:

3. Possible replication of the Prey Veng concept on the future, but

4. Government and NGOs to focus on public water supply.

Ground Water:

As abstraction of groundwater increases, particularly for irrigation, there is a danger that water levels will be lowered out of the range of suction pumps. It was recommended that groundwater levels should be monitored.

Rapid draw down of low yielding aquifers is also a problem. Increasing the diameter of tube wells with separate riser pipe and casing to increase the storage capacity, should be discussed at a future workshop.

Recommendations:

5. Measure water supply now and monitor (Database)

6. Next workshop should look at well design and also at progress in development of a fabricated steel suction pump.

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GROUP No. 2.

Chairman: Bhai Raja Sakya, UNICEF

Minutes: Foort Bustraan, OXFAM

Rapporteur: Leo Goulet, UNDP/OPS

All participants in the group introduced themselves and the guidelines for the group discussion was translated into khmer and discussed. Thereafter followed a general study, exchange of experiences and discussion of each of the pumps.

DEMPSTER:

Experiences in Kompong Chhnang: People were quite unhappy using this pump. Most complains were related to malfunctioning of components such as: Foot valves cannot hold water, extra pumping is necessary to refill the rising pipe whenever the pump had been idle for some time. Furthermore, can become a problem beyond repair in these cases where the Dempster is installed with a combined rising main and casing. Handles break quite frequently.

It was a general observation from the field that this pump would require significant modifications before it would be able to provide the service that is to be expected from a public handpump. All such modifications would require careful monitoring. Many of the parts have been produced nationally, and the pump is known by mechanics and installation teams.

Most of the pumps in Kompong Chhnang have been installed where the static water table is app. 4 to 5 meters. In Battambang and Banteay Meanchey they have been installed for medium lift duties. A lot of maintenance is needed when used in the 10-12 metre range.

If there is a demand for the Dempster pump Ministry of Industry could in a near future be able to supply the cast iron parts.

NIRA AF 85.

In a Cambodia context experience of the performance of the NIRA AF 85 comes from some pumps installed in the border camps, some in Pursat and Siem Reap provinces, and Mongkol Borei district. In the camps the NIRA pump were supplying water to groups of 100 to 200 families.

The pump is easy to install, only few tools are required.

When the water table is at the deeper end of the medium lift range pumping by young children may become difficult. The discharge rate is good.

Maintenance is not a problem, as long as spare parts is available.

Pumping of fine sand can be a problem, the well in which the pump is installed needs good screening.

The group also learned that in the foreseeable future it may be possible to buy NIRA AF 85 pumps from India. This should reduce the price significantly, but when this will happen and how much the price will go down is not known.

A deep setting NIRA direct action pump with a lift capacity down to 20 to 22 meters is also available. Currently not much of this modified pump's performance is known. The manufacturer was not able to supply performance data.

TARA.

Developed in Bangladesh as part of a concept which goes together with a cheap drilling method. Therefore the combined rising main and casing pipe is a part of the standard design.

The pump is designed to supply a user group of 150 - 200 people. Current coverage target in Bangladesh is 167 persons per installation. Its maximum lift capacity is 15 meters.

The community can do all the maintenance themselves.

The TARA is a very well tested handpump. In a semi-real life situation 150 pumps have been under close monitoring for more than 4 years. 2000 real life installations have been monitored for more than 2 years.

The group discussed at length what would be the reaction of new users to the direct action mode of operation, and it expressed concern about this way of operation. Experience from Bangladesh has shown that initial resistance reduces when people see the benefit of easy maintenance and good discharge rates.

The group discussed adoption of a pragmatic approach to the definition of lifting range, especially when operating in the upper end of the medium lift range installation of deep well pumps should be a possibility and is a matter of engineering and social judgement.

The following table no 3 lists the advantages and the disadvantages of the three pumps considered.

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Name of pumps	Advantages	Disadvantages
Dempster	1. Good lever action 2. Local manufacture 3. Low freight cost	1. Not for heavy use 2. Not for low water levels 3. Frequent part replacement 4. Headwork easily broken 5. Rising main is 15m of glued PVC 6. Piston buckets easily broken out 7. Piston buckets imported from India 8. Iron parts corrode easily and difficult to repair 9. Foot valve leakage happens frequently.
NIRA	1. 50.1mm cylinder very reliable 2. Easy installation, few tools 3. Piston rings easily replaced 4. Foot valve screws on riser main 5. 15,000 installed world-wide	1. Expensive ($610 with casing) 2. Replication not possible because of patent rights 3. Need large casing to reach foot valve 4. Life span 6-8 years 5. Possible user dislike because direction action pump
TARA	1. Very reliable 2. Low cost ($200 with casing) 3. Local maintenance possible 4. Local manufacture 5. Life span 12 years 6. 30,000-35,000 already installed in Bangladesh and working satisfactorily	1. Possible user resistance because of direction action pump

Table no. 3

The comparison was done as follows table no. 4:

Comparison	Dempster	NIRA	TARA
Reliability	Poor	Good	Good
Maintainability	Fair	Good	Good
Local manufacture	Good	Poor	Good
Cost installation/ running cost	Poor	Poor	Good
User acceptability	Poor	Fair	Fair

Table no. 4

based on the above the group concluded:

TARA, Best option, max. lift 15 meters.

NIRA, rejected due to high cost; no local manufacture

Dempster, Rejected due to unreliable, frequent break down, no good as a public pump.

and recommended:

- TARA is the most suitable.
- Other pumps should be studied as medium lift. Though India Mark III is a deep lift, it could be tried as medium lift.

Workshop Report:

GROUP No. 3:

Chairperson: Pierre Thevenot, GRET

Rapporteur: Heng Siv, Dept. of Hydrology, Banteay Meanchey.

Minutes: P. Prabhakaran, UNICEF

The group decided that the following criteria should be taken into consideration for discussion.

- maintenance
- reliability
- running cost
- lift capacity
- manufacturing needs
- cost price
- acceptance by community

There was a suggestion to include taste as a criteria because some pumps react with water. Many factors influence this problem such as the material, length and surface area of the rising main. However it was decided not to include this as a criteria. It was also agreed that the quantity of pumps already installed should not be a criteria.

All the four pumps are used by UN organisations. While discussing the economic viability of importing pumps a question was raised whether NGOs could import pumps through UN. Mr Pickardt explained that it will be a cumbersome process. NGOs would be required to deposit the money to UN first and then only the mechanism will start functioning.

Mr Waldemar Pickardt pointed out there are 4 pumps under discussion but he felt that India Mark II could be eliminated from the discussion. The India Mark III is the modified version of India Mark II, so discussion about an older version of the pump is not necessary. There are some practical difficulties with the Mark II: maintenance is difficult and it can be done by only trained technicians and special tools are required for repair. Aspects, like the time of a mobile team, fuel cost, labour cost and special tools have to be borne in mind. Running costs of Mark II and Mark III are almost the same. It was felt that community maintenance system is better than maintenance done by a central team. After some discussion it was agreed that India Mark II could be taken off the list and discussion would concentrate on the other three pumps.

Following is the discussion and the matrix (table no. 5) made by the working group to compare the three pumps.

Ease of maintenance: Afridev and India Mark III work on the same principle. The Afridev has a small advantage because of its PVC rising main; the piston seals can easily be replaced, and although its piston cannot be repaired, it

is cheap plastic and can easily be replaced. Maintenance of the India Mark III can be done by the community, including replacement of the piston seal. The UPM is more complicated.

Reliability: Is good for all the 3 pumps.

Running cost: More or less the same with a slight advantage to Afridev. UPM has many small parts and many pistons and the footvalve is difficult to fabricate.

Discharge rate: Acceptable for all 3.

Lifting capacity and installation depth: At setting depths of about 40m, the India Mark III has a disadvantage because the weight of the steel rising main. In areas like Kompong Cham where the water level is very deep the UPM is more suitable.

Manufacturing needs: All need high technology and will be difficult to manufacture in Cambodia in the near future. Local production of spare parts also difficult at present.

Cost price: Afridev and India Mark III are almost the same, but the UPM is much more expensive.

Community acceptance: All three are same, with a small advantage for the Afridev and UPM with their PVC rising mains which are easy to install and do not corrode like the galvanized steel mains of the India Mark III. However, storage and transport of PVC needs care.

Recommendations:

Afridev is selected as the best choice for Cambodia taking into consideration the plus points compared to the other two pumps as shown in the matrix. However, this is on condition that spare parts are available locally or are manufactured in Cambodia.

Until this condition is fulfilled, the use India Mark III is acceptable, as spare parts are available locally.

The third recommendation was to use UPM pump for special areas where the lifting capacity needed is up to 100m (Kompong Cham for example).

Workshop Report:

	AFRIDEV			India Mark III			UPM		
	Remarks	Rating		Remarks	Rating		Remarks	Rating	
Easy Maintenance		+	G		o	F		o	F
Reliability		o	G		o	G		o	G
Running cost			G			F			F / G
Discharge rate	1m3/h (at 20-30m lift)	o	G	0.7m3/h.	o	G	1.2M3/ h	o	G
Lifting capacity	40 (45)		F	18-40		G	15-100m		G
Manufacturing needs	Stainless steel, plastic bearing	o	F	Stainless steel bearing	o	F	High Tech PVC Industry	-	P
Cost Price	US$ 350.-	+	G	US$ 390.-	o	G	US$ 700.-	-	P
Community acceptance	PVC riser	+	G	GI riser	-	F	PVC riser	+	G

+ = better o = average - = worse
G = good F = fair P = Poor

Table No. 5

12. PLENARY SESSION:

Chairperson: Jeremy Ockelford, OXFAM

Suction Pumps and Family Pumps

Discussion:

The No.6 pump was designed for a user group size of 150-200 people.

Alternative sources and the cost of the No.6 pump are Vietnam (US$30), Nepal (US$48, Sep. 1992), and Bangladesh. The pump has also been made in Cambodia in the past, and the Ministry of Industry is setting up Factory No.8 to start production again.

Independent quality control of production of the No.6, requested by the buyers of pumps, is done by Crown Agents (of the British Government) in Nepal and Bangladesh. In Vietnam, UNICEF carries out inspection. The quality of raw materials is important. Previous production in Cambodia suffered from poor quality pig iron and coke. In Nepal pig iron is sourced from Germany. In Bangladesh, UNICEF supplies good quality pig iron for production and as payment for pumps, so that the manufacturer has extra material for pumps which it sells commercially.

The UN should be added to the recommendation for NGOs and Government to concentrate on public water supplies at present.

Recommendations:

The Plenary Group made the following recommendation regarding the pump for standardization:

1.1. **The No. 6 pump should be the pump for public water supply in the suction lift range.**

with the following supplementary recommendations:

1.2. Possible replication of the Prey Veng concept in future, but Government, UN-organisations and NGO's to focus on public water supply at present.

1.3. A future workshop should look at well design for storage capacity.

1.4. A future workshop should look at progress in development of a fabricated steel suction pump.

and with the following general recommendations:

1.5. Independent quality control of production of pumps and spare parts must be carried out.

1.6. Ground water levels should be measured at time of installation and monitored thereafter.

Medium Lift Pumps:

Discussion:

From several quarters concern was raised about how user communities would react to the way of operating the direct action handpump.

Discussion in the group, reported to the plenary session, was that the Khmer participants were unhappy about the pumps which are new to Cambodia, because of lack of knowledge and experience. As a result it was proposed that when introducing new technology like the direct action pump it is essential to do this within a detailed and thorough programme which will ensure that the user community, village maintainers and installation teams knows and are prepared for the new technology, and knows how to handle it. Monitoring and evaluation of the introduction process is essential. This is to provide feed back from the field and give managers the information based on which programmes can be modified if needed.

The debate resulted in indications from UNICEF and other parties that TARAs should be introduced as a pilot phase of say 100 to 300 pumps. Monitoring of user reactions should provide the basis for a final decision regarding whether direct action pumps are acceptable to a khmer community.

Deep lift pumps such as the India Mark III can be adopted for medium lift and could be compared with other pumps in the range, including capital and running costs. Which pump to use at the borderline between ranges is a matter of engineering judgement.

Recommendations:

The Plenary Group made the following recommendation regarding the pump for standardization:

2.1. **The TARA pump should be the pump for public water supply in the medium lift range.**

with the following supplementary recommendation:

2.2. Other pumps such as the India Mark III, could be studied as a medium-lift pump.

and with the following as a general recommendation:

2.3. When introducing new pumps, a detailed and thorough introduction programme should be implemented. At the same time detailed monitoring of the performance of the new pump should be initiated. Coordination is essential.

Workshop Report:

Deep Lift Pumps:

Discussion:

Following the presentation from the Deep Lift Group, it was proposed and accepted that the recommendation made for the medium lift pumps, about the introduction of pumps new to Cambodia, should also apply.

Concern was expressed about the flexibility and elasticity of PVC rising mains when used at depths up to 40m. It appears that from experience elsewhere this has not been a problem, as long as good quality thick walled pipe is used.

The number of pumps affected by Recommendation 3 below will be about 100.

Recommendations:

The Plenary Group made the following recommendations on the pumps for standardisation:

3.1. **The Afridev pump should be the pump for public water supply in the deep lift range, with the condition that spare parts are available locally or are produced in Cambodia.**

3.2. **For specific areas such as Kompong Cham where the depth to water is more than 40m, the UPM should be used.**

with the following supplementary recommendation:

3.3. Until the condition in Recommendation 1 is met, the India Mark III is considered as suitable and should be used.

3.4. When introducing new pumps, a detailed and thorough introduction programme should be implemented. At the same time detailed monitoring of the performance of the new pump should be initiated. Coordination is essential.

Criteria for calling for a revision of standards:

The following criteria were proposed and accepted as conditions for calling for a revision of standards by a similar workshop in the future:

- Major innovation or changes in handpump designs;
- Failure of standard pumps to perform as expected;
- Non-availability of standard pumps or spare parts;
- Major price fluctuations;
- Changes in local manufacturing capability

One or more of these conditions have to be met for a new workshop to be called to reconsider the standards.

It was proposed and accepted that the Water and Sanitation Sectoral Working Group meeting could be the appropriate forum to call for such a workshop.

13. CLOSING SESSION:

Mr Som Lim Pich, Vice Minister of Agriculture, was invited to close the workshop.

In his speech the Vice-Minister thanked all the agency representatives for their presence and their efforts in the last two days to reach at a consensus. He felt that the effort was worth it as we could reach our goal of selecting the most appropriate pumps for Cambodia. He said that the Ministry of Industry participated in making these recommendations and reminded the participants that it is us who decide what type of pump we need for Cambodia. The manufacturers should produce the pumps according to our requirements. He also hoped that soon private companies and other foreign organizations will invest in importing or making spare parts locally. He assured all possible support from his ministry. He also added that the Ministry of Agriculture and the Department of Hydrology will always welcome any discussion relating to the water and sanitation sector in the future. The Minister thanked all the participants again for making the workshop a success, and he gave special thanks to the interpreters. He wished everyone good luck in their effort to make Cambodia self-sufficient in the field of water and sanitation.

HANDPUMP STANDARDIZATION WORKSHOP

FEBRUARY 17'th AND 18'th, 1993

WORKSHOP DISCUSSION PAPER

Venue: Department of Hydrology.
The Water Managemnent Office
Teuk Thla

UNICEF Handpump Selection Project OXFAM

HANDPUMP STANDARDIZATION WORKSHOP

WORKSHOP SCHEDULE AND AGENDA:

First Day: 17'th February, 1993

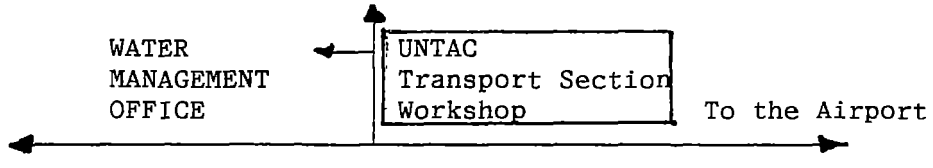
8.00 - 9.00	Registration and Welcome Address.
9.00 - 9.30	Objectives of the Workshop.
9.30 - 9.40	Tea Break.
9.40 - 11.00	Existing Situation and Future Working Environment for Handpumps.
11.00 - 11.50	Tea Break.
11.00 - 12.00	Introduction to Handpump Presentation and Handpump Presentation.
12.00 - 14.00	Lunch Break.
14.00 - 16.30	Handpump Presentation (cont.) incl. tea break.
16.30 - 17.00	Introduction to Group Discussion.

Second day: 18'th February, 1993

8.00 - 12.00	Group Discussion.
12.00 - 14.00	Lunch Break.
14.00 - 17.00	Plenary Discussion, inclusive tea break, Recommendations.
17.00 - 17.30	Closing Session.

The Workshop will take place at the Hydrology Department, Thau Thla. (see sketch)

During the Workshop tea, coffee, soft drinks and snacks will be served.



INTRODUCTION:

This document has been prepared as a support to the discussion which will take place at the Handpump Standardization Workshop; it is expected that it will give all participants a more equal starting point. It was prepared based on information collected during the two months when the Handpump Selection Project (HSP) was active. On some subjects HSP would have been appreciated if more information had been available. Especially on subjects as performance data, as well as the dynamic water level situation a better decision platform would have been appreciated.

The Workshop will give a brief presentation of the situation here in Cambodia, followed by an assumption of what a future working environment for handpumps could look like. Thereafter the handpumps considered for standardisation will be presented and finally the discussion of these handpumps and agreement on recommendation will take place.

It is essential for the discussion that participants with hands on experiences from any of the included pumps, be prepared to share their experiences with the Workshop, especially if experiences could be supported by statistical performance information or something similar.

HISTORY:

GRET, as an organisation working with appropriate technology, took in early 1992 the initiative to call for a workshop with the objective of discussing handpump technology and aiming at selecting a set of handpumps suitable for rural Cambodia. At the same time it was decided to launch a joint evaluation of the water supply and sanitation activities of OXFAM and UNICEF. To avoid any overlap of these two activities it was decided to postpone the suggested workshop.
The joint evaluation mission in its report recommends that action be taken for the establishment of a set of standard specifications for handpumps.
At the time of initiating this action GRET was in a position where it did not have sufficient resources to coordinate the process which should lead towards the establishment of standardisation.
Therefore Danish Cambodia Consortium, DCC, a consortium involved in water supply activities and with the necessary resources and expertise available, was requested by the authorities responsible for rural water supply to take the responsibility for coordination of the above mentioned process. Through one of the partners in DCC - Danish Church Aid - it was arranged to sponsor Bent Kjellerup as coordinator for this process. He is assigned to work through LWS.

At a Sectoral Group meeting this arrangement was confirmed. This process has now reached the stage where it is ready to conduct the above mentioned Workshop.

REASON FOR STANDARDIZATION:

There are many reason for adopting standard handpumps, the following are some of them:

- **Maintenance and management of maintenance becomes easier.**

  By having fewer types of pumps to maintain the number of type of spare parts to stock is also reduced. The same will apply to the number of training curriculums and standard maintenance procedures. Subsequently management requirements will also reduce. The fact that standard pumps are identical, irrespective of manufacture, will make it possible to interchange parts from different manufacturers.

- **Reliability will be ensured.**

  It is a condition that any pump considered for standardization will have a history, which should prove its reliability. Future pump production/procurement according to the same standards and quality will ensure the proven and expected reliability will be met.

  Reliability or availability can be defined as:

  > **reliability is the probability that the pump is in operation condition on any one day, calculated as the sum of the operating time before failure divided by the total time.**

  With this definition it is clear that a pump which breaks down on average after 18 months of operation, but then stands idle for two months each time, waiting for maintenance to arrive, is less reliable than one which breaks down after 2 months of operation, but can be repaired by the villagers themselves within few hours or if spare part purchase is necessary within a few days.

- **Local production will be encouraged.**

  With the availability of a set of standards, potential handpump manufacturers will feel encouraged to start up production. They will be assured that in the foreseeable future the issued standards will - at a maximum - undergo minor changes. Furthermore potential manufacturers can concentrate on setting up production lines. They do not need to spend time on handpump development. Finally with fewer types of pumps to install, the demand for the individual handpump type will increase, all factors which will enhance the motivation for commencing handpump production, or at least production of essential spare parts, or at least production of essential spare parts.

- **Third party quality assurance becomes a possibility.**

  Third party quality assurance is a quality check of a batch of handpumps carried out at the request of the purchaser and executed by an independent inspection agency.

  It will ensure the purchaser, that the product is able to meet standard specification requirements. Implementing third party quality assurance is only possible, if the product in question has been produced according to a detailed set of standard specifications against which its quality can be measured.

- **Cost effectiveness ensured.**

  It is essential that the standard specifications do not refer to a product "owned" by a single manufacture. Selection of a design which is in the public domain will make it possible for a number of manufacturers to establish identical production, whereby monopoly will be avoided.

DEFINITION OF STANDARDIZATION OF HANDPUMPS:

The Handpump Selection Project is building its work on the following definition of what it understood by issuing standards for handpumps:

- For each pump a set of standard specifications will be prepared. These specifications will give all technical details of the pump such as; quality of material to be used, dimensions including tolerances, reference to other standards, corrosion protection, etc.

- The national authorities for rural water supply - the Ministry of Health through CNHÊ and the Ministry of Agriculture through the Department Hydrology - should issue bylaws saying that in future all public handpumps should be able to meet the above mentioned standard specification.

- The above mentioned authorities, will issue these bylaws based on recommendations prepared by a special arranged workshop. In future a similar procedure should be followed when amendments of standards are found feasible.

WORKSHOP OBJECTIVE.:

The objective of this workshop is; For the participants of the Workshop to agree on a set of handpumps which will be able to meet the requirements of public water supply in rural Cambodia, and to recommend to the responsible authorities - that the instruction is issued that in future all handpumps installed as public handpumps will have to conform with the above selected set of handpumps and that similar workshops should be arranged whenever amendments of the standards is found necessary.

Introduction: Annex No. 1

Through discussion it is the aim that the Workshop will reach agreement on the mentioned set of handpumps, which in practical terms means that one type of handpump will be selected for each of the lift categories.

This discussion will be based on the knowledge that each participant will bring to the Workshop, together with presentations of the current rural water supply situation with regard to handpumps, as well as future conditions under which handpumps will have to work. All handpumps included in the shortlist will be presented together with information regarding their past performance. These handpumps will also be on display at the Workshop.

Existing Situation. Annex No. 1

COVERAGE:

Rural water supply is the responsibility of The Ministry of Health and the Ministry of Agriculture. Through their respective departments - the CNHÊ and the Department of Hydrology - implementation of new public water supply points are carried out; at the same time NGOs are likewise implementing water supply points in close collaboration with the two mentioned departments.

For both departments the focus is on handpumped water.

The approximately number of handpump installations implemented so far are 6500, a break down by type of handpumps will look like the following:

No. 6 (suction lift)	:	1,900
IM II (deep lift):		4,000
IM III (deep lift):		210
Dempster (Medium lift):		300
NIRA AF 85 (Medium lift):		10
Other pumps		80
Total		6,500

MAINTENANCE:

Maintenance of installed pumps appear to happen - in both a formal and an informal way, with an impact which is difficult to assess. The percentage of pumps out of order on any one day is difficult to establish. Depending on the source of information this percentage vary from 10% to 40%. Although with much uncertainty regarding how maintenance is organised and also its impact, one thing is clear: until now only very limited involvement of user communities has taken place. Especially in the case of the IM II pump - a pump which is nearly impossible for the user communities to maintain themselves, even if they are equipped with the right set of tools and have been trained - the user community is excluded from doing practical maintenance.

INSTALLED HANDPUMPS:

The majority of installed handpumps are of the type No 6 and IM II, in some case both pumps have been installed in the same area. Recently CNHÊ/UNICEF shifted from installing the IM II to the IM III, this shift was done to make maintenance easier (see presentation of these two pumps).
On an experimental basis UNICEF and OXFAM jointly installed some 300 Dempster pump heads combined with local modified below ground components. Monitoring results of its performance very clearly indicated that the Dempster in this modification would not be able to meet performance expectations; therefore further experimentation ceased.

WATER LIFT REQUIREMENT:

The general knowledge of the static water level in Cambodia is quite good. However an important factor which has been addressed only in some areas is the dynamic water level. Experiences in many provinces indicates that draw down is a factor which needs to be taken into consideration when planning a water supply point. In Battambang a very simple pump test involving 10 randomly selected pumps was carried out. The test showed a minimum draw down of 0.15 meters and a maximum of nearly 5.0 meters, with an average of 3.0 meters.

LOCAL PRODUCTION:

Currently local production of handpumps is limited to examples like the Prey Veng case (see below), and some experimental activities. Until recently production of the No. 6 pump and the cast iron parts of the Dempster pump took place at Factory No. 7 here in Phnom Penh, but at the moment casting is not taking place at this factory.

INVOLVEMENT OF NGOs:

The Handpump Selection Project has requested members of the Water and Sanitation Sectoral Group to provide some basic information regarding their involvement in water supply activities. 36 information forms were circulated and 16 have been return.

From the provided information it can be seen that out of 6500 installed handpumps 5850 were installed by CNHE/UNICEF, the remaining 650 pumps were installed mainly by DoH/OXFAM. It should be underscored that these figures do include open wells.
Currently only six NGO's have installed handpumps.

Annex I shows in which provinces water activities are under planning or in progress by organisation.

A LOW COST WATER SUPPLY SOLUTION:

It is a rather common experience among handpump water supply projects that as a spin off of the introduction of public handpump supply points, simultaneously it has been seen that small scale entrepreneurs initiate supply of the same service but for individual households or groups of the same. The set up can vary - in some cases purchasing a complete system is possible; in others the consumer will have to buy the facility as parts, like pump from the hardware store, well from a driller and finally installation from the local plumber.

In Prey Veng the project came across such an initiative.

Prey Veng Province is situated on the east bank of the Mekong River. It is a delta area with a water table which never goes beyond the suction level. Furthermore it is an area where most of the year water is plentiful from ponds and similar sources. In spite of these favourable conditions for easy access to water - not always safe water - individual households have in plenties invested in their own handpump water supplies.

A local self established blacksmith - Mr. Sok - has some years ago established production of a very simple handpump. The design is based on using easily available material - if not available in Prey Veng then at least in Phnom Penh. The pump follows the cross head concept equal to the Dragon or Lucky pump. It is a suction pump using an ordinary PVC pipe as the cylinder and iron rods as a cross head mechanism and metal sheet as flanges. The handle is a wooden stick. The piston seal is cut out of a car tyre and the weighted flap valve is cut out of inner tube. The production of the pump requires only very basic tools.

The pump can be characterized as a very simple pump, most probably it will have a relatively high breakdown frequency. On the other hand it can be repaired very easily, because the manufacturer himself lives within a relatively short distance from any user and will be able to attend repair with short notice. This will under all circumstance give the pump high reliability.

Mr. Sok has established not only facilities for production of handpumps, he has taken his concept one step further and is also providing the drilling operation. In other words from his workshop a complete water supply concept can be procured. The drilling method is very simple and is carried out by using the water jet method. Drilling rods are ordinary 1/2 inch GI pipes, the handpump to be installed is used as a circulation pump, and drilling is done as manual drilling. Casing is a 50 mm PVC pipe. It should be noted that the utilized aquifers are yielding so much water that it has not been necessary to use any screen. Water simply enters at the open bottom end of the casing pipe.

One main concern is related to the concept that without construction of a platform and attached drain, sanitary sealing of the well is not established. A very obvious risk exist that waste water will have an "easy" passage down

the well, and subsequently contamination of the aquifer will happen - a not very appreciated recycling system has been established. The lack of a platform will also make the surrounding unhygienic and less attractive.

The current price of the pump is what is equal to US$ 25.-, for the pump itself and US$ 45.- if the tubewell is included. The number of installed pumps is approximately 1500.

The conclusions of the Prey Veng visit are.

- that a concept has been established, the number of installed pump - 1500 - in itself speaks for the concept's appreciation among the community,

- that the pump is of a design which is appropriate and simple to produce and maintain, and as a family handpump it will provide a good service,

- that the price of US$ 25.- for the pump is relatively high, when material used and anticipated labour time is estimated. If the price is compared with a No.6 pump likewise the price is found high,

- that the sustainability of the system is relying on one person, - Mr. Sok - if he decide to leave Prey Veng or give up handpump business it will take some time before a new entrepreneur will get established, and

- that the lack of a platform and proper sanitary sealing could counteract the expected health impact.

Because this concept is responding to a demand and because it will have impact on the water supply situation in Cambodia, it should be documented and promoted as an income generation activities.

INTRODUCTION:

This chapter will describe how the future working environment in which handpumps will have to work could look like. These projection of the future is based on what has been seen in Cambodia together with what is common trend within the rural water sector globally,

THE COMMUNITY AND THEIR HANDPUMP:

One of the most important factors which will have influence on the performance of a handpump is linked to the attitude of the community towards it. A factor which is important already now a day, and which will become even more important in future.

A handpump installation which the community feels is providing a good service to them will always be appreciated, and with the right training, spares and tools available, an good chance exists that the pump will be available for the community for a long period. This means that not only the technology will have influence on the operation of the pump, but factors like: communities' ability and willingness to take care of the pump, functioning of the maintenance and support back up system and many other factors are also important.

One aspect which shouldn't be neglected is the commonly expressed high sensitivity towards the taste of drinking water among most communities in Cambodia. An often heard comment for not using handpump water is that the taste is not appreciated. When a type of handpump is selected it is essential to consider the way the pump itself could add to the concentration of iron in the water it will supply. In other words when below ground level components are affected by corrosion, the rust particles will become absorbed by the water media and in this way will increase the iron concentration.

OPERATION AND MAINTENANCE:

World wide it has been recognized that a Government managed centralized maintenance system for handpumps will not be able to provide the expected service. Alternatively the focus is now on the user community as the responsible body. This is also called Village Level Operation and Maintenance (VLOM), an acronym which stands for quite an open concept.

It is assumed that in future pumps will have to function in an environmental where ownership of the pump is with the community, as well as the responsibility for keeping the installed facilities in running condition. Introduction of such a concept will require that spare parts will be for sale at private shops and any repair activity which the community cannot perform themselves will have to be purchased - preferably - from a local selfemployed mechanic, or from a governmental set up like the provincial and district offices of Department of Hydrology. This means that the community will have to organise themselves and collect money for the up keep of their pump. All the pumps considered have been rated against their degree of VLOM, assuming that eventually they will work under condition as describe above. (easy

maintenance, reliability, running cost etc.).

WATER QUALITY:

Discussions with many quarters involved in water supply has left the impression that generally water is not abnormally corrosive, apart from Siem Reap Provence. UNICEF is expecting a life time of a galvanized steel rising main to be in the range of five to six years which seems to be acceptable. However, corrosion can affect the taste of water, also - in some cases - to a degree where the water is rejected for drinking and cooking purpose.

Water with high sand concentration is often found. Sandy water is liked to certain factors like: fine sandy aquifers, together with provision of a well screen not suitable for the aquifer, furthermore sufficient development of the well is often neglected. Sandy water will have influence on the lift time of piston seals, valves and other below ground components.

WATER LIFT REQUIREMENT:

The lack of information of the level from where installed handpumps actually are drawing water makes it difficult to say anything precise about lift requirements. Anyhow, if the three mentioned lift categories are applied to Cambodia, it looks like suction and medium lift pumps will be able to cover most populated areas of Cambodia.

Whereas information on a static level is sufficient to draw up a general country wide picture, when the question comes to the dynamic water level - the draw down when the pump is been operated - information is rather limited. What is known only for some areas is the capacity of implemented wells and the subsequent draw down. A significant draw down has been measured in parts of the country, but whether this is a result of well design and poor well development or whether it is because of the utilized aquifer simply has a limited capacity is to a certain extent unknown.

Local Production:

It is expected that in a near future production of cast iron pumps here in Cambodia is a possibility. At Factory No. 8 production facilities is under implementation, and they should be ready within two to three months. If there is a demand it is anticipated that production of No. 6 and the Dempster pump will commence.

INTRODUCTION:

To structure the coming handpump discussion and to make it possible to prepare the included documentation in advance the Handpump Selection Project found it necessary to make a shortlist of pumps to be considered for standardization. Based on outside and Project suggestions the following list emerged:

Suction:	No. 6
	Lucky
	Prey Veng Pump
Medium:	NIRA AF 85
	TARA
	Dempster
Deep:	UPM
	India Mark II
	India Mark III
	Afridev

To ensure that all workshop participants will have some basic information about the pumps to be discussed during the workshop, this chapter includes a technical description and performance discussion of each individual pump is included.

This pump presentation should be read in conjunction with the following remarks:

-General Description:

This point will include a technical description of the pump and should be self-explanatory.

-Manufacture: Will assess the minimum requirements (skills, machinery, tools, etc.) for setting up a production line. Generally the following categories are used:
-Low industrial base,
-Medium-level industry,
-Advanced industry,
This point will also mention whether the design is in public domain or not. If the latter is the case it means the manufacturer is the owner of the design and most probably the pump can only be purchased from this manufacturer.

-Suppliers: Describes the supply network if such exists.

-Facts about the pump:

Gives certain specific data. The cost price mentioned is delivered in Cambodia.

-Evaluation: Under this heading the performance of the pump is discussed. The main source of information for this discussion is the UNDP/World Bank "Community Water Supply - The Handpump Option," report, which was published in 1987. This report - substantially quoted in the presentation - presents a thorough examination of more than 42 handpumps, based on both laboratory and field performance information. The laboratory test was carried out at Consumers Association in the UK, where a 4000-hour endurance test gave the major indication of the performance of the pump; however, it should be stressed that a laboratory test is very helpful during design development, but should not be regarded as identical to working under real life conditions. The field test is based on close studies of involved pumps over a two-year period.

All the above listed pumps, except the Prey Veng and the UPM pump are mentioned in this report, although not all of them passed both the lab. test and the field monitoring phase.

The fact that the "Handpump Option Report" recommended implementation of some modifications of tested pumps prompted many manufacturers and designers to modify their pumps. Performance improvements are to be expected as a result of these modifications. In other words the performance result mentioned in the "Handpump Option Report" has had to be supplemented by up dated performance data collected from relevant sources. Other sources of information are: The Joint UNICEF/OXFAM evaluation Report, Report on Field Testing of India Mark II and India Mark III, and the TARA handpump Report.

The individual pump maintenance requirement is measured against a situation where maximum responsibility for the up keep of the pump is with the community.

-Running cost: The running cost for a handpump will vary from pump to pump. Factors like, water quality, lift requirement, quantity of water pumped, the user groups way of operating the pump are all factors which will ave influence on the tear and wear of the pump and therefore also on the running cost.

Exact running cost is difficult to obtain, it has not been possible to establish a uniformed information level regarding running costs. Figures mentioned is only covering spare part costs, no labour cost or running cost of a central maintenance organisation is not included.

-Over all Conclusion:

This is a summary of the above.

EVALUATION GUIDELINES:

-The Rating Box: For the purpose of establishing an overview and for easy comparison of the individual pumps a rating box has been included. This rating box could also be used by workshop participants for the own rating during the presentation.

Ratings have been given as Good (G), Fair (F), or Poor (P).

Each pump has been rated against the following points:

Easy Maintenance: Highest score will be given to a pump which can be maintained by the community itself with only limited assistance from outside the village level. Lowest score is given if major and frequent input is required from sources outside the village.

Reliability: A pump which has a high frequency of reliability/availability will be given the highest score. Reliability or availability is to be understood as the time the pump is working in proportion to total time. (The subject reliability was discussed in details in the Introduction Meeting - Briefing Note)

Running cost: Running cost will be measured against the service level the pump provides. e.g. the running cost of a deep well pump is expected to be higher than the running cost of a suction pump.

Discharge rate: The discharge rate has been compared with what is normal for the actual pump's lift category.

Lift Capacity: Rating is based on whether the pump cover its lifting range totally or only partly; e.g. a pump with a lift capacity of 10 meters will be regarded as a medium lift pump, however it will only cover the medium range partly (from 7 to 10 meters) therefore it will be given a rating (F).

Manufacture Needs: The more advanced the requirements the lower rating.

Cost Price: Rating is based on comparing the cost price with what is average for a pump in its lift category.

HANDPUMP TYPES:

The presentation refers to three categories of lift capacities which are:

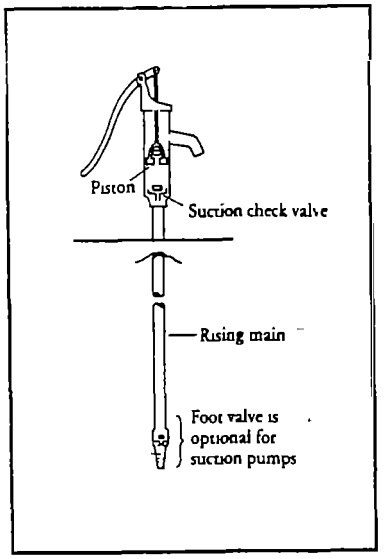
Suction Lift	0 - 7	meters
Medium Lift	7 - 15	meters
Deep Lift	15 - 45	meters

The above lift indication refers to the range where the lifting capacity will be optimally utilized. In general all pumps will be able to work from the shallow water table to their maximum capacity.

Following is a description of the main features of the three mentioned pump ranges mentioned.

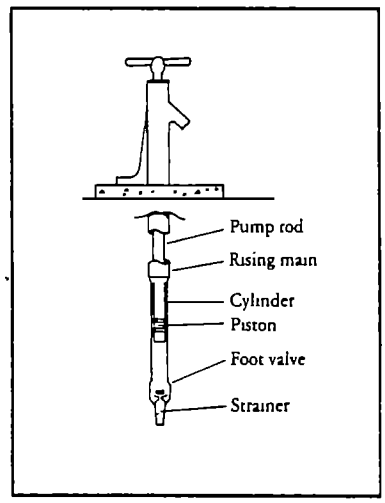
SUCTION LIFT:

The suction pump - a handle operated pump - has a limited lift capacity of 7 meters maximum. All the moving parts of suction pumps are located above ground level; only the suction pipe extends down the well. In rare cases the necessary footvalve is installed at the bottom of the suction pipe. A significant draw back of this pump is that if the footvalve is not 100% tight, it will be necessary to prime the pump now and then. Because contaminated water will most probably be used for priming, it becomes a built-in health hazard. As is characteristic for many suction pumps, they have a high frequency of breakdown, but on the other hand they can also be repaired by the villagers themselves in no time. Therefore the reliability will usually be good. Suction pumps is having certain well capacity requirement. Because there is no reservoir built-in be between the aquifer and the pump, instant replenishment of water is a requirement.



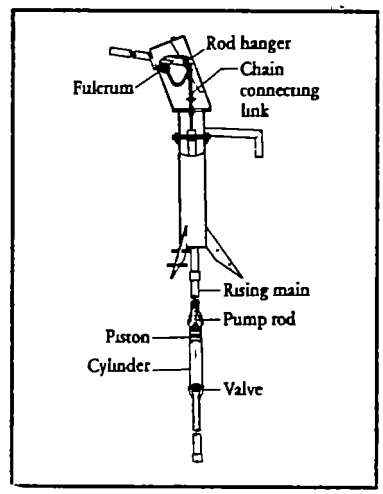
MEDIUM LIFT:

Medium lift is generally the range from 7 to 15 meters. This lift range has been introduced together with the direct action handpump. It differ from suction and deep lift pumps by having no lever action handle. The water column is lifted directly, with the help of a submerged plunger and cylinder installation. It has a limited lifting capacity. On the other hand, the mechanical simplicity of this type of pump and the potential for low-cost, lightweight construction makes it well equipped to meet VLOM objectives. Repair of footvalve and plunger will require removal of the pump rod and the two mentioned parts. A process which in most types of direct action pumps is very easy to perform. Most direct action pump designs take advantage of using a lightweight hollow pumprod where the buoyancy effect will distribute the pumping force both to the upstroke and down stroke.



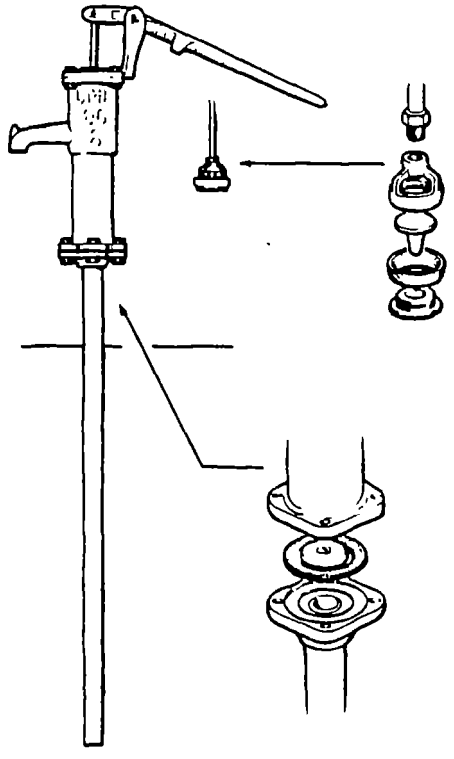
DEEP LIFT:

In deep well pumps, as in direct action pumps, the cylinder is immersed below the water level; therefore priming is not necessary. They are suitable for lifts down to 45 meters or more. Repairs will require removal of components from down the well. Generally deep lift pumps will work for a long time without need for any repair, but for most of them when repair is required it will also require involvement of a repair team which may take time to respond to requests. Having a combination of, a heavy lift pump and at the same time an easy-to-repair pump has been achieved by few pumps only.



General Description:

The No. 6 pump is a simple and robust shallow-well suction pump constructed almost entirely of cast iron, with a polished cylinder. As an alternative the pump can also be supplied with a PVC cylinder lining. The piston uses a moulded PVC cupseal and the foot valve is a weighted leather flap valve. The pumpstand is mounted directly on the suction pipe, which is a 1.5 inch galvanized steel pipe, cast into the platform.



Manufacture:

The No. 6 pump is suitable for manufacture in any developing country with basic foundry skills. It has no fine tolerances. The pump is manufactured widely in Bangladesh, Nepal and Vietnam just to mention some countries. The design is in public domain.

Suppliers:

Supply from Vietnam, Bangladesh and Nepal is possible. In each of these countries there are several No. 6 foundries. Previously supply from a Cambodian factory was possible, reintroduction of No. 6 production is seriously considered.

Facts about the pump:

Lift Capacity:	7 meters
Discharge/stroke:	1 liter
Avg. discharge/min.:	20 liters
Avg. discharge/hour:	1.5 M3
Well requirement:	2.0 M3/h

Cost price: US$ 30.-

The quoted price is for a Vietnam produced pump, including stand pipe, but not rising main.

The No. 6 pump or pumps similar to it have been produced in great numbers. In Bangladesh alone more than a million units have been installed. In Cambodia the number is app. 2000.

Evaluation:

The pump will usually be received assembled. Installation is simple and requires only basic tools and skills. The pump is mounted directly on a 1.5 inch GI drop pipe, which must be securely cast into the platform. Maintenance is simple and could be carried out by villagers themselves. Corrosion of fasteners - bolts and nuts - could

give reasons for difficulties in taking the pump apart.

Insufficient smoothness of the surface of the cylinder could cause rapid wear of seals. Initially after replacement of a couple of cupseals improved performance is to be expected. The alternative with the PVC lining will eliminate this problem.

Requirements of a maintenance back up organisation will be limited. Only a steady distribution of spare parts, preferably through the private sector, is required.

The simplicity of the installation does mean that it has little resistance to abuse, as it is easy to remove the complete pump from the drop pipe.

Sanitary sealing can be achieved through casting the drop pipe into the platform, but maintenance of the sealing effect is difficult, however this problem is not directly linked to the pump.

Mounted directly on the well casing the design does not provide any reservoir between the aquifer and the pump. The capacity of the well therefore has to be sufficient to instantly replenish every stroke pumped. The draw down must be within the limitation of a suction pump - 7 meters.

The fact that a suction pump will have to be primed if the foot valve is not working 100% perfectly, means it can not avoid becoming a source of contamination if polluted water is used.

Running Cost:

No documentation of running cost is available, but it is anticipated that each year it will be necessary to replace one cupseal, one flap valve and both pivot axles. Every second year replacement of handle and top part is to be expected. The projected spare part replacement cost will therefore be in the range of US$ 5.- per year.

Overall conclusion:

The No. 6 pump is a very simple, cheap and sturdy pump; however the wear pattern is likely to be linear, - that means heavy use will also cause considerable wear. Anyhow the simplicity of the pump makes it easy to bring it back into operation whenever any misfunction occurs. Villagers, trained and equipped with the right tools will be able to do this.

The very high discharge will always be appreciated by user communities.

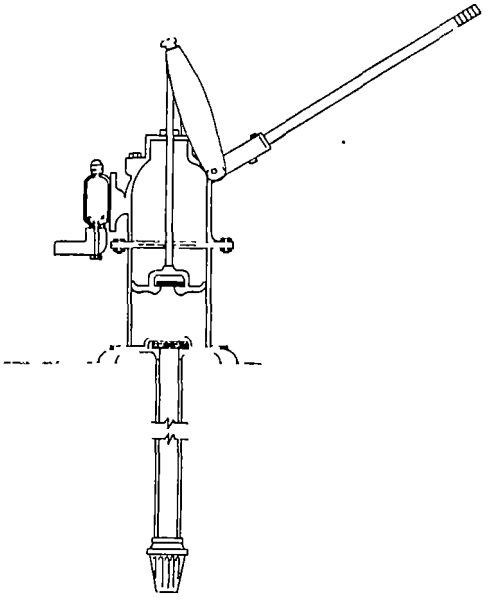
RATING BOX	Rating
Easy Maintenance	G
Reliability	G
Running cost	G
Discharge rate	G
Lifting Capacity	G
Manufacture Needs	F
Cost Price	G

General Description:

The Lucky is a simple shallow-well suction pump constructed mainly of cast iron with a footvalve installed at the bottom of the drop pipe. The drop pipe could be galvanized steel but also uPVC is supplied.

The plunger has a large diameter rubber seal, giving a high discharge per stroke.

The pump is following the cross head concept which makes it more complicated to produce than a simple lever action pump like the ˚No. 6.



Manufacture:

The Lucky is widely manufactured in Thailand by small and medium size foundries, but its reliability depends on good casting skills and quality control of items such as the handle, fulcrum pins, piston rod guides, etc.

Suppliers:

Available from many foundries throughout Thailand.

Facts about the pump:

Lift Capacity:	7 meters
Discharge/stroke:	1 litre
Avg. discharge/min.:	25 liters
Avg. discharge/hour:	1.5 M3
Well requirement:	2.0 M3

Cost price: US$ 30.-

Installation in Cambodia as a public pump is limited to a few pilot installations.

Evaluation:

The Handpump option report evaluation says: "The Lucky pumps performed very poorly in the field proving quite unsuitable for heavy duty operation at village level.
The crosshead system has too many moving parts, which are subject to rapid wear. Though the discharge is high and the pump is therefore popular with users when it is working properly, the frequency of necessary repairs means that its use would have to be restricted to small user group.
As a suction pump, the Lucky is inherently easy to maintain, though in comparison with other suction

pumps, it does have some disadvantages. Several spanners are needed to take the pump apart, and the need to lift out the drop pipe to service the footvalve precludes maintenance by the village caretaker".
Even if higher production standards could be achieved, it is unlikely that the Lucky design would be suitable for high daily outputs.

Although the Lucky pump is used in the north west provinces there is not much information available about is performance here in Cambodia.

RATING BOX	Rating
Easy Maintenance	G
Reliability	F
Running cost	G
Discharge rate	G
Lifting Capacity	F
Manufacture Needs	F
Cost Price	G

Running Cost:

Is not known.

Overall conclusion:

A pump which is suitable for small user groups - a household type of pump.

General Description:

The Prey Veng pump is a locally produced simple suction handpump, using the crosshead concept. Simplicity and the use of locally available material whenever this is possible are the basis for this pump. The crosshead connections are made of steel rods, the cylinder is a 100 MM PVC pipe with a top and bottom flange made of steel sheet. The plunger seal is cut out of car tyre and valves are weighted rubber cut out of inner tubes. The handle is a wooden stick. Corrosion protection consist of painting.

For this pump no drawings or any specification exist.

Manufacture:

Production will require only a minimum of skills, and a simple workshop.

Suppliers:

Currently this pump is only being produced by one manufacturer in Prey Veng.

Facts about the pump:

Lift Capacity:	7 meters
Discharge/stroke:	1 liter
Avg. discharge/min.:	25 liters
Avg. discharge/hour:	1.5 M3
Well requirement:	2.0 M3

Cost price: US$ 25.-
inclusive stand pipe.

A complete installation can be supplied by the pump manufacturer for US$ 45.- which does not include a platform.

More than 1500 pumps have been installed in Prey Veng province, and only in this province is the pump available.

Evaluation:

The high number of installed pumps sold in Prey Veng, in itself proves the pump is appreciated among individual households, who are willing to spend the necessary amount of money on their own water supply point.

The Prey Veng pump would most probably have a very high frequency of break down if it were used as a public handpump. A important factor for keeping it in running condition

is that as a household pump it is constantly being looked after. Interventions will most probably be carried out whenever needed.

A cost price of the pump alone of US$ 25.- including the stand pipe is quite on the high side of what should be expected from a local produced pump, considering that a No. 6 pump is available at a cost price of US$ 30.-.

Sustainability is achieved by relying on one person only.

Running Cost:

No data is available regarding running cost.

Overall conclusion:

A very interesting concept as a family and house hold pump. As a public pump it will most probably have a too high frequency of break down.

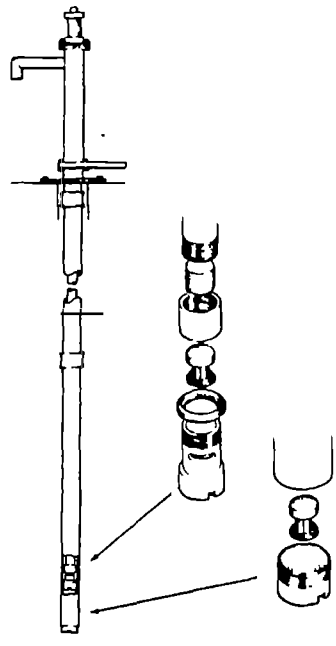
It should be considered to promote the Prey Veng concept in other areas where the availability of ground water is as favourable as in Prey Veng.

As a first step towards such promotion a comprehensive documentation of the concept should be carried out.

RATING BOX	Rating
Easy Maintenance	G
Reliability	F
Running cost	?
Discharge rate	G
Lifting Capacity	G
Manufacture Needs	G
Cost Price	F

General Description:

The NIRA AF 85 is a direct action pump. The pumpstand is made from fabricated steel and is nylon coated for corrosion protection. A stainless steel T-bar handle slides in a long guide bush made from plastic - high density polyethylene (HDPE). A footplate is bolted to the bottom of the pumpstand. The rising main and large diameter pumprod and its coupler are also made of HDPE. All other below-ground components are plastic. The standard cylinder diameter is 51.4 mm, recommended for a setting down to 15 meters. For deeper settings - down to 20 meters - a cylinder with diameter of 40 mm is available.



Manufacture:

The pump is being produced in Finland. It uses expensive material and production requires good skills, machinery and quality control. The design is to be used by the owner only. The lack of good medium lift pumps with a design in the public domain caused the inclusion of the NIRA pump.

Suppliers:

Only the Finnish manufacturer has the right to use the NIRA design. Available NIRA pumps here in Cambodia have been imported from Finland.

Facts about the pump:

Lift Capacity: 15 meters
Discharge/stroke: 0.5 liters
Avg. discharge/min: 26 liters
Avg.discharge/hour:1.5 M3
Well requirement: 1.5 M3/h

Cost price: US$ 530.- excl. freight, for a 16 meter setting pump unit.

NIRA AF 85 in a D version will have a lift capacity of 20 to 22 meters.

The NIRA AF 85 have been installed in many countries since production commenced in the 80s. Number of installed pumps app. 15.000.

Evaluation:

The light weight of the below-ground assembly, and the simplicity of its design, mean that only a few tools and a modest degree of skill will be required to install and maintain the pump. Only a few

special tools are required.

The performance of the pump will be very good in water with little abrasive material like sand. It has been reported that sandy water will have some wear effect on both the cylinder and on the rising main.

It has proved to be capable of serving a large user group.

The buoyancy effect of the hollow pump rod distributes the required force input both to the up stroke and the down stroke.

Requirement of the maintenance organisation is very limited. Assuring a spare part supply could cause some problems because they will have to be imported from Finland. On the other hand because of its high quality the demand for spare parts will be relatively limited. It should be noted that supply of new units and of spare parts will rely on one manufacturer only. Although this Finnish pump production is supported by FINNIDA, the single manufacturer factor is making the concept less sustainable.

Running Cost:

No information available, but most probably running cost is in the lower end of what is expected for a pump in this lift category, for the first five to six years of operation. Thereafter - if expensive parts have to be replaced the running the pump can become costly.

Overall conclusion:

A very robust pump which is easy to install and requires limited maintenance backup, and it has a high corrosion resistance.

It is popular with users, being very easy to operate down to 12 meters, and gives a high discharge.

The cost of the NIRA is very high.

RATING BOX	Rating
Easy Maintenance	G
Reliability	G
Running cost	F
Discharge rate	G
Lifting Capacity	G
Manufacture Needs	F
Cost Price	P

General Description:

The TARA is a direct action handpump. The galvanized pumpstand is fabricated from steel. Pumprod and rising main are standard uPVC pipe. The cylinder is also uPVC pipe of the same outside diameter as the rising main, but with greater wall thickness. The standard design suggest that the rising main also serve as the well casing. The piston and the footvalve are injection moulded plastic components, having a simple rubber flap valve. Fittings on the piston and the footvalve enable them to be coupled together and removed for maintenance or repair. Cylinder setting is 15 meters.

Manufacture:

The TARA has been designed for manufacture with limited requirements: simple steel fabrication, uPVC pipe extrusion according to BS specification, some terminal forming of uPVC pipe and simple plastic moulding are required. The design is in public domain.

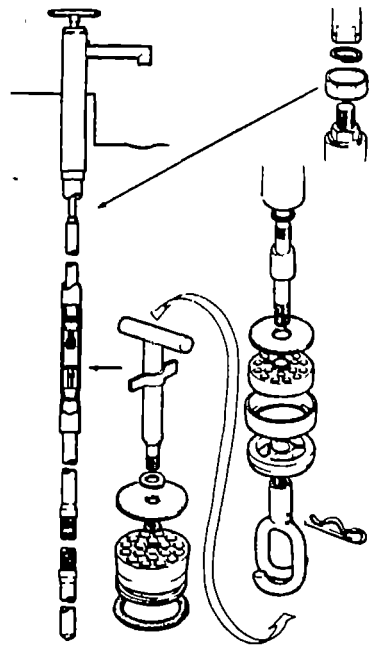
Suppliers:

The TARA is being produced in Bangladesh, Vietnam and in India. Both in Bangladesh and India a number of manufacturers are producing TARAs.

Facts about the pump:

Lift Capacity: 15 meters
Discharge/stroke: 1 liter
Avg. discharge/min.: 25 liters
Avg. discharge/hour:1.5 M3
Well requirement: 2.0 M3/h

Cost price: US$ 116.-



for a 15 meter cylinder setting.

Installation of TARA takes place in Bangladesh, India, Nepal, Guatemala and Vietnam.

By 1988 the basic design was frozen and further improvements will be compatible with this design. The same year production commence from a number of prequalified manufacturers in Bangladesh. The number of TARA produced is app. 40.000, with most of them installed in Bangladesh.

Evaluation:

The TARA has undergone more

elaborate performance test than most other handpumps. The evaluation is therefore based on a very solid background.

The TARA is an easy to install handpump. When installed as a combined rising main and casing pipe design, the rising main will be installed by the drilling team. In open wells installation will easily be done by a trained mechanic assisted by the community.

The design utilizes the buoyancy effect of the submerged uPVC pumprod, which means the lifting force is distributed between the up and down stroke. Force has to be applied both at the up stroke as well as at the down stroke. This design feature makes pumping more convenient; however it also increases the quality requirement of the pump rod installation.

Using the combined rising main and the casing pipe concept has the disadvantage that malfunction of the rising main function will bring the installation beyond repair.

Pumping water with a high sand content will reduce the lifetime of the pump, especially if a standard leather seal is used. Using a nitrile rubber seal proved a better solution.

Requirement of the maintenance organisation are very limited. Only in the case of a pump rod problem or an unforeseen situation will it be necessary to call in assistance from outside the village level. Apart from this a steady spare part supply system must be in place - preferably through the private sector.

In Bangladesh during the dry season many TARAs pump water from 15 meters.

Running Cost:

The running cost will be limited to purchase of spare parts.

Overall conclusion:

The TARA is a pump which has proved it can fulfil the expectation set out for it at the beginning of the design. Its VLOM status is very high. Village communities have proved they are able both to maintain and repair the pump, but also to bear the running cost. All repairs can be carried out without using any tools apart from a household knife and a extension rod used for fishing out the footvalve. Large scale performance monitoring proved that the use of a combined casing and rising pipe is not creating any problems.

RATING BOX	Rating
Easy Maintenance	G
Reliability	G
Running cost	G
Discharge rate	G
Lifting Capacity	G
Manufacture Needs	F
Cost Price	G

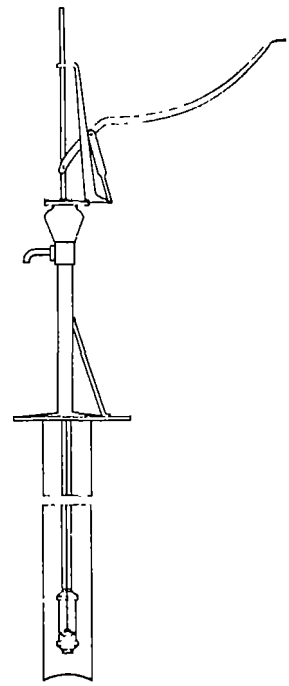
General Description:

The original Dempster pump was designed in the USA in the last century as a family pump used normally in a farmyard.

Since the Dempster pump was in production in Cambodia until recently, it was found feasible to consider using it as a public deep lift pump with a lift capacity down to 25 meters. However, it was also known that its performance was poor, and improvements had to be introduced, especially of the below ground components.

UNICEF took steps to introduce some modifications and for installation of the modified pump.

After modification the Dempster emerge as an above-ground cast iron pump of its traditional design. For the rising main and the cylinder standard uPVC pipes are used. The foot valve is of a spring loaded extractable mode design.



Manufacture:

One of the reasons for introducing this pump was based on the local production possibility. However, in the meantime the manufacturer has closed down his foundry. The Dempster cast iron head is still available from Thailand.

Suppliers:

If production of below-ground components was to be considered a manufacturer has to be identified.

Facts about the pump:

Lift Capacity:	? meters
Discharge/stroke:	1 liter
Avg. discharge/min.:	25 liters
Avg. discharge/hour:	1.5 M3
Well requirement:	2.0 M3/h

Cost price: US$ 50.-

Evaluation:

Initial performance monitoring of the modified pump was so poor that the team behind this initiative decided to cancel any further experimentation.

Running Cost:

Not known

Overall conclusion:

The local modified Dempster did not manage to prove it is a feasible option in Cambodia.

Because of its poor performance further modification has ceased.

If on the other hand in future it will be decided to take up experimenting with this design again, it is essential that the necessary resources be devoted and that objectives and a strategy for such development work will be established.

Under the given circumstances it is not possible to do a proper rating of this pump.

General Description:

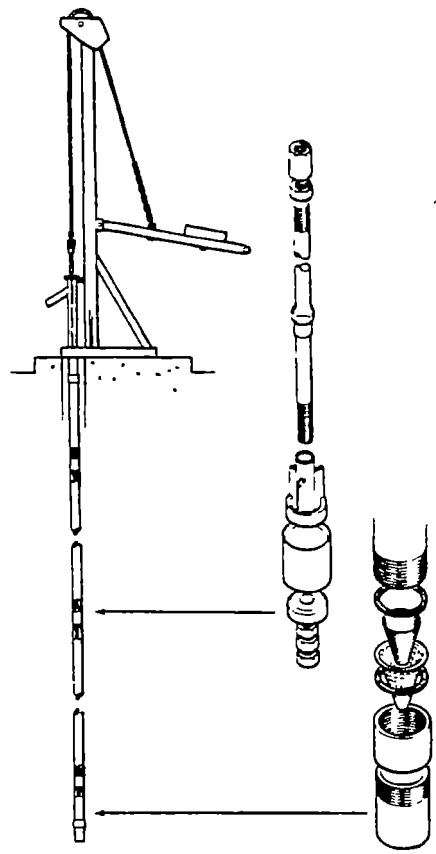
The UPM pump is a deep lift pump with a number of innovative features. UPM stands for "Universal Multi-Pistons" which relates to the design feature of having a piston, with discharge valve, located every 3 meters along the pumprod, an important departure from the mainstream of conventional pump design.These pistons move within a 2-inch uPVC high quality uPVC pipe. The sealless piston functions as a friction piston. The annulus between the piston and the rising main/cylinder requires very strict tolerances. Standard uPVC pipes will not meet these tolerances. An extractable footvalve is installed at the bottom end of the rising main. Pumprods are 10 MM GI with threaded connectors.

The pump stand is made of structural steel and includes a 3.5 meter high mast with a pulley at the top and a beam with a T-bar which serves as the handle. The mechanical advantage is that the handle beam is adjustable to suit any lifting depth.

Modification of the UPM pump by incorporating locally produced components is in progress, mainly for the purpose of reducing the cost price. This alternative will have a lift capacity of 12 meters.

Manufacture:

Production of the piston and the rising main/cylinder will require advanced industry, with good quality control. The pumpstand can be modified to suit local production although the lack of galvanizing facilities will be a problem.



Suppliers:

The design of the rising main and the piston is owned by the manufacturer.

Facts about the pump:

Lift Capacity: meters
Discharge/stroke: 1 liter
Avg. discharge/min.:20 liters
Avg. discharge/hour:1.2 M3
Well requirement: 1.2 M3/h

Cost price: US$ 905.-

Cost price of the modified UPM will be app. US$ 450.- for a 12 meter

setting.

Evaluation:

The cost price of this pump when compered to other deep lift pumps is prohibitively high. Especially the piston and the high quality specially produced PVC rising main/cylinder is very costly, and local production of this component is out of the question. Field experiences from Cambodia have highlighted that the piston will be severely affected if it has to pump in sandy water.

RATING BOX	Rating
Easy Maintenance	F
Reliability	G
Running cost	?
Discharge rate	G
Lifting Capacity	G
Manufacture Needs	P
Cost Price	P

Running Cost:

No data is available.

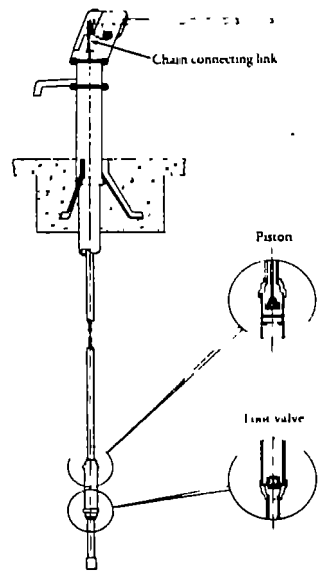
Overall conclusion:

This pump has a very interesting piston/cylinder design, but its sensitiveness towards sandy water could become a problem here in Cambodia. The cost price of the UPM pump is just too high.

The modified version with a cost price of US$ 450.- for a 12 meter lift, will become a very costly solution to a medium lift pump, a pump which only partly covers the medium lift range. It should be noted that this modification will feature a combination of high tech components with a low frequency of intervention and locally produced components with a higher frequency of repair.

General Description:

The India Mark II (IM II) is a handpump developed with UNICEF support.
The pumpstand and the handle are galvanized steel, and the pump is distinguished by the chain and quadrant link between the handle and pumprod, which depends on a gravity return to effect the downstroke. Ball races are used for the handle bearings. The steel pedestal is concreted into the pump platform.
The below-ground assembly is conventional with 1 1/4 inch GI rising main, a 63.5 mm brass-lined cast iron cylinder and machined brass footvalve and plunger. Recommended setting of cylinder is min. 24 meters.



Manufacture:

The IM II calls for skills in steel fabrication and foundry work with good quality control. The pump design is in public domain.

Suppliers:

The pump has been supplied to Cambodia from India, where more than 50 prequalified manufacturers produce this pump. It is also being produced in a number of other countries.

Facts about the pump:

Lift Capacity 45 meters
Discharge/stroke:0.33 liters
Discharge/min.: 12 liters
Discharge/hour: 720 liters
Well requirement: 720 l/h

Cost price: US$ 285.-
inclusive 24 meters of rising main.

The huge number of installed IM II throughout the world - over a ten year period - speaks for itself about its reliability.

In Cambodia more than 3500 have been installed mainly by UNICEF. Recently installation of IM II ceased, and IM III took over, see this pump.

Although a deep lift pump, many IM II are installed in suction and medium lift areas, simply because it was the pump available at the time of installation.

Evaluation:

Although many good things can be said about the India Mark II, the time is running out for this type of handpump. The main problem is its cumbersome way of maintenance and repair of below ground level components. Furthermore its basic head design has been superseded by many new handpump designs.

This has caused modification of the India Mark II into the India Mark III.

The experiences with the IM II in Cambodia are good. Although it is supported by a moderately functioning maintenance organisation a major proportion of installed pumps are in working condition. It is found by UNICEF that replacement of rising main and pump rods can be expected to take place after five to six years of use.

Some IM IIs have been seen equipped with a T-bar handle, a modification not always appreciated by the communities.

The fact that many IM IIs will have to be kept in running condition for many years in Cambodia should be kept in mind when the selection discussion takes place.

Running Cost:

A major running cost factor is the anticipated replacement of rising main and pump rods app. every six years. This in itself will amount to US$ 18.- per year, cost of replacement other parts will vary from few dollars to 15 US$ depending on source of information.

Overall conclusion:

The IM II has been a good pump for Cambodia, but with introduction of more user friendly pump designs it is becoming too old fashioned.

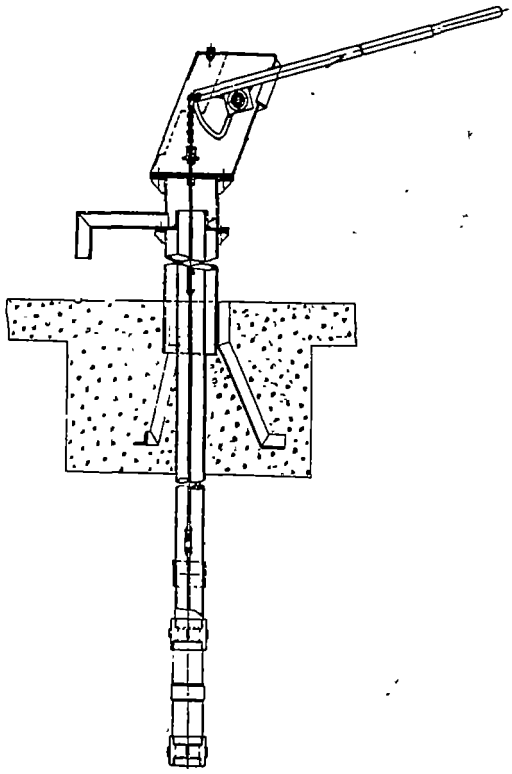
Many IM II have been installed where their lifting capacity is not being utilized.

RATING BOX	Rating
Easy Maintenance	P
Reliability	G
Running Cost	F
Discharge Rate	G
Lifting Capacity	G
Manufacture Needs	F
Cost Price	G

General Description:

The modified version of the India Mark II - the India Mark III - differs from the standard version in that it has pumping elements which can be recovered without having to lift out the rising main. An open-topped 63.5 mm cylinder (OTC) is used in a 2 1/2 inch galvanized steel rising main.
The purpose of this modification is to make maintenance easier by reducing the tools needed, skills required and the time taken to service down the hole components. Introduction of nitrile seals together with other modifications has improved the overall performance of this pump. However the OTC modification introduces a much heavier and costlier rising main.

Anticipated introduction of a standardized uPVC rising main concept never materialized.



Manufacture:

See India Mark II

Suppliers:

See India Mark II

Facts about the pump:

See India Mark II and in addition, by September 1990 the Indian Bureau of Standard issued standards for the open top cylinder India Mark III pump.

Cost price: US$ 390.-
inclusive 24 meters rising main.

As mentioned under the IM II pump, UNICEF has shifted to the India Mark III pump recently. Already 250 numbers have been installed. In addition 800 numbers have been ordered from Indian manufacturers.

Evaluation:

The introduction of a 2 1/2 inch rising main makes installation a much heavier duty. Although installation does not require lifting tackles it requires availability of a heavy set of special tools. However, it is anticipated that the rising when in place will not have to be touched again for app. five years.

The main advantage of introducing an open top cylinder is the

possibility to remove pumping elements without touching the rising main. In future when maintaining plunger and footvalve, it will be necessary to disconnect head, and handle and take out the treated connected pump rods. Whether this intervention can be performed by the villagers themselves or whether a mechanic will have to be called in is still to be found out.

As mentioned previously corrosion is affecting the taste of water, by introducing a bigger diameter rising main there is a probability that this problem will increase. Water will have a longer storage time in the rising main.

The requirement to the maintenance organisation will depend on this outstanding question. Most likely all maintenance except rising main maintenance will be carried out at the village level by the user community themselves or by a local mechanic - preferably selfemployed. A secure spare part distribution system must also be in place - as a private sector initiative if possible.

A comprehensive test report proves that the IM III will operate with much fewer requirements of the maintenance organisation than the IM II. In that respect it will get a relatively high VLOM score.

Running Cost:

If the replacement pattern of the IM III will be the same as in case of the IM II, the cost of replacing the rising main and the pump rods every six year will amount to US$ 28.- per year. Replacement of other parts will vary from few dollars to 15 US$ depending on the source of information. It should be noted that this calculation is only including spare part costs.

Overall conclusion:

Although a number of individual projects have carried out experiments with uPVC riser pipes and preliminary results were promising nobody has taken it to a stage where standard specifications could be issued.

In the field the India mark III has proved it is able to reduce the maintenance burden significantly.

But it is also a fact that the India Mark III is based on a pump design which in many ways has been superseded by other more user friendly designs.

RATING BOX	Rating
Easy Maintenance	F
Reliability	G
Running Cost	F
Discharge Rate	G
Lifting Capacity	G
Manufacture Needs	F
Cost Price	G

General Description:

The Afridev above ground level components are mainly all-steel fabrication. The handle - a T-bar telescopic type - makes provision for adjusting the advantage from 1:3 to 1:5. Handle and rod hanger bearings are easily replaceable twin bushes of plastic which snap together.

Rising main is 63 OD standard 16 bar uPVC pipe with solvent cemented bell and spigot joints. It is suspended from the pumpstand using a compressed rubber cone. Standard pump rods are GI 10 mm steel, with forged hook and eye connectors. The standard 50 mm cylinder is a long brass tube sleeved into a uPVC pipe. Plunger and footvalve are identical plastic components with a snap fitting rubber seal.

Manufacture:

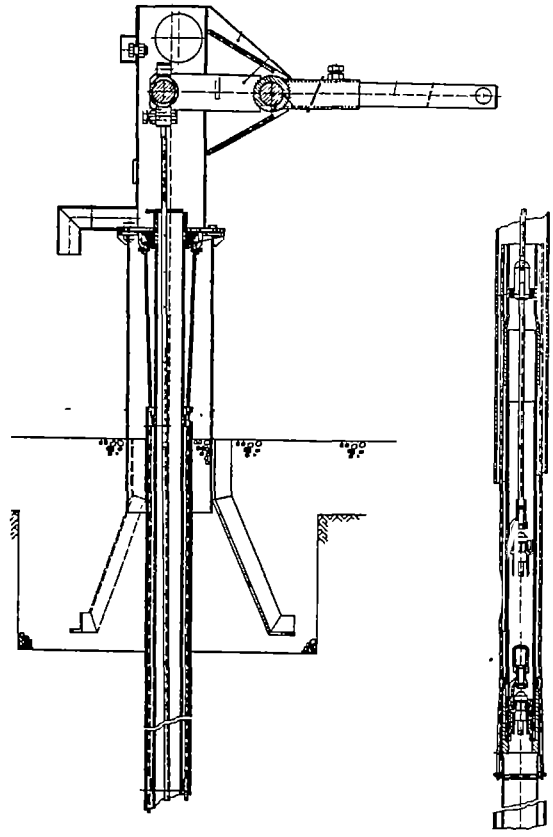
The all-steel- and the rubber components will require medium level industry, whereas the sophisticated plastic components will require advanced industry, and good quality control. The pump design is in public domain.

Suppliers:

Although meant for local production in the country of use, the majority of Afridev pumps now-a-days are produced in India, but production is also taking place in Pakistan, Kenya and a few other countries in Africa. Pumps can be supplied from a range of manufacturers.

Facts about the pump:

Lift Capacity: 40 m
Discharge/stroke: 0.4 liters



Avg.Discharge/min: 16 liters
Avg.Discharge/hour: 1 M3
Well Requirement: 1 M3/h

Cost price: US$ 350.-
including 24 meter rising main.

The Afridev pump development began in early 80's, and further improvements are still being considered; however, this is done under the condition that any design change must be compatible with the existing design. The Afridev design team issued standard specifications in 1989, with the latest amendments dated July, 1991. By 1989 mass production of Afridev pumps commenced; the app. number of pumps produced so far is 3500. Afridev are used in Pakistan, Afghanistan,

Malawi, Kenya, Ghana, and a number of other countries.

Evaluation:

The pump is fairly easy to install. After casting the foundation of the pedestal, installation of the rising main is the only remaining task which will require certain skills. If needed villagers themselves can pull out the rising main in its full length. Dismantl-ing the above ground level components is very easy, only two spanners are needed. Recovery of the foot valve is done by using a simple fishing tool. The pump rod with its hook and eye connector is likewise very easy to install and recover. Adjusting requires only a hacksaw.

Compared to the scale of effort put into the development of the Afridev, the subsequent performance test and monitoring programme has been rather neglected. Although available performance data are not very exhaustive and specific, they give sufficient background to conclude that the pump will perform very much within the expectation range. Also its very high degree of VLOM status is beyond any doubt.

The pump rod appear to be the component which will require maximum attention. A five year replacement frequency is expected. The available performance documentation does not prove a 45 lift capacity.

Requirement of the maintenance organisation after installation will be limited to assistance whenever repair of the rising main is needed. Apart from this a secure spare part distribution system must be in place, preferably through the private sector.

Running Cost:

An annual spare part cost of US$ 30.- is anticipated, over a ten year period. Of all Afridev components the pump rod will require app. 25 % of annual spare part cost.

Overall conclusion:

A major objective set for the development of the Afridev pump was to reach a optimum degree of VLOM status. To a great extent this objective has been reached.

The Afridev pump was under development for a long period. Design improvements are still taking place, however under the condition that improvements must be compatible with the existing design. It is a reliable pump which will be appreciated by the user community because of its easy maintenance. Its simplicity will make the community confident that they can handle it themselves.

RATING BOX	Rating
Easy Maintenance	G
Reliability	G
Running cost	G
Discharge rate	G
Lifting Capacity	F
Manufacture Needs	F
Cost Price	G

PROVINCIAL ID:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
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	H			N														L				V
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24 Hours TV																						
ACR																						
Action Nord Sud																						
ADRA						X																1
AFAICF																						
AICF																	X				X	2
ARC																						
CARE																						
CARE Birch Pr.	X	X																				2
CCC																						
CIDSE								X														1
CONCERN	X				X										X							3
COR		X					X							X	X							4
CRS																						
DoH see OXFAM																						
FHI							X															1
GRET					X			X				X		X								4
HEKS				X	X									X								3
IRC																						
JVC																						
LWS																						
MCC								X						X					X		X	4
MoH - CNHE	X	X	X	X	X	X	X	X		X				X	X		X			X	X	14
MSF/F																						
MSF/H/B																						
New Humanity																						
OXFAM - BATTAMB.	X	X																				2
OXFAM - SVAY RIENG.														X						X		2
PADEK																						
Redd Barna												X										1
SCF (A)																						
SKIP																						
UNDP/OPS	X	X													X							3
UNHCR																						
UNICEF see CNHE																						
WORLD VISION					X			X														2
	5	5	1	2	5	2	3	5	0	1	0	2	0	6	4	0	2	0	1	2	3	

STANDARD SPECIFICATION

The following standard specifications will apply for the individual considered pumps:

AFRIDEV:	Standard specification, Revision No. 1, 1991, Issues by Swiss Centre for Appropriate Technology.
INDIA MARK II:	Standard Specification, Date: March, 1990 Issued by Indian Bureau of Standard, India
INDIA MARK III:	Standard Specification, Date February, 1991 Issued by Indian Bureau of Standard, India
TARA:	The TARA Handpump, Production Manual and Drawings. Date: September, 1990 Issued by UNICEF - DPHE, Bangladesh.

Guidelines for Discussion Groups - Medium Lift and Deep Lift

A chairperson has been appointed for each group.

The group members should select one person to takes minutes of the discussions. These minutes will be used for the report on the workshop.

The group members should select one person to make a presentation of the group's discussions and recommendation to the plenary session.

The group should arrange the time available, 4 hours, so that:

- the operating environment is discussed in general;
- each of the pumps in the category can be thoroughly considered;
- a comparison between the pumps can be made;
- a recommendation of the most suitable pump is made;
- a presentation is prepared for reporting back to the plenary session.

The following points should be considered for each pump:

- ease of maintenance
- reliability
- running costs
- discharge rate
- lift capacity
- manufacturing needs
- cost price

plus any other points which the group considers relevant.

The pumps for discussion should be available in the room.

The recommendation should be supported by:

- reasons for making the choice of pump;
- reasons for rejecting the other pumps in the group;
- any qualifications about the choice;

The report to the Plenary Session should be prepared with a summary written on flip charts. Please see the Guidelines for Reporting Back.

Guidelines for Discussion Groups - Suction Lift and Family Pumps

A chairperson has been appointed for the group.

The group members should select one person to takes minutes of the discussions. These minutes will be used for the report on the workshop.

The group members should select one person to make a presentation of the group's discussions and recommendation to the plenary session.

The discussion should be divided into 2 parts:

- the pump selection;
- discussion and recommendation of the family handpump issue;

The group should arrange the time available, 4 hours, so that:

- the operating environment is discussed in general;
- each of the pumps in the category can be thoroughly considered;
- a comparison between the pumps can be made;
- a recommendation of the most suitable pump is made;
- the family handpump issue is discussed;
- a presentation is prepared for reporting back to the plenary session.

The following points should be considered for each pump:

- ease of maintenance
- reliability
- running costs
- discharge rate
- lift capacity
- manufacturing needs
- cost price
- plus any other points which the group considers relevant.

The pumps for discussion should be available in the room.

The recommendation should be supported by:

- reasons for making the choice of pump;
- reasons for rejecting the other pumps in the group;
- any qualifications about the choice;

Discussion/recommendations on the family handpump issue should include:

- the demand for a family water supply point;
- whether it should be promoted/supported by NGOs or others agencies;
- the extent to which outside agencies should be involved in:
  the actual design of the pump

quality control (consumer protection)
encouragement of consumers to buy a family handpump
coordination

The report to the Plenary Session should be prepared with a summary written on flip charts. Please see the Guidelines for Reporting Back.

Guidelines for Reporting Back

Total time allowed for each lift range - 45 minutes

Report back to include:

summary of general discussion — 5 mins
- working conditions
- maintenance
- special issues to be addressed, e.g. caretaker training

summary of discussion on each pump — 5-10 mins
- good points
- bad points

recommended pump — 5 mins
- reasons for recommendation
- reasons for rejecting other pumps

Please make use of flip charts to summarise points.

General discussion — 20 mins

questions
additional comments
additional experience

Summary and recommendation — 5 mins

Timetable

14.00 - 14.45	Suction pumps
14.45 - 15.00	Break
15.00 - 15.45	Medium lift pumps
15.45 - 16.00	Break
16.00 - 16.45	Deep well pumps
16.45 - 17.00	Criteria for calling another workshop
17.00 - 17.30	Closing session

WORKSHOP - PARTICIPANTS		
1	Hussein Amirie	LWS
2	Bengt Andersson	UNICEF
3	Adrian Bailey	COR
4	Simon Batchelor	COR
5	Sam Bonal	CNHE
6	Foort Bustraan	Oxfam (Battambang)
7	Prum Chamroeun	GRET
8	Khut Bun Cheang	Concern
9	Pok Chuon	CNHE (Takeo)
10	John Coats	MCC
11	Ir Chan Darong	CNHE (CWB)
12	Frederic Fourtune	AICF
13	Vijay Gaikwad	LWS
14	Leo Goulet	UNDP/OPS
15	Pierre Gubri	AICF
16	Yohannes Hagos	Oxfam (Prey Veng/Svay Rieng)
17	Heng Meng Hak	DoH (Planning)
18	Hon Hnot	WVI (Kandal)
19	Men Khoeun	DoH (Kandal)
20	Bent Kjellerup	LWS
21	Ping Siv Lay	Min. of Industry
22	Sar Chhun Lim	Min. of Industry
23	Yin Lorn	WVI (Kandal)
24	Colin McLaurin	CAA
25	Chhim Mony	CNHE (Kompong Speu)
26	Nuon Nall	DoH (Siem Reap)
27	So Neou	DoH (Organisation)
28	Michel Nowacki	UNICEF
29	Jeremy Ockelford	Oxfam
30	Kim Sam Onn	Min. of Industry
31	Waldemar Pickardt	UNICEF
32	Nhea Kim Pon	CNHE
33	Jerome Rihouey	GRET
34	Hem Sovanna Rith	UNICEF
35	Hou Rithy	WVI (Kompong Speu)
36	Bhai Raja Sakya	UNICEF
37	Leap Samnang	HEKS
38	Chim Sarun	CIDSE (Kandal)
39	Yam Saveung	Concern
40	Chea Seiha	UPM Rep

WORKSHOP - PARTICIPANTS (cont.)		
41	Johanne Siffointe	CARE
42	Ek Sithonn	AICF (Takeo)
43	Heng Siv	DoH (Bantey Meanchey)
44	Khum Sokhom	CIDSE (Kandal)
45	Pen Sopheap	CNHE (Kompong Chhnang)
46	Nap Sovann	UNICEF
47	Hour Stothy	UNICEF
48	Toul Suen	DoH (Pursat)
49	Am Than	CNHE (Kandal)
50	Pierre Thevenot	GRET
51	Veng Sakhon	DoH
52	Jean Francois Vidal	AICF

DISCUSSION GROUP No. 1 - PARTICIPANTS	
Jean Francois Vidal	AICF Chairperson
Nuon Nall	DoH (Siem Reap)
Bengt Andersson	UNICEF
John Coats	MCC
Kim Sam Onn	Min. of Industry
Jerome Rihouey	GRET
Prum Chamroeun	GRET
So Neou	DoH (Organisation)
Heng Meng Hak	DoH (Planning)
Nap Sovann	UNICEF
Hem Sovanna Rith	UNICEF
Hour Stothy	UNICEF
Ek Sithonn	AICF (Takeo)
Adrian Bailey	COR
Simon Batchelor	COR
Sam Bonal	CNHE
Bent Kjellerup	LWS
Veng Sakhon	DoH

DISCUSSION GROUP No. 2 - PARTICIPANTS	
Bhai Raja Sakya	UNICEF Chairperson
Pen Sopheap	CNHE (Kompong Chhnang)
Hon Hnot	WVI (Kandal)
Chhim Mony	CNHE (Kompong Speu)
Pierre Gubri	AICF
Ping Siv Lay	Min. of Industry
Khum Sokhom	CIDSE (Kandal)
Chim Sarun	CIDSE (Kandal)
Men Khoeun	DoH (Kandal)
Michel Nowacki	UNICEF
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Leo Goulet	UNDP/OPS
Foort Bustraan	Oxfam (Battambang)
Colin McLaurin	CAA
Hussein Amirie	LWS
Jeremy Ockelford	Oxfam

Discussion Group Participation: **Annex No. 5**

DISCUSSION GROUP No. 3 - PARTICIPANTS	
Pierre Thevenot	GRET Chairperson
Am Than	CNHE (Kandal)
Pok Chuon	CNHE (Takeo)
Ir Chan Darong	CNHE (CWB)
Sar Chhun Lim	Min. of Industry
Khut Bun Cheang	Concern
Hou Rithy	WVI (Kompong Speu)
Nhea Kim Pon	CNHE
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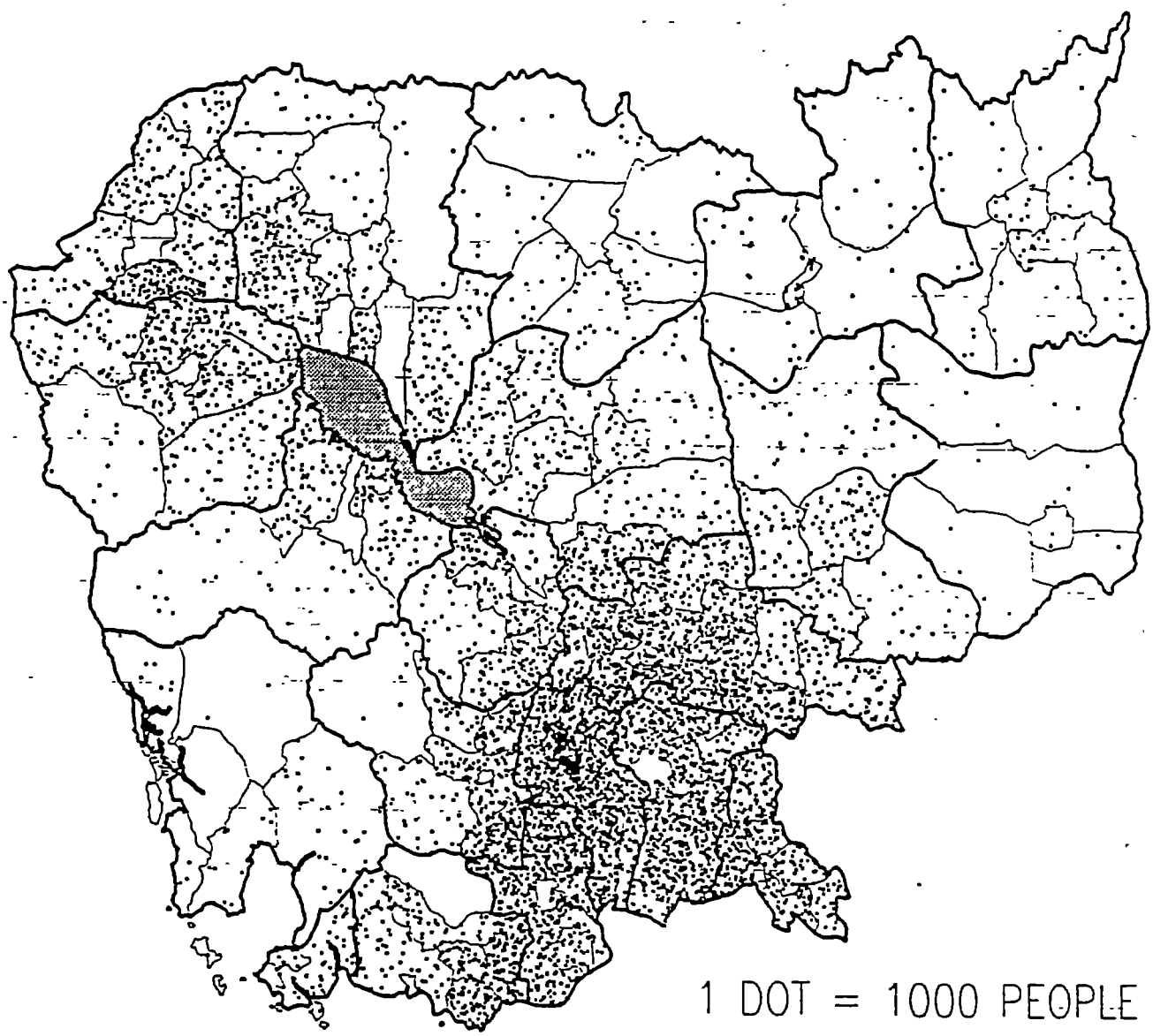
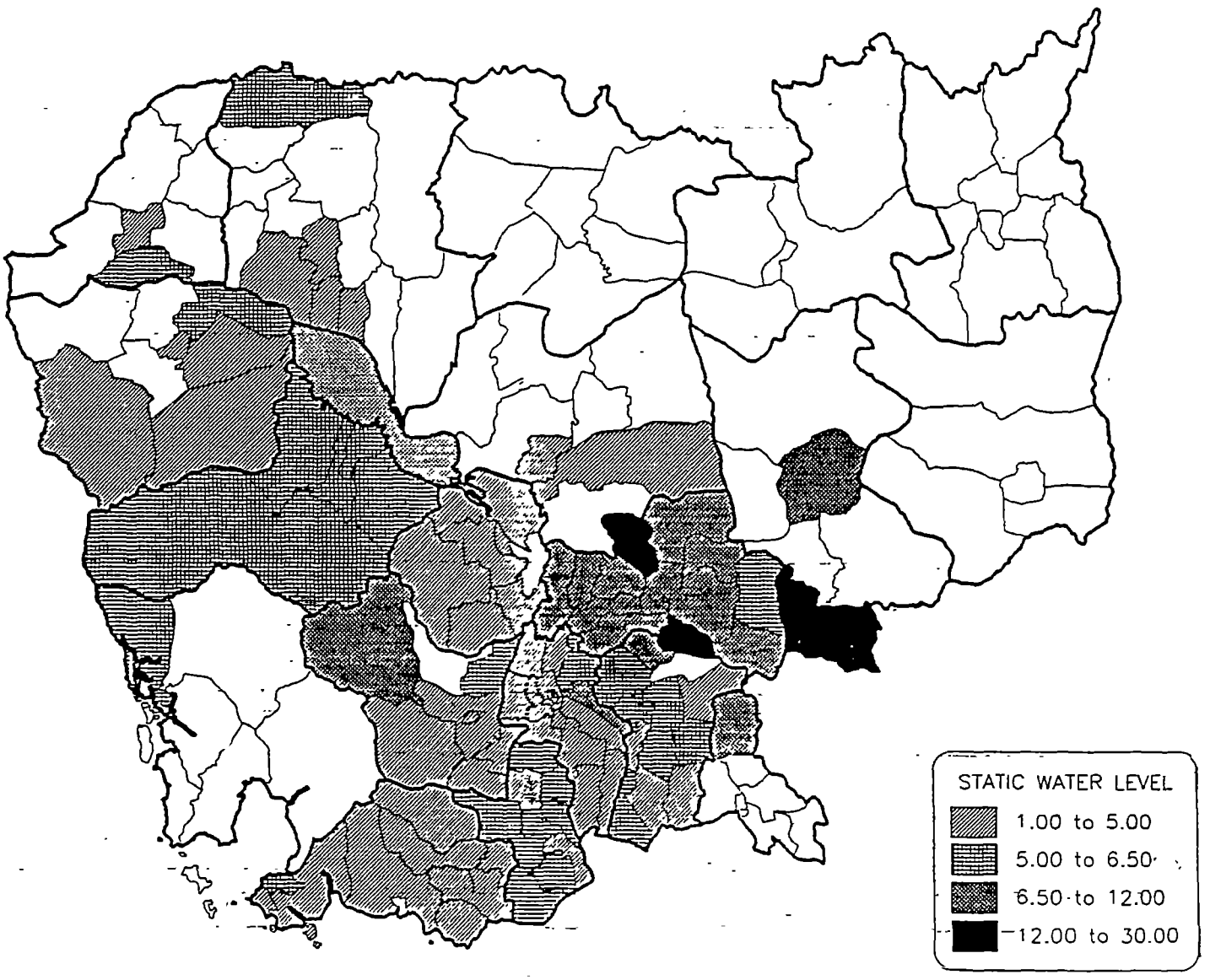
Yin Lorn	WVI (Kandal)
Waldemar Pickardt	UNICEF
Yohannes Hagos	Oxfam (Prey Veng/Svay Rieng)
Chea Seiha	UPM Rep
Johanne Siffointe	CARE

RURAL POPULATION IN CAMBODIA



STATIC WATER LEVEL



Annex

PROPOSAL

ESTABLISHMENT OF STANDARD SPECIFICATIONS FOR HANDPUMPS

Background:

It has been recognised world wide that some of the ways to overcome maintenance and operation problems in connection with providing handpumped drinking water, are by establishing uniformity among handpumps, by ensuring high production and installation quality etc. Furthermore, a maintenance and operation concept where the community takes over most of the responsibility for keeping their installation in working conditions will also have significant impact on the reliability of the handpumped water supply source.

The present proposal will discuss the introduction of standard specifications for handpumps. Issuing of such a specification should not be regarded as a purely technical issue. It should be looked at as a step towards improving the rural water supply sector and should therefore be seen together with other tasks such as, introduction of a village level operation and maintenance system, improved distribution of spare parts, monitoring of scheme performance, and establishment of local production of handpumps,

The advantage of having handpumps produced and installed according to standard specifications are:

- The number of types of handpump to be installed will be kept to a minimum,
- stock keeping of spare parts will subsequently become easier,
- mechanics will need to know about fewer pump types,
- parts from qualified manufacturers are interchangeable, and
- the introduction of standard specifications will also provide the chance to introduce the latest achievements within handpump development.

The following describes how establishment of standard specifications could be achieved.

Objective:

The objective of this task is to establish a set of standard specifications for public handpumps, and to have them endorsed by the responsible Government authorities, whereby it is ensured that all future public handpumps will comply with these standards.

Strategy:

The responsible authorities will give to a lead agency the task of preparing a recommendation based on which final decision regarding standard specifications will be made. The strategy below should be followed by the lead agency:

- It is essential that all organisations, agencies and NGOs, involved in rural water supply are given the chance to express their views and have an influence on the final selection of a handpump.

- The final selection will take place at a workshop where potential pumps will be presented and evaluated by the participants.
- A detailed study of the Cambodia situation with respect to ground water quality, water table fluctuations, number of pumps required etc., together with essential information regarding pumps considered , should form the basis for the selection procedure.
- Specifications should give details for any parts, so that parts from one manufacture are interchangeable with parts from another manufacture.
- A rating system could be considered as the evaluation tool,
- Parameters against which potential pumps will be rated will be given final approval by the workshop.
- Only pumps which have already proved their reliability, and can produce minimum two years of performance record will be considered.
- After standard specifications have been issued amendments if found necessary, will be issued by the responsible authorities, once a year. An annual workshop should review experiences of the past year, and forward recommendations.

Process:

A process which eventually will lead to issuing of standard specifications could look like the following:

- The authorities responsible for rural water supply give a lead agency the task of initiate and coordinate the process described below. The aim of this process is to prepare recommendations for standard specifications for a family of handpumps suitable for Cambodia.

- The appointed lead agency will collect all necessary background information. As a minimum they should collect:
- Lift requirement, the following categories are suggested:
  low lift 0 - 7 meters
  medium lift 7 - 15/20 meters
  high lift 15/20 - 45 meters
- number of existing handpumps by type and by location.
- expected total number of handpumps to be installed by category over a five year period
- expected user group size and quantity of water required
- expected annually replacement requirement
- for all potential handpumps collect:
  design specifications,
  lift and volume capacity,
  available performance data,
  VLOM status,
  corrosion and abrasion resistance,
  manufacturing needs, and
  capital and running cost

- The lead agency will also prepare an evaluation format, based on which rating of the included handpumps can take place.
- A workshop will be arranged by the lead agency where the above will be presented followed by selection of a handpump for each lift category.
- Following the workshop the responsible authorities will prepare and issue the final set of specifications.

The consequences of issuing standard specifications are:

- The authorities responsible for rural water supply issue instructions to all organisations, agencies etc. installing handpumps, that only the type of handpumps for which standard specifications have been issued can be accepted in connection with public water supply.
- All future installed handpumps will thereafter conform to the same set of specifications,
- A detailed specification will make quality control possible, subsequently, a quality control system should be introduced.
- Potential manufacturers will be encouraged to establish a production line. They will be provided with production specification, they do not need to concentrate on development of design as well.
- By issuing standards free to be used by potential manufacturers, a monopoly will be avoided,

Bent Kjellerup
Danish Cambodian Consortium
June 1992

taken from Evaluation Report UNICEF/OXFAM, 1992