SUMMARY REPORT

FUNCTIONING OF HAND PUMPS AND WATER USES IN SELECTED RURAL AREAS

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BHUBANESWAR
1984

A C K N O W L E D G E M E N T

ORG expresses its gratitude to UNICEF,New Delhi for entrusting this important and interesting research project. The approach to the study was conceived in consultation with UNICEF in several rounds of discussion. ORG takes the pleasure of putting on record the help received from Messers Elding, Grey, Mendis and Kumar in conceptualising the approach to the study. We are indebted to Mr.B.Elding for his continued participation in the study and the guidance given to us.

The findings of the study were discussed in a joint meeting with UNICEF and the Ministry of Works & Housing,Government of India. Based on the comments received the report was finalised. ORG takes this opportunity to express its sincere thanks to all those who participated in the discussion especially Messers Bevacqua, Elding, Mendis and Mathur of UNICEF,New Delhi and Mr.Nand Kumar of the Ministry of Works and Housing for their valuable suggestions which helped us in bringing the report to its present form.

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(B.B.SAMANTA)

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MAP OF
INDIA
SHOWING
LOCATION OF STUDY
DISTRICTS
RAJASTHAN
4
MADHYA PRADESH
3
ORISSA
1
TAMILNADU
2
1 MAYURBHANJ
2 TIRUNELVELI
3 JHABUA
4 AJMER

SURVEY ON THE FUNCTIONING OF HANDPUMPS AND WATER USES IN SELECTED RURAL AREAS

BACKGROUND

The importance of tubewells fitted with handpumps as sources of providing potable water to rural people is generally acknowledged; this is more so in India where the peculiar settlement pattern in the rural areas affords handpumps a distinct advantage over other modes of supply in terms of economy and coverage. As per the Planning Commission estimates (1980), the investment per capita on a handpump is Rs 60 as compared to Rs 250 on piped water supply. The World Bank estimates(1976), put the per capita cost of a tubewell with handpump at $ 3(US) as against $ 10(US) in case of piped supply through motorised pumps.

India, a signatory to the United Nations sponsored Water Supply and Sanitation Decade(1981-1990) which aims at providing potable water to cent percent of the rural population by 1990, has embarked upon a massive rural water supply programme. The programme has gathered a steady momentum over the past three years. However, considering the magnitude of the problem, there is still a long way to go before it reaches the goal. UNICEF which has been playing the role of a

catalyst in the various developmental programmes since the mid 1960's, is now an active partner to the Government of India in this endeavour.

Three years have passed since the water supply programme got a boost after 1980, and therefore, it is time that the functioning of the programme is given a once-over particularly with regard to coverage of the population by handpump and its efficacy as a source of drinking water. The master plan of cooperation agreed to between UNICEF and Government of India in 1982 envisaged among other things, a survey to be conducted by the UNICEF in selected villages to determine the appropriateness of the measures taken under the programme for providing potable water to the people. The survey was supposed to cover the functioning of the previously installed systems, socio-cultural patterns relating to the use of water collection practices, extent of community participation and so on. It is in this context that UNICEF entrusted ORG to carry out the present study in four selected districts viz. Mayurbhanj (Orissa), Tirunelvelli (Tamil Nadu), Jhabua (Madhya Pradesh) and Ajmer(Rajasthan). This report summarises the findings of the survey undertaken in these districts.

OBJECTIVE AND SCOPE

The major objectives of the study are, (1) to evaluate the operation of handpump in rural areas with emphasis on siting, quality of installation, maintenance and repair, (2) to assess the coverage of handpumps (how much water to how many users), and (3) to analyse the water consumption and water collection habits of the people. The scope of the study which was agreed upon in consultation with the UNICEF can be seen from Annexure-I.

The four districts selected by UNICEF had a substantial number of India Mark-II Handpumps installed in them. While geographical distribution was one criterion, the other criteria were the degree of UNICEF's involvement, the agencies responsible for maintenance of handpumps and other variations in the maintenance system and also the population composition (tribals and non tribals). This Tirunelvelli of Tamil Nadu state in the southern region is the first district where the 3-tier system of maintenance was field tested. Similarly, Mayurbhanj -a predominantly tribal district (in Eastern India)- was the first district in Orissa state where the 3-tier system was introduced. In contrast an entirely different system of maintenance is being tried out in Ajmer district of Rajasthan(northern India). Finally, Jhabua, a tribal

While selecting households for canvassing, a detailed house-listing was undertaken in the village to identify those households which used community handpumps. After identifying all the user households which now formed the universe, 10 to 25 households per village were selected for canvassing the household schedules. These households are referred to as "user households" in the report.

The study eventually covered 19 blocks, 205 villages, 2550 user households and 1254 handpumps. This worked out to 25% of blocks and 12% of pumps in the study districts. The average number of villages covered per block and the number of households interviewed per village worked out to 11 to 12 respectively. The details of sample covered in each of the four districts can be seen from Table-1.

APPROACH AND METHODOLOGY

In view of the complexity of the situation it was considered necessary to obtain the required data through various methods which included measurements, observations, questionnaires and collection of secondary data. In addition, tertiary data as available from various studies were also obtained mainly for the purpose of comparison when required. In order to avoid the hazards of subjective judgement, data on various aspects were collected through actual measurements.

For instance, the investigators were provided with spirit levels to make sure that the pedestals of the pumps were vertically mounted. Similarly the carrying capacity of vessels generally used in the study area was measured by appropriate methods. Observations on water collection practices of a household, the firmness of pedestal, the intensity of pump use, the physical features of platforms and the like were also recorded.

Three types of schedules were used for collection of data for the study. These were: (1) village schedule, (2) household schedule, and (3) handpump schedule. The field enquiry was carried out by a group of well trained field investigators under the direct control of a group of supervisors and overviewed by the concerned professionals. The questionnaires used for the survey were field tested and finalised in consultation with UNICEF.

The training of the investigators lasted a week which included both classroom training and field exposure. On completion of this part of the preparatory work, individual teams were formed consisting of 6 investigators and one supervisor. In each team, two or more of the investigators were women. Initially, the teams worked in a compact area under the

close supervision of the professionals. Such controlled canvassing was considered necessary to ensure uniformity in the understanding of all the team members with regard to various concepts involved in data collection and their interpretation.

PROFILE OF THE STUDY AREA

In Table-2 a comparison has been made among the four districts through a set of selected indicators. The objective is to get a backdrop of the study area which would facilitate understanding of the findings and appreciation of the associated issues. The districts under study do present significant variations in their physical, social and economic features. We have thus a small district like Jhabua which has a geographical area of 6781 sq.kms. and a population of 0.80 million of which 0.73 million live in rural areas. On the other hand, Tirunelvelli has 3.56 million people spread over an area of 11,429 sq.kms., of which 2.32 million live in rural areas.

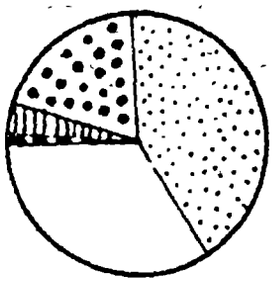
In terms of growth, density and composition of population, the four districts show a wide divergence. The decadal population growth (1971-81) ranges from as low as 9.96% in Mayurbhanj to 25.50% in Ajmer. Tirunelvelli is the most densely populated district of the study area, the density

of population being 311 per square kilometre. In contrast Jhabua has only 117 persons per square kilometre.

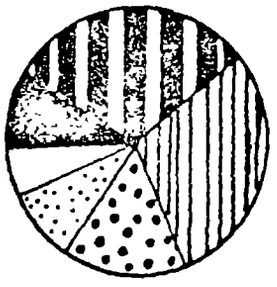
As regards the population composition, Jhabua and Mayurbhanj are predominantly tribal districts; 96% of the total rural households in the former and 50% in the latter are tribals. Tirunelvelli and Ajmer, the two upper caste dominated districts have fewer tribal households but more scheduled caste families (20% to 25%). Tirunelvelli shows the lowest household size among the study districts(5.10 members) and Ajmer the highest (5.60 members).

The population composition in the four district is very much reflected in the size of villages. It is generally observed that areas with larger tribal population have villages of relatively smaller size. This is probably the reason why the average size of villages in Jhabua (532) and Mayurbhanj(400) is much smaller compared to Ajmer(892) and Tirunelvelli(2383). While,three-fourths(75.36%) of the villages in Mayurbhanj and two-thirds(66.66%) in Jhabua have a population of less than 500, the corresponding figures for Tirunelvelli and Ajmer are 14.68% and 42.91% respectively. Tirunelvelli is one district where the size of villages is very large and in fact that population of some of the hamlets is more than the average size of a village in the other three districts.

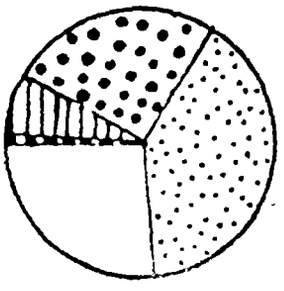
VILLAGES BY POPULATION



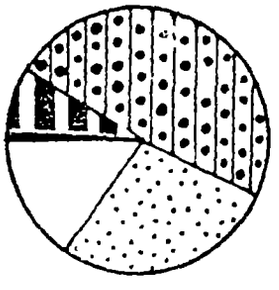
MAYURBHANJ



TIRUNELVELLI



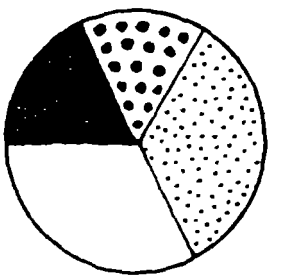
JHABUA



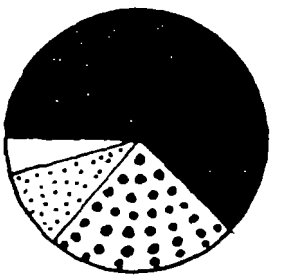
AJMER

- LESS THAN 200
- 200 TO 499
- 500 TO 999
- 500 TO 1999
- 1000 TO 1999
- 2000 TO 4999
- MORE THAN 5000

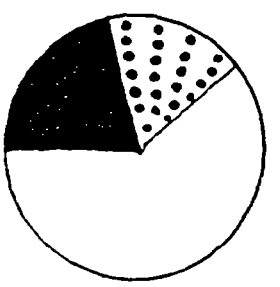
VILLAGES BY NUMBER OF HAMLETS



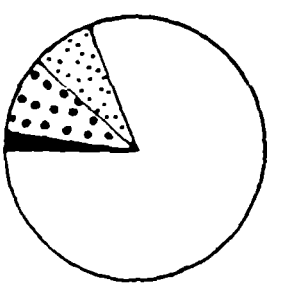
MAYURBHANJ



TIRUNELVELLI



JHABUA



AJMER

NO HAMLET

2 HAMLETS

1 HAMLET

3 HAMLETS OR MORE

However, a peculiar feature of this district is the large number of hamlets (or habitations) per village. Only 3% of the villages in Tirunelvelli have no hamlets whereas in over half of the villages there are 4 or more hamlets. The situation is just reverse in case of Mayurbhanj, Jhabua and Ajmer.

In terms of literacy, Tirunelvelli has an edge over all the others. The rate of literacy in Jhabua is extremely low (7.01%). Only 3% of females are literate in this district as compared to 35% in Tirunelvelli. But in all the districts the participation rate of females in the work force is much lower than that of males. Cultivation and labour are reported to be the two most important occupations of the households. In this respect, Tirunelvelli shows certain amount of diversification in terms of non-agricultural activities whereas Jhabua is almost totally dependent on agriculture.

In the villages with handpumps, openwell is the major alternative source available. In Mayurbhanj and Tirunelvelli, however, apart from these two sources tank is also another important source.

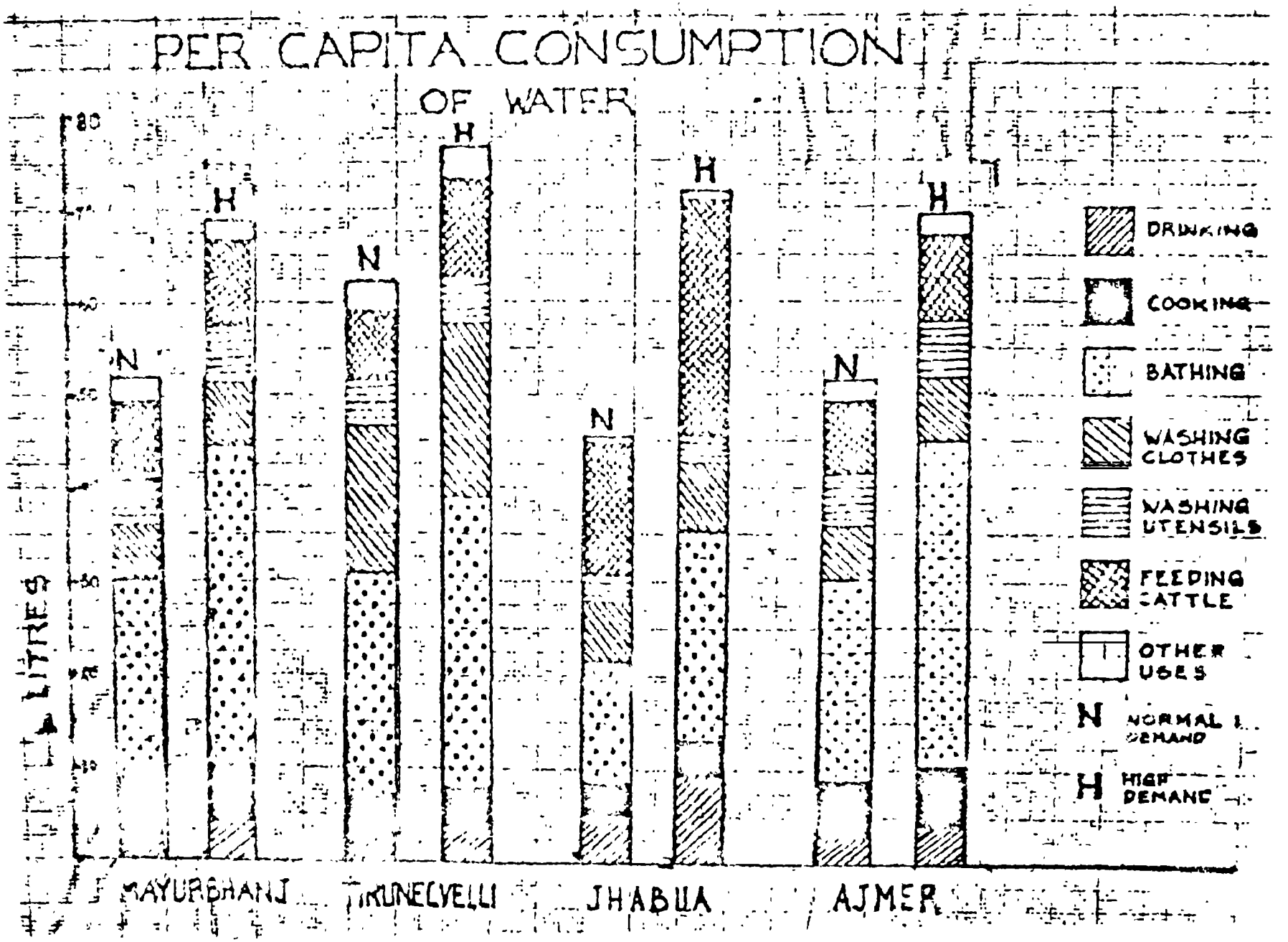
HOUSEHOLD WATER CONSUMPTION

The Manual of Water Supply and Treatment published by Ministry of Works and Housing envisages a supply rate of 70 litres per capita per day through house service connections and 40 litres through standposts and handpumps.

In the present study per capita water consumption has been estimated separately to reflect the seasonal variation in the study area. For this purpose, a distinction has been made between normal months and high demand months. While high demand months range from March to June, normal months refer to the rest of the year.

The daily per capita water consumption and for different purposes in normal and high demand months can be seen from Table-3. In normal months water consumed per capita / day varies from 45.49 litres (in Jhabua) to 62.99 litres(in Tirunelvelli)- a variation of 17.5 litres. However, such variation is marginal between Ajmer and Mayurbhanj; the per capita consumption ranging between 52-54 litres in normal months to 70-73 litres in high demand months.

In high demand months the level of water consumption goes up by 58% in Jhabua, 36% in Mayurbhanj, 35% in Ajmer and 22% in Tirunelvelli. Variations in the per capita water consumption between and within the districts can be attributed


PER CAPITA CONSUMPTION
OF WATER
LITRES
80
60
40
20
N
H
MAYURBHANJ
TIRUNELVELLI
JHABUA
AJMER
DRINKING
COOKING
BATHING
WASHING CLOTHES
WASHING UTENSILS
FEEDING CATTLE
OTHER USES
N NORMAL DEMAND
H HIGH DEMAND

to (1) difference in food habits, (2) differences in climate, (3) ownership pattern of cattle, and (4) other cultural practices.

It is observed that rice-eaters require more water for cooking but less for drinking than do 'chapati' eaters, because the cooking of rice as well as the side dishes that go with it entails greater consumption of water. Our analysis of the rate of water consumption for drinking and cooking in the sample districts indicates this pattern. Thus the consumption of water for cooking is higher compared to that for drinking in Mayurbhanj and Tirunelvelli districts where people eat rice. The situation is reversed in Ajmer and Jhabua districts where 'chapati' is the staple food. The pattern remains unaltered irrespective of the seasonal variation.

It was also obtained that the variation in temperature between the normal and high demand season is higher in Ajmer and Jhabua compared to Mayurbhanj and Tirunelvelli. The former also have a relatively dry weather and extreme climate. This explains the higher consumption of drinking water in general as well as the larger variation between seasons noticed in the former set of districts compared to the latter.

As regards bathing and washing clothes Tirunelvelli presents a picture distinctly different from others. In this area people generally wear white clothes(lungis), which require more frequent washing, and are relatively more particular about personal hygiene in terms of cleanliness; a reason why in Tirunelvelli the per capita water consumption for bathing and washing is higher as compared to other districts.

Ajmer is one of the districts where cattle population is very high. It is observed that dairy is an important subsidiary occupation with a large proportion of the rural households and hence water consumption for feeding the cattle is the highest in Ajmer. Jhabua which comes next also has a very large buffaloe population which require larger quantity of water than cows/bullocks do.

COVERAGE OF HANDPUMPS

The average number of households using handpump per village in either season varies from 48 in Mayurbhanj to 219 in Tirunelvelli, the corresponding figures for Jhabua and Ajmer being 55 and 126 respectively(Table-4). This is consistent with the average population of a village in these four districts. But in terms of percentage of household using handpump the figures are quite different. Thus while in Ajmer 79% of households use handpumps, it is as low as 47%

in Tirunelvelli. In Mayurbhanj and Jhabua user population is restricted to 55% and 57% of households respectively.

Not all the user households however depend upon handpumps for drinking and cooking. The number of households per village actually using handpumps for these two purposes varies from 39 in Mayurbhanj to 125 in Tirunelvell. They constitute 81% to 57% of the total user households in the two districts respectively. Jhabua is one district where the dependence of households on handpump from drinking and cooking is very high; 98% of the user households in this district use handpumps for the two purposes. The probable reason for such a high dependence is that no suitable alternative sources are available particularly during high demand months. In addition, most of the pumps (99.38%) surveyed were reported to be yielding water suitable for drinking and cooking.

The average user households per pump are 40 in Tirunelvelli, 34 in Ajmer, 28 in Jhabua and 27 in Mayurbhanj. However variation with regard to the number of households using handpump for drinking and cooking is much less between districts. Computed this way we have in Mayurbhanj 22 households per pump, in Tirunelvelli 23, in Jhabua 28 and in Ajmer 29. In terms of population the average works out to 113 in Mayurbhanj, 117 in Tirunelvelli, 150 in Jhabua and 162 in Ajmer.

The coverage of handpumps can also be viewed from another angle, -their share in the total water consumption of a household during high demand months. In Table-4 the share of handpump in overall water consumption as well as in the quantity consumed for drinking and cooking has been presented separately. While the contribution of handpump to total water consumption ranges between 40%(Mayurbhanj) to 82% (both in Jhabua and Ajmer), its share in the household requirement for drinking and cooking is consistently high.

Although in Ajmer and Jhabua some alternative sources are available, they are not very reliable since larger part of the year they remain dry. It is only for brief periods after the rains that they contain some water. In fact, in Ajmer besides handpumps practically the only other source used is openwells. This is probably the reason why the share of handpumps in the total water consumption is so high in Ajmer and Jhabua.

In a district like Jhabua 98% of the drinking water consumption is met from handpumps, followed by 80% in Mayurbhanj, 68% in Ajmer and 56% in Tirunelvelli.

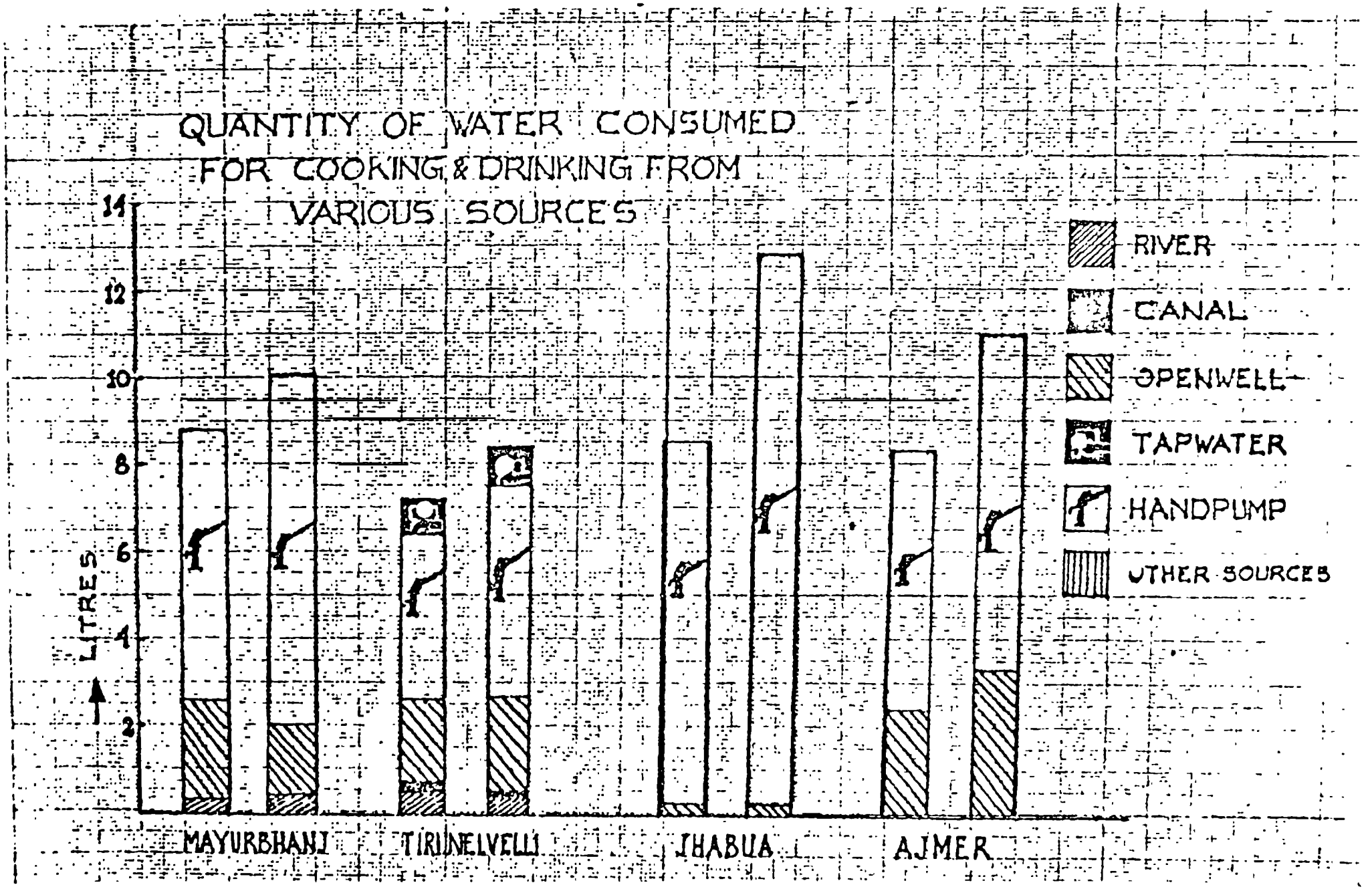
A more or less similar trend is noticed with regard to the cooking water requirements. Thus the coverage of a handpump

is larger in terms of household water consumption than in terms of the number of actual users.

Besides drinking and cooking handpump is used for other purposes as well. This can be seen from Table-5. It is pertinent to note that sometimes the percentage of households using handpumps for other purposes is much higher than that for drinking and cooking. Thus in Tirunelvelli 78% to 82% of the households depend upon a pump for washing utensils while only 50% to 57% use it for drinking/cooking. Usage rate for other purposes is also quite high in Jhabua and Ajmer. In semi-arid areas like Ajmer where there is scarcity of water, handpumps are extensively used even for feeding cattle.

Except in Jhabua, where almost the entire demand of water for cooking and drinking is met by handpumps, in the other three districts openwells serve as a supplementary source. While the share of handpumps in these districts ranges between 5-8 litres the share of openwell never exceeds 3 litres. The use of other sources for drinking/cooking remains minimal (Table-6).

Openwell therefore is the only other competing source worth mentioning. In fact, the earlier programme of rural water-supply centered mainly around community openwells, later


QUANTITY OF WATER CONSUMED
FOR COOKING & DRINKING FROM
VARIOUS SOURCES
LITRES
14
12
10
8
6
4
2
RIVER
CANAL
OPENWELL
TAPWATER
HANDPUMP
OTHER SOURCES
MAYURBHANJ
TIRUNELVELI
JHABUA
AJMER

substituted by sanitary wells. Thus the predilection for openwells is yet quite strong. This is more so among the relatively affluent who have their own wells. But one interesting point which emerges is that the additional consumption during high demand months is met more from handpumps than from openwells. This establishes that handpump is a more reliable source of water particularly during the summer season when other surface sources including openwells are not so dependable.

While planning for the installation of handpumps the State Governments have laid down certain guidelines with regard to the priority of siting. For example, in Rajasthan the first priority has been to instal a handpump in a hamlet inhabited by Scheduled Caste or Scheduled Tribe population. In the remaining 3 districts even though there is no such official communication, the understanding has been to give priority to hamlets housing weaker sections of the community(Scheduled castes and scheduled tribes).

In this connection, it may be pointed out that a village in the Indian context does not necessarily mean a contiguous patch of habitation. In many areas a village has several habitations or clusters of settlements(known as hamlets) which could be a few kilometres away from one another.

Further, it is also seen that each hamlet is more or less dominated by a particular community. This is more conspicuous in respect of Scheduled Castes and Scheduled Tribes who traditionally live in homogenous clusters. Thus in a village we may see one hamlet inhabited solely by the Tribes, one by Scheduled Castes, and another one by the weavers alone and so on. Hence availability of a handpump in a village does not ensure its utilisation by all segments of the population particularly the backward communities (Scheduled Caste and Scheduled Tribe). However, it is heartening to note that the usage rate among the scheduled castes and scheduled tribes is quite comparable with the usage rate among upper caste households.

In some cases, the percentage of households using handpump is relatively higher among scheduled castes and scheduled tribes as compared to others(Table-7). For instance, one notices that in Mayurbhanj over 70% of the scheduled caste households use handpumps as compared to 59% of upper caste households. Similarly, in Ajmer 89% of the Scheduled Tribe population use handpump as against 80% of upper castes. Even in the tribal dominated districts of Mayurbhanj and Jhabua the percentage of tribal population using handpump is quite close to that of upper caste. Thus it appears that the benefit of handpump has

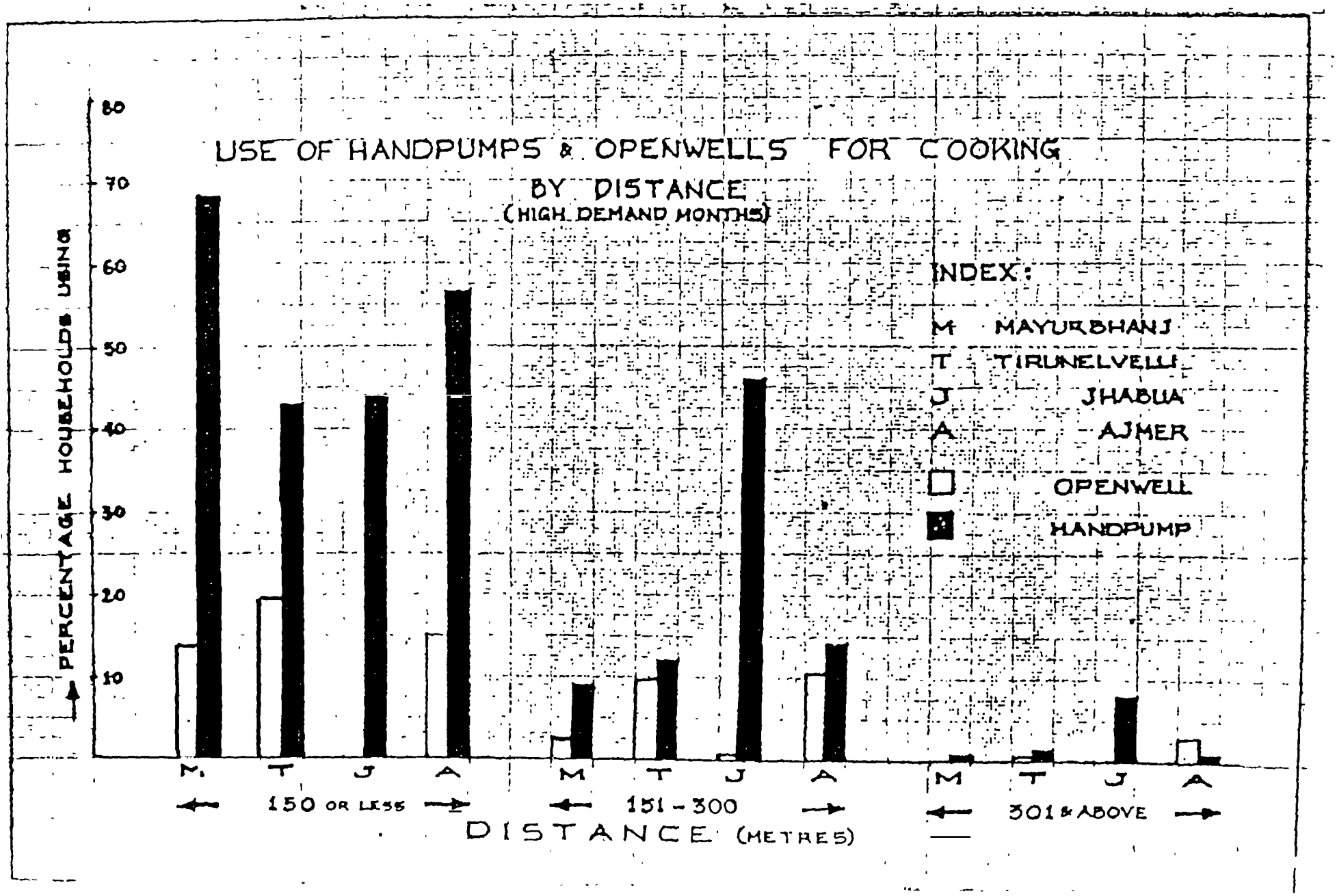
accrued to all the three major segments of the population viz. Scheduled Castes, Scheduled Tribes and upper castes. Such problems of social distance as exist in a village are of no particular relevance as long as a hamlet with predominantly backward population is provided with a pump.

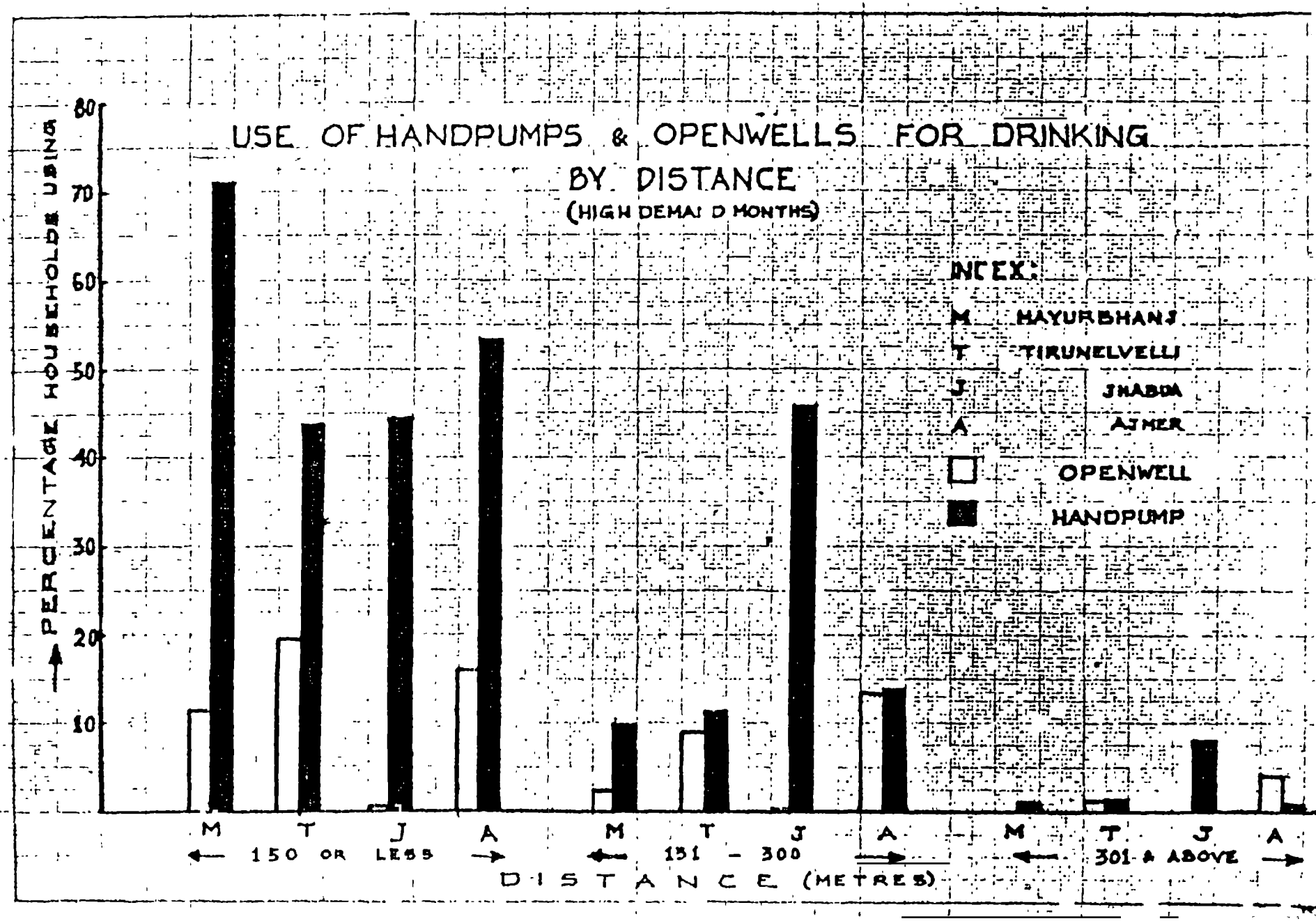
Only in cases where such hamlets are not provided with pumps can one anticipate certain social conflicts. As regards the location of a pump, it is physical distance rather than social distance which affects usage rate, as we shall see a little later.

What emerges from the preceding analysis is, irrespective of the social formation of a village, all households do not use handpump although it has been provided within the village. Even the user households do not seem to depend solely on this source. Since the intention is to provide the entire rural population with a source of potable water it is necessary to investigate as to why households do not use handpumps even when they are available in a village. In this connection, the following reasons are worth mentioning:

First, the settlement pattern in the districts is a major factor in determining the degree of usage of handpumps. This emerged from a comparison drawn between two sets of villages, categorised as 'high usage' and 'low usage' villages based on the extent of handpump usage. While the former included those where cent percent usage was noticed, the latter included those showing an average usage lower than the district average. Data on the size of these villages, the number of habitations within them, the number of pumps available etc. have been presented in Table-8 for two districts viz. Mayurbhanj and Ajmer. It is noticed that, villages with a larger number of habitations (hamlets) have a lower usage rate. Smaller the village better is the coverage. Here it may be clarified that even in small villges if the houses are scattered, the coverage tends to fall.

All these above evidences lead us to believe that the physical distance of a handpump from its potential users appears to be a determinant of the extent of its utilisation. This is substantiated in Table-9, where the utilisation rate for two important purposes -drinking and cooking has been represented. It can be seen that the percentage of users shows a sharp decline beyond 150 metres except in Jhabua where such decline is noticed only beyond 300 metres. The number of handpump


USE OF HANDPUMPS & OPENWELLS FOR COOKING
BY DISTANCE
(HIGH DEMAND MONTHS)
INDEX:
M MAYURBHANJ
T TIRUNELVELLI
J JHABUA
A AJMER
OPENWELL
HANDPUMP
PERCENTAGE HOUSEHOLDS USING
80
70
60
50
40
30
20
10
M T J A M T J A M T J A
150 OR LESS
151 - 300
301 & ABOVE
DISTANCE (METRES)

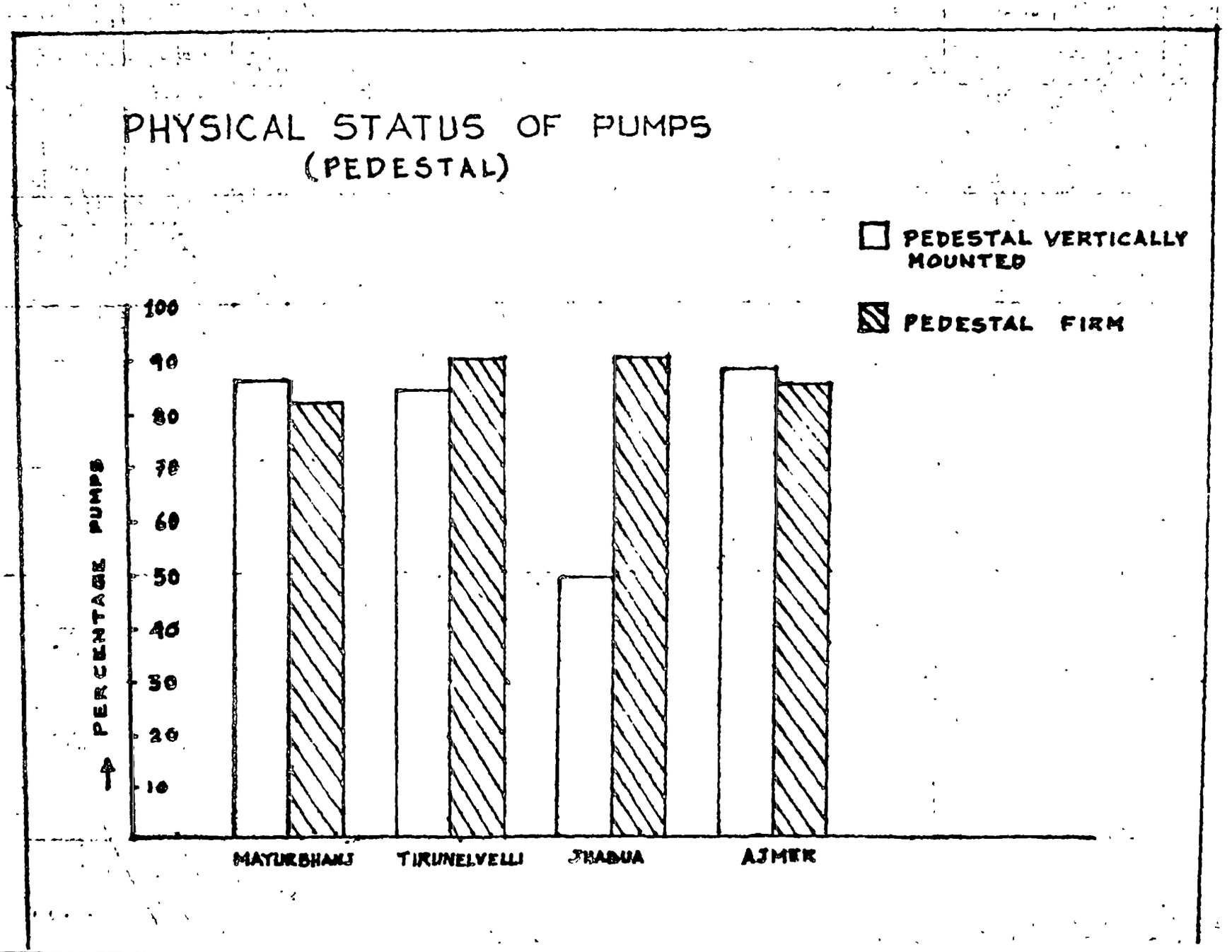

USE OF HANDPUMPS & OPENWELLS FOR DRINKING BY DISTANCE
(HIGH DEMAND MONTHS)
INDEX:
M MAYURBHANJ
T TIRUNELVELLI
J JHABUA
A AJMER
OPENWELL
HANDPUMP
PERCENTAGE HOUSEHOLDS USING
80
70
60
50
40
30
20
10
M T J A M T J A M T J A
150 OR LESS
151 - 300
301 & ABOVE
DISTANCE (METRES)

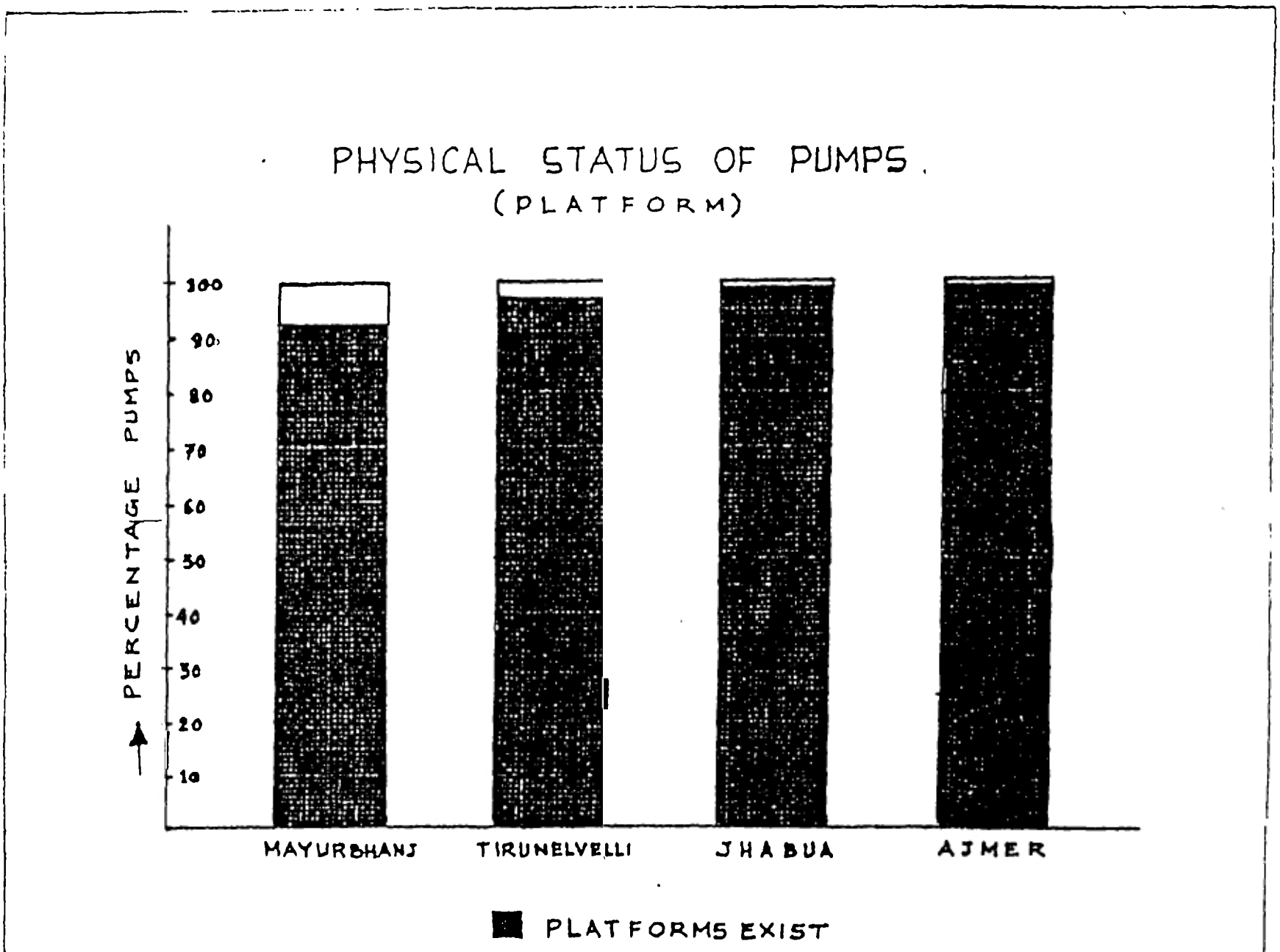
users generally falls to a negligible figure when the distance exceeds 300 metres. This is true even in respect of the other water sources(Table-10).

Secondly, within a village/hamlet the location of the pump is equally significant from the point of view of its usage. In rural areas since it is mostly women of the households who collect water, pumps installed in public places like weekly market, bazar, panchayat office, bus stand, school etc. are generally avoided by them for social reasons. Also, if a pump is installed at one extreme end of the village utilisation rate gets reduced to some extent.

Thirdly, households who have openwells in their courtyard prefer to use them rather than travel longer distances to reach a handpump. This is more so among affluent groups who can afford to invest in openwells. Primarily low level of awareness regarding health and hygiene coupled with easy accessibility of an alternate source determines this preference pattern.

Lastly unsuitability of pump water for drinking and cooking-real or perceived -also at times reduces the extent of usage. As may be seen from Table-11 except for Jhabua, in the remaining three districts, the yield from a sizeable

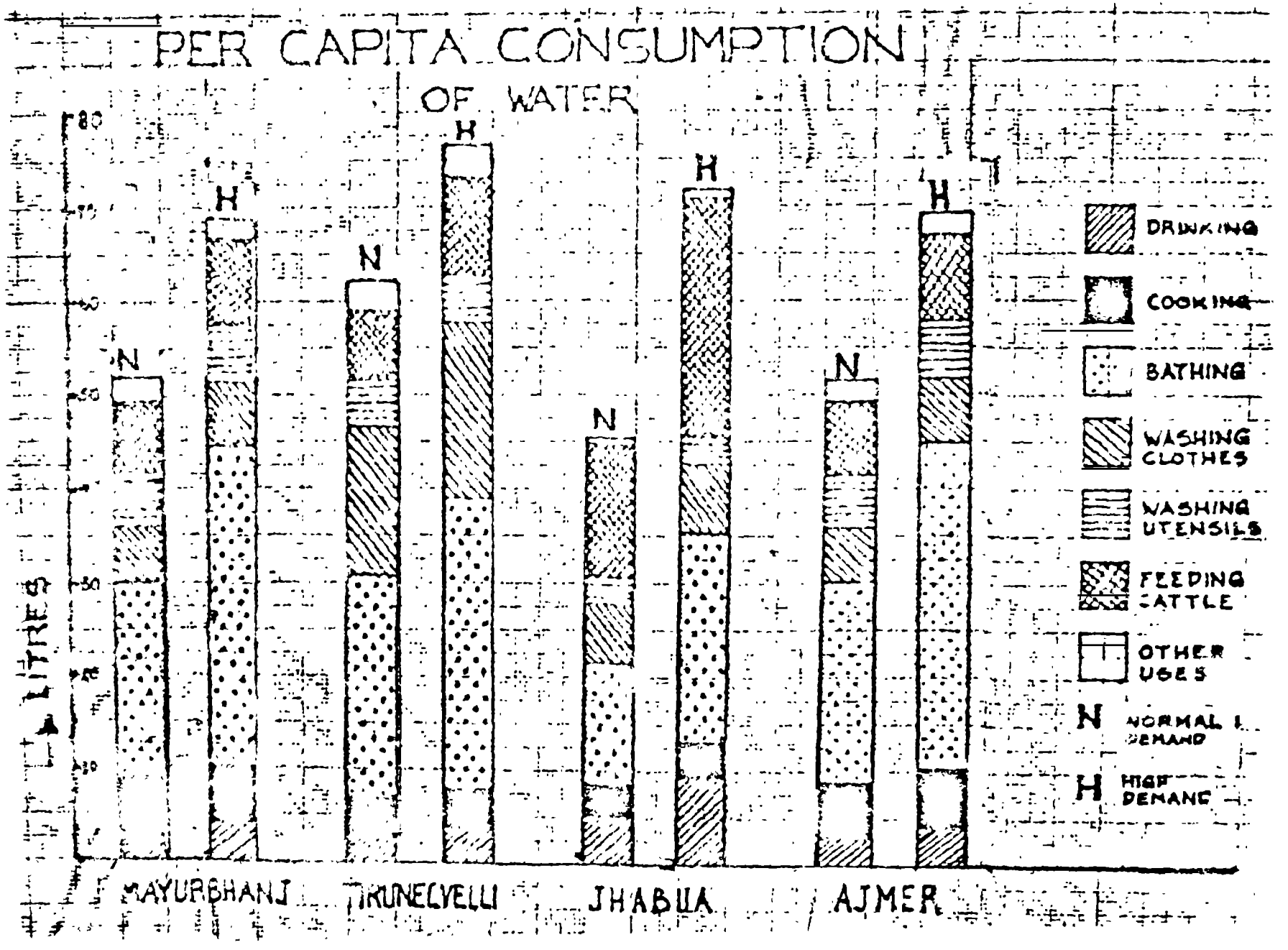

PHYSICAL STATUS OF PUMPS
(PEDESTAL)
PEDESTAL VERTICALLY MOUNTED
PEDESTAL FIRM
PERCENTAGE PUMPS
100
90
80
70
60
50
40
30
20
10
MAYURBHANJ
TIRUNELVELLI
JHABUA
AJMER


PHYSICAL STATUS OF PUMPS
(PLATFORM)
PERCENTAGE PUMPS
100
90
80
70
60
50
40
30
20
10
MAYURBHANJ
TIRUNELVELLI
JHABUA
AJMER
PLATFORMS EXIST

percenge of pumps was not eonsidered suitable for drinking and cooking. 18% of the pumps in Tirunelvelli and 23% in Ajmer were considered unsuitable for drinking purposes while in Mayurbhanj it was as high as 36%; 'small of iron', 'saline taste', 'foul smell', 'muddy water', 'film over stored water' and 'hard water' are cited as various reasons most often. As regards unsuitability of handpump water for cooking, the responses were varied as 'rice tastes bad', 'pulses do not boil', 'rice cooks dark', 'smell of kerosene' and so on.

In Mayurbhanj smell of iron has been reported as a major reason for quite a few pumps not being used by the households for drinking. Our field observation also showed that when the water from some handpumps was stored for a few hours a thin film probably of iron oxides appeared over the water. In Tirunelvelli and Ajmer saline taste of water has been a major deterrent to the use of pump water for drinking.

In Tirunelvelli, Mayurbhanj and Ajmer it appears that rice cooked in pump water does not taste good in some cases and hence discourages households to use the pump. There is also a very storage feeling in certain areas that pulses do not boil in pump water.


PER CAPITA CONSUMPTION
OF WATER
LITRES
80
60
50
40
30
N
H
DRINKING
COOKING
BATHING
WASHING CLOTHES
WASHING UTENSILS
FEEDING CATTLE
OTHER USES
N NORMAL DEMAND
H HIGH DEMAND
MAYURBHANJ
TIRUNELVELLI
JHABUA
AJMER

While it was possible to physically verify the truth with regard to suitability of handpump water for drinking, it could not be ascertained for cooking. However in one village in Tirunelvelli an experiment showed no perceptible difference between handpump water and well water in cooking pulses. Nevertheless, the fact remains that the people have developed some sort of negative stereotype about handpump water. It is necessary to find out the truth and educate them so as to improve the extent of handpump usage.

INTENSITY OF HANDPUMP USAGE

On an average a handpump is used for 8 hours a day during normal months except in Jhabua where the number of working hours is reported to be less than 7. In high demand months it goes upto 10 in Mayurbhanj and Jhabua, 11 in Ajmer and 12 in Tirunelvelli (Table-12).

Generally the peak period of usage in a day varies between two to four hours during normal months and three to six hours during high demand months.

Over 97% of households collect water from the handpump through their family members; the rest who belong to the relatively more affluent group engage servants for the task. 70% to 90% of the total number of persons collecting water are females. The average number of persons collecting water varies from

1.37 in Mayurbhanj to 1.73 in Ajmer during normal months and this goes upto 1.50 and 1.80 during the high demand months respectively (Table-13). Generally a person makes 3 to 5 trips per day during normal and 4 to 7 trips during high demand months.

The average time spent per trip is estimated to be between 10 to 14 minutes, the range of variation being 10-12 minutes in normal months to 12-14 minutes during high demand months.

As regards the type of vessels used earthen pot is quite common in 98% or more of the households in Jhabua and Ajmer. In Mayurbhanj, too, two-thirds of the households use earthen pot to collect water from handpump. Only in Tirunelvelli less than 6% use earthen pot; metal pot is very popular in Tirunelvelli and also in Ajmer. Cleaning of vessels and straining the water during collection is observed commonly in Jhabua and Ajmer. Most households merely rinse the vessels with plain water (Table-14) except in Mayurbhanj in the other three districts the vessels are scrubbed with ash and soil and rarely though with soap.

INSTALLATION

The programme for providing potable drinking water through handpump gathered momentum after 1980. An analysis of the information on handpumps surveyed by us reveals this. As may be seen from Table-15, except for Tirunelvelli, in the remaining three districts, majority of the pumps have been installed during the last three years(between 1981-84). Even in Tirunelvelli 34% of the pumps have been installed during or after 1982.

That the programme of rejuvenating the old pumps with India Mark-II pumps has gained ground is quite apparent from the ratio of new pumps to the rejuvenated ones (Table-16). This is probably the reason why except for Tirunelvelli, where Jalna type of handpumps are still in use in a few pockets, in all the other districts the pumps (installed on deep tubewells) at present are India Mark-II types.

The process of installing a pump passess through three phases -drilling, construction of platform and installation of pump. In fact, the prooess of installation is initiated before the drilling operation. During this stage it is expected that a survey team should conduct a feasibility study in the village and solicit the opinion of the villagers with regard to a suitable site where the pump could be located. This can be termed as the pre-installation stage.

borewells, absence of a technical study does not appear to be a major problem except in cases where the quality of yield is unacceptable.

As regards consultation with the villagers on site selection, the percentage of pumps for which this was reported varied from 69% in Jhabua to 97% in Mayurbhanj. The corresponding figures for Tirunelvelli and Ajmer are 75.30% and 93.42% respectively. In this connection, it may be mentioned that the results of the study should be interpreted in the context of locating a pump in a hamlet rather than in a village. The survey team is usually given the name of the particular hamlet in a village where the pump is to be installed. Hence on reaching the hamlet they consult only the people residing in that particular hamlet rather than all the inhabitants of the village. Of course some of the elected representatives of the village like Sarpanch, Ward Member etc. are consulted irrespective of the hamlet in which they reside. In actual practice it has been noticed that only after drilling operation in a particular village is undertaken the next village/hamlet on the list is consulted regarding site selection. Sometimes, if the villagers come to know that a

pump is going to be installed in their village they approach the drilling team in advance to select the location. Hence depending on the situation, the time given to the villagers to decide about the location varies any where from one day to one month before the drilling operations commence.

As regards the agency carrying out the drilling operations the situation differs from district to district (Table-17). In Mayurbhanj only in 9% of the pumps surveyed, the bore-wells were drilled by the Government Department, while the rest were executed by the Private contractors. We were informed that given the magnitude of the drilling operation and the short time frame, the resources available with the district PHED office were not adequate to carry out the drilling operation departmentally. Ajmer is another district where only 30% of the drilling operations were carried out by the Department. In contrast, almost cent percent of drilling in Jhabua and 70% of drilling in Tirunelvelli were done departmentally. Of course there was a short period in Tirunelvelli too, during which private contractors were engaged to take up drilling operations. The State was hit by a severe drought during 1982-83 and the Rural Water Supply Programme was taken up on a crash basis.

Generally once the drilling operations are over, the platform has to be built before the pump is installed and made operational. It is suggested that a week should be allowed for the concrete used in the platform to cure before the pump is finally made usable. Thus it is expected that the minimum time lag between drilling and installation would be at least a week, assuming a continuity in the installation process.

In caseswhere the drilling agency is different from the agency carrying out the construction of platform it results in a lack of coordination causing delays in construction of the platform. In this connection, it is worthwhile to examine which are the agencies involved in construction of platforms and final installation of the pump in the selected districts. In Mayurbhanj, while construction of platform is the responsibility of PHED, installation of pumps is done through private contractors. In Tirunelvelli and Ajmer both construction of platform and installation is done by the private contractors and in Jhabua both these phases are the responsibility of the Department. This is probably the reason why in Jhabua for 90% of the pumps the time lag between drilling and installation has not exceeded a fortnight. In contrast in Mayurbhanj, where the work is shared between the

GOvernment and private contractors, the time lag has invariably been over a fortnight. This can clearly be attributed to a communication gap and lack of coordination between involved parties. In Ajmer too since drilling operation and construction of the platform are done by two separate agencies the time lag appears to be quite high. All these indicate that if the various phases of installation are handled by a single agency the process can be speeded up.

While setting up a pump it is expected that certain specifications are adhered to for quality installation. Information on these aspects were collected through physical checks and observations.

While vertically mounted pedestals could be noticed in 90% of the pumps in Ajmer, 86% of the pumps in Mayurbhanj (86%) and 84% of the pumps in Tirunelvelli, in Jhabua where all the phases of installation is done through Government department, only in 49% of the pumps the pedestal was found to be mounted vertically . However, with regard to the firmness of the pedestal, Jhabua seems to be fairing better; in 98% of the pumps the pedestal was firm. In other districts it varies from 83% to 90%.

Only a few pumps in Jhabua and Ajmer did not have platform on the date of our visit. For Tirunelvelli and Mayurbhanj the

percentages of pumps without platforms were 2 and 8 respectively. Thus, by and large most of the pumps had platforms.

The survey also provided information on the approximate drilling depth, water table and cylinder depth. The average drilling depth of the borewells on which the pumps are installed varies anywhere between 37 metres (in Ajmer) to 57 metres(in Jhabua). But with regard to water table the variations are between 20 metres to 30 metres respectively. As regards cylinder depth, the specification is to instal the cylinder at a minimum depth of 24 metres; in all the districts surveyed the reported depth was greater than this limit. Thus in Tirunelvelli the average cylinder depth was 27 metres and in Ajmer 34 metres (Table-18).

While all the pumps had drainage in Jhabua, only 85% in Ajmer had drains (Table-14). However, in this connection it may be mentioned that construction of the soakpit as an outlet for the water spilt from the pump has not been taken up as per specifications. Although there are a few pumps which have soakpits, these are very crudely made.

In concluding it may be said that except for the delay in the installation of pumps after the completion of the drilling operations the quality of installation appears to be

satisfactory except in Jhabua where in over half of the pumps the pedestals were not vertically mounted. However, a closer examination by year of installation does indicate that whenever the installations were taken on a crash basis the quality deteriorated. For instance, in Mayurbhanj, where the maximum number of installations were taken up during 1983-84, one-third of these pumps were not vertically mounted, and as for the firmness of pedestal it was even worse. As regards platforms, almost every third pump installed during this period did not have one. A similar situation is noticed in Tirunelvelli for installations of 1982-83, when the program was taken up on emergency basis to tide over a drought situation. Construction of soakpits as per the standard specifications is virtually conspicuous by its absence. This would sooner or later cause waterlogging and create health hazards.

WORKING OF THE PUMP

A pump was operationally defined as out of order if there was no flow of water or the flow was too little. This was considered necessary to avoid any subjective interpretation of the term "breakdown" of a pump on the part of the investigators.

The percentage of pumps which were found to be in working order was very high. In Jhabua and Mayurbhanj 98% and 95% of the pumps respectively were in order on the date of survey; for Ajmer and Tirunelvelli the figures were 75% and 78% respectively. Thus among the four districts, the percentage of pumps out of order was lowest in Jhabua (2%) and highest in Ajmer (25%); while Mayurbhanj registered 5% breakdowns, in Tirunelvelli the figure was 22%. On probing further it was discovered that whereas the percentage of pumps which had gone out of order during the preceding year was only 5% in Jhabua, the figure was as high as 53% in Mayurbhanj. The corresponding figures for Ajmer and Tirunelvelli were 52% and 20% respectively.

For two districts, namely, Tirunelvelli and Ajmer we had the breakdown figures since the pumps were installed(Table-20).It is to be noted that 13% of the pumps in Ajmer and 17% in Tirunelvelli have never broken down since their installation. This means 83% to 84% of the pumps in these two districts have had some problem or other since installation. However, the frequency of breakdown does not appear to be too high. Except for Tirunelvelli where 20% of the pumps seem to be having frequent operational problems, in the remaining three districts breakdown was occasional for most of the pumps.Incidentally, Tirunelvelli is one district where the installation of

handpumps was taken up relatively earlier and hence many of these old pumps are more vulnerable to breakdown.

An analysis of the data collected on pumps which were defunct on the date of our visit, indicates that frequency is higher among the relatively older pumps except for Mayurbhanj where 13% of the pumps installed during 1984 were not in order; this can be attributed to bad installation.

It may be recalled that as most of the pumps have only recently been installed one would expect the frequency of breakdown to be relatively less. Besides, the reliability of Mark-II handpumps is expected to be very high during the initial three to four years. The study also reveals a somewhat similar trend. The apprehension that once India Mark-II handpumps start showing signs of wear and tear, they would require specialised skill for their repair is also indirectly supported by data available on the period of breakdown of the currently non-operational pumps(Table-21). As may be seen, in Mayurbhanj 86% of the non-operational pumps have remained so for more than one month. This is followed by Ajmer(64%), Tiruhelvelli (62%), and Jhabua (40%). This only suggests the possibility of problems likely to be encountered in the near future.

As regards the nature of problems with the pumps currently non-operational, the more common ones are: 'handle works but there is no flow of water', severed connecting rod, worn out washers and jammed handle (Table-21).

An attempt was made to ascertain the parts which were most susceptible to damage. The parts were categorised as 'above ground' and 'below ground'. So far as the parts 'above ground' are concerned, chain assembly seems to be the most vulnerable part in all the four districts followed by bearing, handle and connecting rod check nuts. In 87% of the pumps in Jhabua and 66% in Ajmer the components of chain assembly were reported as the parts most susceptible to breakdown. Corresponding figures for Tirunelvelli and Mayurbhanj are 54% and 28% respectively. Incidentally these parts of the head assembly take the maximum load during operation and hence they are subject to a very high wear and tear. In addition mishandling of the pump adds to the problem. It is also noticed that children drop sand, pebbles, small stone chips, garbage etc. into the pump head assembly. This happens more frequently when the inspection cover is missing. The handle being very free and smooth-moving in the India Mark-II pump, it is seen that people tend to use short jerky strokes. It is also a common sight to see people operating the pump from a position across the plane of movement of the handle. Such rough handling puts uneven

pressure on the moving parts. Since in most cases there is no preventive maintenance like greasing or oiling of parts, the vulnerability of these parts to breakdown increases.

Among the parts 'below grounnd', washer is the most vulnerable item followed by cylinder valve and connecting rod. In 85% of pumps in Jhabua, 'washer' is a frequent item needing replacement followed by 72% in Tirunelvelli, 49% in Ajmer and 35% in Mayurbhanj. As regards cylinder, Mayurbhanj reports the highest percentage (48%) which may be due to the high iron content in water.

MAINTENANCE OF PUMP

The four districts selected for the study have different types of maintenance systems. The 3-tier system of maintenance is in operation only in Tirunelvelli. In Mayurbhanj where the system is supposed to have been implemented, it is yet to be operative. In this district, 7 out of the 26 blocks in one sub-division are proposed to be covered under the 3-tier system. Already there are 569 caretakers selected and trained for the purpose. There are also 3 mobile teams in the district with necessary staff and equipment. But in the absence of block mechanics the 3-tier system can not be considered complete.

In Tirunelvelli a 3-tier set up does exist. There are four mobile teams, 31 blocks mechanics and 2614 caretakers of which half are said to have been trained. It may be recalled that the district has 974 villages which means a village may have more than one caretaker. It is so because of the large size of the villages. In fact, an average hamlet in this district often has a larger population than an average village in Jhabua or Mayurbhanj. In Jhabua there is no 3-tier system. The district, however, has 3 mobile teams and 36 block mechanics. There are no caretakers in this district. Ajmer is one case where an experiment has been tried out for pump maintenance. Instead of block level mechanic and village level caretaker (as a part of the 3-tier system), both the functions have been combined in the "Hand Pump Mistry" who is a locally selected person trained in maintenance of handpump. In some sources this system is referred to as "One-tier system". The decision to change the system was reportedly taken with the objective of decentralising the maintenance system, reducing the maintenanoe cost and shortening the time in repairing the pump.

In this so called "one-tier system" the Hand pump mistry is paid Rs. 150 per pump per year of which Rs.100 are his emoluments and the rest goes towards defraying the cost of spare parts. There is no mobile team.

As may be seen from Table-23, in Mayurbhanj, Tirunelvelli and Jhabua the number of pumps per mobile team varies from 711 in Jhabua to 803 in Tirunelvelli and 900 in Mayurbhanj. It is ascertained that ideally a mobile team should have a maximum of 500 pumps to cover. Thus while the number of mobile teams has remained constant, the number of pumps has gone up. This has naturally affected their performance. Similarly, the number of pumps per mechanic varies from 104 in Tirunelvelli to 59 in Jhabua. So far as Ajmer is concerned in addition to the pump mistries (55 pumps per mistry) there are departmental mechanics to provide back up facility. It may be mentioned that the so-called 'one-tier system' envisages one mistry to look after 30-40 pumps spread over two to three panchayats. In contrast the three-tier system expects one block mechanic to look after not more than 50 pumps.*

It is significant that in 45% of the cases of breakdown in Tirunelvelli nobody apparently reported the matter to the block mechanic. In Jhabua and Mayurbhanj the corresponding figures were 40% and 21% respectively. Apparently in Ajmer the reporting system seems to be functioning better than in the other districts. It does not, of course, necessarily follow that the pumps are repaired promptly.

* The trainers' Guide to Flipchart, For the India Mark II handpump caretaker training program (1981), UNICEF WEES New Delhi; Page 6.

It is to be noted that except for Jhabua the time gap between reporting of breakdowns and actual repairs was quite high. Even in Ajmer where the so called "one tier system" was expected to improve the situation, in over half of the cases the pumps were non-operational for more than a month. The corresponding figures for Mayurbhanj and Tirunelvelli are 43% and 38% respectively. Although a large proportion of pumps were in order on the date of our visit, the downtime for repair of the non-operational ones remained very high.

With regard to the maintenance of log sheets the picture is no better. Even in Tirunelvelli where the 3-tier system is in operation for quite some time, only in 21% of the cases maintenance of log sheets was reported. For Mayurbhanj the figure was 13%. In Jhabua and Ajmer such a system virtually did not exist.

Participation of people in the maintenance of community pumps is conspicuous by its absence. As noticed, even the breakdowns at times go unreported. There is no system for monetary contribution by the users for maintenance. Even preventive maintenance like oiling, greasing of the moving parts in head assembly is assumed to be entirely the responsibility of the caretaker or block mechanic. Here again, although it is expected (under the 3-tier system) that the

caretaker should carry out preventive maintenance, in actual practice there is no provision for preventive maintenance. Apparently in Tamil Nadu the caretaker is not supposed to do any preventive maintenance. His responsibility is restricted to reporting the breakdown to the block mechanic.

SUGGESTIONS

In spite of the fact that the study has been undertaken in only four districts of the country, some of the conclusions derived from it have general implications. It is worthwhile to focus on such issues and draw certain guidelines which could help both in planning and in implementation of the rural water supply programme through installation of hand-pumps.

While fixing targets for installing handpumps in different locations it is the hamlet which should be the basic unit of reference rather than the village; the latter should be used merely for identification of the area. For this purpose it is necessary that a village- wise list of hamlets in the block/district planned to be covered under handpump programme should be prepared in advance. Such a list should also contain the number of households and population for each hamlet and the caste structure. Obtaining the distance between hamlets should also be a part of this exercise.

Besides, the number of handpumps and other protected sources (e.g.piped water) already available in the village should be obtained for each hamlet.

Once such a list is prepared and the required data obtained, the next step would identify the hamlets where pumps should be located. For this purpose the catchment population to which the handpump would cater will have to be estimated. The existing criterion of providing one handpump for every 250 population does not seem to be realistic even if one takes into account the maximum number of hours that a handpump can work in a rural setting. In all the four districts surveyed the number of households depending upon handpump varied from a minimum of 27 to a maximum of 40, the corresponding populations ranging from 139 to 235. As against this the actual number of households who depend upon handpump for drinking and cooking worked out to a minimum of 22 and a maximum of 29; the corresponding population figures were 113 and 162.

In the present circumstances it is not possible to alter the water usage patterns and hence an immediate increase on the utilisation rate of handpumps for drinking and cooking can be ruled out; more so, because all the pumps in operation can not be made to yield water suitable for these purposes.

It would be more appropriate, therefore, to take the population which is currently using pumps for drinking/cooking as the base for planning purposes. This population could vary between 120 and 150. It may be recalled that in two of the districts namely, Ajmer and Mayurbhanj this was also the population range in villages where cent-percent coverage of handpump was reported.

In addition to taking population of hamlet as a criterion, another factor which is very improtant from the point of view of coverage is distance of pumps from potential user households. The distance criterion acquires greater significance in areas where (i) the hamlets are large (e.g. in Tirunelvelli); or (ii) the village is quite large, and does not have any hamlets. As we have seen earlier, the number of handpump users shows a sharp decline beyond 150 metres and falls to a negligible figure when the distance exceeds 300 metres. Although as a long term strategy it would be advisable to have a handpump within a range of 150 metres, in the short run a handpump should be provided within a distance not exceeding 300 metres from user households to ensure optimal utilisation.

Thus the three factors which should be taken into account for installing a handpump are (1) hamlet, (2) population, and (3) distance. The present norm of providing handpump

to 250 population may work only in marginal cases where the density of population is very high, the households live in a tight cluster, and the pump is centrally located. Public places like bazar, weekly market, panchayat office etc. should be given a second priority while locating a pump in a village/ hamlet.

Presently, women generally have no say in the location of a pump. From a pragmatic standpoint one may not expect much improvement in the situation sicnce most decisions relating to pub,ic issues are taken by the male members espeqially in rural areas. Hence, once the public places are deliberately excluded in the first phase, and the pumps are located in the residential pockets, proximity of the pump to its potential users would be ensured to a considerable extent. A distinction should be made between pumps located at public places and these installed in residential pockets during collection of village level data referred earlier. Pumps located at public places may have to be excluded at the first stage while calculating the requirement of handpumps for household use.

Mass education programs emphsising the superiority of hand-pump as a source of potable drinking water over openwell should be undertaken in villages selected for installation of handpumps. In villages where people are apprehensive with regard to the

quality of handpump water it is suggested that on-the-spot demonstrations be carried out to allay such misapprehensions. Similar demonstrations should also be conducted to establish the superiority of handpump as a source of water for cooking purposes.

In areas where water is suspected to be unsuitable for drinking, chemical tests should be carried out at the pre-installation stage itself. Failing this, even tests carried out at the drilling stage may still be useful since investment on a pump which can hardly be used for drinking can be avoided. However, such investment need not necessarily prove wasteful in areas where no alternative source is available and/or handpump can be used for other purposes during scarcity months.

It is imperative to plan in advance before the actual drilling operations start in an area. Once the required data for a village/hamlet are obtained and a decision on location arrived at, certain minimum tests on water availability may be taken up before the drilling operations start. In some areas where data on ground water are readily available a prior analysis of such data can facilitate the decision making process. The absence of a master plan for rural water-supply programme and the practice of engaging private contractors to execute the programmes within a limited time-frame probably precludes any possibility of conducting pre-installation surveys. In

spite of the satisfactory success rate of borewells the importance of this aspect cannot be ignored. Moreover, the success rate of a drilling operation should not be linked with the availability of water alone. The quality of water available from the point of view of drinking and cooking is equally important.

The programme can be executed at a faster race if a single agency is entrusted the task of undertaking all the three phases of installation viz., drilling, construction of platform and installation of the pump. If the task is shared by Government department and contractors it would be advisable to identify specific areas of operation depending on the capability of the respective agencies. And as such specific targets be earmarked for installation rather than divide the work for the same installation between the concerned agencie Such an approach is also likely to improve the general qualit of installation.

Even though breakdown is not frequent with most of the pumps there are enough indications which call for close monitoring of their performance. Such monitoring is of particular relevance for the relatively older pumps, say, those install before four years.

Preventive maintenance of handpumps should be given importan and attempts should be made to take this up at village level.

This should be possible at least where caretakers are availabl. It is apprehended that Mark-II handpumps are likely to develop more frequent breakdowns, once the installations are older thai 3 to 4 years and this may require specialised skill to repair. In some of these cases even a block mechanic/mistry may requir assistance to carry out the necessary repair. This aspect has to be given due weightage because the pressure on the maintenance team is likely to build up over the years.

The uneven distribution of workload per mechanic as existing at present in some areas should be rationalised. Since majorit of the pumps have only been recently installed and the exact nature and frequency of the problems are yet to be ascertained the present norm of assigning 50 pumps to each mechanic may have to be reviewed at regular intervals. This can from a part of the general monitoring system.

In sparsely populated pockets where the area of a district is large, the distances to be negotiated by a mechanic in course of his work may be unmanageable considering his restricted mobility in the absence of a mechanised transport. Covering the area with a bi-cycle not only delays his attending to calls but also dissuades him to act promptly. Hence in areas where pumps are thinly distributed providing a moped to the mechanic might improve his efficiency.

The present system of engaging voluntary and honorary caretakers (as a part of the 3-tier system) does not appear to be wholly effective. In this context the so called "one-tier system" appears to be more pragmatic in the sense that the pecuniary benefits accruing to the handpump mistry acts as an incentive. However, a similar arrangement on a limited scale if envisaged for the village caretakers could motivate them to aspire for higher efficiency level.

The present reporting system relating to the breakdown of the pumps and their maintenance needs substantial improvement. There should be adequate supervision to ensure that the log sheets are meticulously maintained for each pump and the time lag between reporting of the breakdown and repair of the pump are promptly recorded in order to assess the objective performance of the maintenance staff. In the absence of any such rigorous follow up, punps remain unattended for a prolonged period. It is further suggested that a single person in each village/hamlet should be identified to report such breakdowns, if any, to the nearest maintenance point. Where a 3-tier system is in vogue the existing caretaker performs this task. However, in areas where such a system is not prevalent the village elders/elected representatives may be deputed to perform this task.

Finally, an appropriate monitoring system may be evolved encompassing comilation of pre-installation data, actual installation operations down to the maintenance of handpumps. This calls for an independent exercise.

TABLE - 1

SAMPLE

Sl. No.	Particulars	Mayur-bhanj	Tirunel-velli	Jhabua	Ajmer
1.	No. of blocks	5	6	4	4
	- % covered	19.2	19.4	50.0	36.4
2.	No. of villages	77	30	55	43
	- Average per block	15.4	5.0	13.8	10.8
3.	No. of households	961	461	551	557
	- Average per village	12.5	15.4	10.0	13.4
4.	No.of handpumps	306	336	321	291
	- % to total pumps in the district	11.0	10.5	15.0	11.4

TABLE - 2

SELECTED SOCIO-ECONOMIC INDICATORS

Sl. No.	Particulars	Mayurbhanj	Tirunelvelli	Jhabua	Ajmer
1	2	3	4	5	6
A.	Area and population				
	a)Geographical area(sq.km.)	10418	11429	6781	8481
	b)Total population (million)	1.58	3.56	0.80	1.44
	c)Rural Population (million)	1.49	2.32	0.73	0.82
	d)Decadal population growth (1971-1981) -Total(%)	9.96	11.21	10.99	25.50
	e)Decadal population growth (1971-1981) -Rural(%)	6.61	6.93	7.01	15.14
	f)Density per sq.km(Total)	151	311	117	170
	g)Density per sq.km(Rural)	144	217	N.A.	102
	h)Households by caste - Rural(%)				
	- SC	10.09	24.96	3.29	21.56
	- ST	50.45	0.51	95.86	6.54
	- Others	39.46	74.53	0.85	71.90
	i)Family size (Rural)	5.15	5.10	5.49	5.60
B.	Settlement pattern				
	a)No.of villages (inhabited)	3712	974	1326	923
	b)Average population of a village	400	2383	532	892

..Contd.

Table-2 (Contd..)

1	2	3	4	5	6
	c) % of villages with population				
	- less than 200	33.56	5.95	25.87	14.74
	- 200 to 499	42.05	8.73	40.05	28.17
	- 500 to 999	19.75	16.02	25.64	48.21
	- 1000 to 1999	4.07	29.77	7.38	
	- 2000 to 4999	0.57	30.50	1.06	7.69
	- 5000	Nil	9.03	Nil	1.19
	d) % of villages with hamlets				
	- No hamlet	32.47	3.33	61.82	81.40
	- One hamlet	33.77	10.00	-	6.98
	- Two hamlets	15.58	23.33	18.18	9.29
	- Three hamlets	12.99	10.00	10.91	2.33
	- Four or more hamlets	5.19	53.34	9.09	-
C.	Literacy				
	a) % literacy(district)				
	- Total	25.47	50.79	10.99	35.01
	- Male	37.01	61.91	15.54	47.10
	- Female	13.82	40.14	6.38	22.02
	b) % literate(Rural)				
	- Total	23.52	45.90	7.01	19.10
	- Male	35.02	57.69	10.80	31.36
	- Female	12.02	34.75	3.19	6.13

..Contd.

Table-2 (Contd..)

1	2	3	4	5	6
D.	Infrastructure				
	a) Road length for 100 sq.km.	86	76	34	20
	b) Average population per school				
	Primary School	711	1450	635	1656
	M.E.School	2677	5296	3684	6547
	High School	7369	15341	22738	10591
	c) % of villages electrified	36.53	100.00	N.A.	53.41
E.	Source of water				
	a) % of sample villages reporting				
	- River	36.36	26.67	29.09	9.30
	- Canal	15.58	33.33	3.64	-
	- Tank	75.32	96.67	18.18	37.21
	- Openwell	92.20	100.00	78.18	95.35
	- Community handpump	100.00	100.00	100.00	100.00
	- Reservoir	10.39	6.67	1.82	9.30

N.A. = Not available

TABLE - 3

WATER CONSUMPTION

(Per capita per day in litres)

Particulars	Mayur-bhanj	Tirunel-velli	Jhabua	Ajmer
TOTAL				
- Normal	51.55	62.99	45.49	54.38
- High	69.60	77.03	72.10	73.06
DRINKING				
- Normal	2.93	3.13	5.44	5.69
- High	4.11	4.26	9.67	8.07
COOKING				
- Normal	5.82	4.07	3.01	2.62
- High	6.06	4.14	3.05	2.95
BATHING				
- Normal	21.65	24.08	13.26	13.77
- High	32.12	31.13	23.25	19.17
WASHING CLOTHES				
- Normal	5.86	16.20	6.31	8.58
- High	7.06	19.14	6.71	11.25
WASHING UTENSILS				
- Normal	5.49	4.61	2.81	3.55
- High	5.62	4.83	2.95	3.79
FEEDING CATTLE				
- Normal	7.71	7.73	14.28	19.88
- High	11.50	3.17	25.79	27.46
OTHERS				
- Normal	2.09	3.17	0.38	0.29
- High	3.13	3.51	0.68	0.37

TABLE - 4
HANDPUMP COVERAGE

Sl. No.	Particulars	Mayur-bhanj	Tirunel-velli	Jhabua	Ajmer
1.	Average no.of using handpump per village*	48	219	55	126
2.	% to total households	55	47	57	79
3.	Average no. of household using handpump for drinking & cooking per village**	39	125	54	88
4.	% to total user households per village	81	57	98	70
5.	Average no. of household per pump	27	40	28	34
6.	Average no. of household using pump for drinking/ cooking per pump	22	23	28	29
7.	Average population per pump	139	204	154	235
8.	Average population using pump for drinking/cooking	113	117	150	162
9.	Total per capita water consumption in litre**	69.60	77.03	72.10	73.06
10.	Share of handpump(litre)	28.23	48.08	59.51	60.41
11.	Share of handpump (percentage)	40.56	62.42	82.54	82.69
12.	Total water consumption for drinking**	4.11	4.26	9.67	8.07
13.	Share of handpump(litre)	3.29	2.38	9.52	5.53
14.	Share of handpump (percentage)	80.05	55.87	98.45	68.53
15.	Total water consumption for cooking(litre)**	6.06	4.14	3.05	2.95
16.	Share of handpump(litre)	4.63	2.38	3.01	2.15
17.	Share of handpump (Percentage)	76.40	57.49	98.69	72.88

* either season

** high demand months

TABLE - 5

DISTRIBUTION OF HANDPUMP USERS BY PURPOSE

(Percentage of households)

Sl. No.	Purpose	Mayur-bhanj	Tirunel-velli	Jhabua	Ajmer
1.	Drinking				
	- Normal	71.18	50.33	98.19	67.76
	- High	81.79	56.62	98.19	69.15
2.	Cooking				
	- Normal	68.57	50.33	98.19	71.75
	- High	78.77	56.40	98.00	70.54
3.	Bathing				
	- Normal	7.80	37.96	88.20	92.89
	- High	20.08	59.87	88.92	92.37
4.	Washing clothes				
	- Normal	9.26	38.61	85.30	93.24
	- High	20.40	58.13	85.30	93.07
5.	Washing utensils				
	- Normal	62.85	78.31	94.19	96.01
	- High	75.23	82.43	94.19	95.32
6.	Feeding cattle				
	- Normal	33.92	35.79	68.60	69.84
	- High	44.54	37.53	68.24	70.88
7.	Others				
	- Normal	47.97	67.24	7.26	2.56
	- High	59.00	68.98	7.20	2.25

TABLE - 6

QUANTITY OF WATER USED FOR DRINKING/ COOKING FROM HANDPUMP VIS-A-VIS OTHER SOURCES (PER CAPITA)

(In litres)

Sl. No.	Source	Mayur-bhanj	Tirunel-velli	Jhabua	Ajmer
1.	River				
	- Normal	0.30	0.52	0.02	-
	- High	0.41	0.39	0.03	-
2.	Canal				
	- Normal	0.01	0.18	-	-
	- High	0.03	0.09	-	-
3.	Tank				
	- Normal	0.06	-	-	-
	- High	0.03	-	-	0.01
4.	Openwell				
	- Normal	2.35	2.03	0.10	2.47
	- High	1.69	2.37	0.18	3.29
5.	Handpump				
	- Normal	5.91	3.67	8.34	5.84
	- High	7.92	4.76	12.53	7.68
6.	Reservoir				
	- Normal	0.08	-	-	-
	- High	0.06	-	-	-
7.	Tap water				
	- Normal	-	0.62	-	-
	- High	-	0.60	-	-
8.	Others				
	- Normal	0.02	0.17	-	-
	- High	0.03	0.19	-	0.04
9.	Total				
	- Normal	8.75	7.19	8.46	8.31
	- High	10.17	8.40	12.74	11.02

TABLE - 7

USE OF HANDPUMPS BY CASTE

(Percentage of households)

Sl. No.	Caste group	Mayur-bhanj	Tirunel-velli	Jhabua	Ajmer
1.	Scheduled caste	70.47	55.56	47.65	73.42
2.	Scheduled tribe	52.74	49.53	57.01	88.86
3.	Other castes	58.82	44.11	59.65	79.99
4.	Average	55.55	46.86	56.63	79.55

TABLE - 8

INTENSITY OF PUMPS IN SAMPLE VILLAGES UNDER HIGH AND LOW USAGE CONDITIONS

Sl. No.	Particulars	Mayurbhanj		Ajmer	
		High usage	Low usage	High usage	Low usage
1.	No. of villages	11	11	5	5
2.	No. of households	606	1257	274	961
3.	Estimated population	3120	6474	1534	5382
4.	No. of habitations	14	32	5	12
5.	No. of handpumps	21	15	13	24
6.	No. of handpumps per habitation	1.5	0.5	2.6	2.0
7.	No. of households per pump	29	84	21	40
8.	Population covered per pump	149	432	118	224

TABLE -9

USE OF HANDPUMPS FOR DRINKING/ COOKING BY DISTANCE (HIGH DEMAND MONTHS)

(Percentage of households)

Sl. No.	Purpose/distance	Mayur-bhanj	Tirunel-velli	Jhabua	Ajmer
1.	Drinking				
	150 meters and less	71.06	43.17	44.28	54.77
	151 - 300 metres	9.99	11.93	45.92	13.34
	301 and above	0.74	1.52	7.99	1.04
	Total users	81.79	56.62	98.19	69.15
2.	Cooking				
	150 metres and less	68.69	42.96	44.09	55.82
	151 - 300 metres	9.14	11.92	45.92	13.51
	301 and above	0.94	1.52	7.99	1.21
	Total users	78.77	56.40	98.00	70.54

TABLE - 10

USE OF HANDPUMP FOR DRINKING AND COOKING BY SOURCE/DISTANCE(HIGH DEMAND MONTHS)

(Percentage households)

Particulars	Mayur-bhanj	Tirunel-velli	Jhabua	Ajmer
A. Drinking				
Openwell				
150 meters and less	11.55	19.30	0.18	16.64
151 - 300 metres	2.40	9.33	0.91	13.17
301 metres and above	0.10	1.30	0.18	3.81
Total users	14.05	29.93	1.27	33.62
Handpumps				
150 metres and less	71.06	43.17	44.28	53.05
151 - 300 metres	10.01	11.93	45.92	13.67
301 metres and above	0.74	1.52	7.99	1.04
Total users	81.77	56.62	98.19	67.76
B. Cooking				
Openwell				
150 metres and less	13.32	19.74	0.18	15.26
151 - 300 metres	2.50	9.33	0.91	10.22
301 metres and above	0.10	1.08	0.18	2.77
Total users	15.92	30.15	1.27	28.25
Handpump				
150 metres and less	68.69	42.96	44.09	56.50
151 - 300 metres	9.12	11.93	45.92	14.04
301 metres and above	0.94	1.52	7.99	1.21
Total users	78.77	56.41	98.00	71.75

TABLE - 11

SUITABILITY OF PUMP WATER

Sl. No.	Particulars	Mayur-bhanj	Tirunel-velli	Jhabua	Ajmer
1.	Pumps reporting(%)				
	a) Suitable for drinking/cooking	63.73	81.55	99.38	73.88
	b) Not-suitable for drinking/cooking	36.27	18.45	0.62	22.68
	c) Not suitable for drinking water only	26.14	18.15	0.31	23.71
	d) Not suitable for cooking only	31.05	16.07	0.62	25.09
2.	Pumps reporting reasons unsuitability-Drinking(%)				
	a) Smell of iron	63.75	6.56	-	-
	b) Saline taste	8.75	90.16	-	79.71
	c) Foul smell	26.25	3.28	100.00	-
	d) Muddy water	26.25	1.64	-	-
	e) Film over stored water	22.50	-	-	-
	f) Hard water	-	-	-	23.19
	g) Pungent taste	-	-	-	7.25
3.	Pumps reporting unsuitability-Cooking(%)				
	a) Rice tastes bad	48.42	18.52	-	79.45
	b) Pulses do not boil	49.47	61.11	-	23.29
	c) Vegetables do not boil	37.89	-	-	-
	d) Rice cooks dark	90.53	12.96	-	-
	e) Smell of kerosene	6.31	-	-	-

TABLE - 12

INTENSITY OF HANDPUMP USE

Sl. No.	Particulars	Mayurbhanj	Tirunelvelli	Jhabua	Ajmer
1.	Average no. of hours used per day				
	- Normal	8.02	8.43	6.66	8.32
	- High	10.41	11.68	9.54	11.05
2.	Peak hours				
	- Normal	2.32	2.84	4.03	2.23
	- High	3.02	4.39	5.65	2.79

TABLE - 13

WATER COLLECTION DETAILS

Sl. No.	Particulars	Mayur-bhanj	Tirunel-velli	Jhabua	Ajmer
1.	Average no. of persons collecting water per household:				
	- Normal	1.37	1.58	1.70	1.73
	- High	1.50	1.70	1.59	1.80
2.	Persons collecting water (sex-wise breakup)				
	Male				
	- Normal	12.59	6.51	14.78	28.98
	- High	14.25	7.88	14.61	29.84
	Female				
	- Normal	87.41	93.49	85.22	71.02
	- High	85.75	92.12	85.39	70.16
3.	Average no. of trip per person				
	- Normal	3.54	5.25	4.58	5.43
	- High	4.48	6.67	6.32	6.31
4.	Average distance travelled (Metres)				
	- Normal	127	173	238	145
	- High	133	174	239	145
5.	Average time per trip (in minute)				
	- Normal	9.83	9.88	10.47	11.80
	- High	11.60	13.81	14.19	13.60

TABLE - 15

HANDPUMPS SURVEYED BY YEAR OF INSTALLATION

(Percentage pumps)

Sl. No.	Particulars (Year of installation upto)	Mayur-bhanj	Tirunel-velli	Jhabua	Ajmer
1.	1979	17.98	59.22	15.26	1.79
2.	1980	32.36	62.79	28.34	6.18
3.	1981	58.83	65.77	48.90	42.26
4.	1982	72.56	79.16	80.06	82.47
5.	1983	92.48	99.40	90.03	93.81
6.	1984 March	100.00	100.00	100.00	100.00

TABLE - 16

HANDPUMPS BY TYPE OF INSTALLATION

(Percentage pumps)

Sl. No.	Particulars	Mayur-bhanj	Tirunel-velli	Jhabua	Ajmer
1.	New	84.31	57.14	93.77	98.97
2.	Rejuvenated	15.69	42.86	6.23	1.03

TABLE - 17

PRE-INSTALLATION DETAILS

(Percentage pumps)

Sl. No.	Particulars	Mayur-bhanj	Tirunel-velli	Jhabua	Ajmer
1.	Agency responsible for drilling :				
	- Department	9.15	69.94	99.38	30.24
	- Contractor	90.85	30.06	0.62	69.76
2.	Feasibility study conducted	5.23	97.62	79.13	3.78
3.	Consultation with villagers on site selection	97.06	75.30	69.47	93.47

TABLE - 18

INSTALLATION DETAILS

(Percentage pumps)

Sl. No.	Particulars	Mayur-bhanj	Tirunel-velli	Jhabua	Ajmer
1.	Time-lag between drilling and installation				
	a) Same day	4.58	1.49	5.92	2.41
	b) Within a week	8.50	12.80	43.92	11.34
	c) Week to fortnight	19.93	34.82	40.19	21.99
	d) Fortnight to a month	21.24	29.76	8.72	39.52
	e) One to three months	25.49	17.86	1.25	21.65
	f) Three months and above	20.26	3.27	-	2.75
2.	Physical status of pumps				
	a) Pedestal vertically mounted	86.27	83.93	48.60	87.69
	b) Pedestal firmly mounted	82.68	90.48	90.97	85.22
	c) Platform currently exists	92.16	97.92	99.38	99.66
	d) Platform currently does not exist	7.84	2.08	0.62	0.34
3.	Average drilling depth (metres)	49.00	40.00	57.18	37.20
4.	Average water table (metres)	14.40	13.00	13.08	19.94
5.	Average cylinder depth (metres)	32.00	27.00	29.54	34.17

TABLE - 19

PLATFORM AND DRAINAGE

(Percentage pumps)

Sl. No.	Particulars	Mayur-bhanj	Tirunel-velli	Jhabua	Ajmer
1.	Platforms in good condition	86.52	90.89	85.26	87.59
2.	Platforms by time of construction -				
	a) At the time of installation	34.27	26.19	8.47	62.54
	b) Immediately after	8.04	60.41	33.54	1.37
	c) Sometime after	21.68	11.31	57.68	25.78
	d) After a longer time	36.01	1.79	0.31	10.31
3.	Pumps reporting drainage	89.87	91.07	99.69	84.88

TABLE - 20

PERFORMANCE OF PUMPS

(Percentage pumps)

Sl. No.	Particulars	Mayur-bhanj	Tirunel-velli	Jhabua	Ajmer
1.	Pumps currently in working order	95.42	77.98	98.44	74.91
2.	Pumps reporting no breakdown during last year	53.00	20.07	4.84	52.36
3.	Pumps reporting no breakdown since installation	N.A.	17.26	N.A.	13.06
4.	Pumps reporting breakdown as a common features	98.04	80.06	96.57	94.50
5.	Pumps currently not in working order by year of installation				
	1979 and before	7.27	26.00	2.04	60.00
	1980	2.27	25.00	2.38	7.69
	1981	6.17	10.00	1.52	36.19
	1982	-	22.22	-	22.22
	1983	1.64	11.76	-	15.15
	1984	13.04	-	3.12	-

N.A. = Not available

TABLE - 21

PERIOD OF BREAKDOWN AND NATURE OF PROBLEM

(% of pumps not in working order)

Sl. No.	Particulars	Mayur-bhanj	Tirunel-velli	Jhabua	Ajmer
1.	Pumps not in working order by period of breakdown -				
	a) Upto a fortnight	7.14	14.06	40.00	12.33
	b) Fortnight to one month	7.14	9.46	20.00	13.70
	c) One to three months	50.00	27.03	20.00	39.72
	d) Three months and above	35.71	35.15	20.00	34.25
2.	Pumps not in working order by type of problem-				
	a) Handle works but no flow	35.71	5.41	40.00	19.18
	b) Connecting rod disconnected	14.29	63.51	20.00	49.32
	c) Leather bucket worn out	14.29	2.70	-	5.46
	d) Handle jammed	7.13	8.11	-	2.74
	e) Piston assembly stuck in cylinder	14.29	-	-	-
	f) Others	14.29	20.27	-	-
	g) Water level gone below the cylinder	-	-	40.00	5.48
	h) Chain broken	-	-	-	10.98
	i) Cylinder damaged	-	-	-	5.48

TABLE - 22

PARTS SUSCEPTIBLE TO DAMAGE

Sl. No.	Particulars	(Percentage of pumps) Mayur-bhanj	Tirunel-velli	Jhabua	Ajmer
1.	Above ground				
	a) Axle washer nut/ check nut	0.76	41.07	28.04	33.68
	b) Chain assembly	28.03	53.87	27.42	65.98
	c) Handle	6.81	16.96	10.59	8.59
	d) Connecting rod check nut	6.81	16.96	9.35	9.97
	e) Flange nuts and bolts	0.76	5.06	3.43	34.36
	f) Bearing	1.51	32.14	31.78	14.09
2.	Below Ground				
	a) Connecting rod	15.91	16.67	7.79	17.87
	b) Valve	7.58	12.50	36.14	22.68
	c) Rise pipe	15.15	27.68	1.56	15.81
	d) Cylinder	48.49	33.04	6.54	7.56
	e) Washer	34.85	71.73	85.36	49.48

TABLE - 23

MAINTENANCE SET UP

Sl. No.	Particulars	Mayur-bhanj	Tirunel-velli	Jhabua	Ajmer
1.	Is there a three-tier system ?	Being intro-duced	Yes	No	No
2.	No. of mobile teams	3	4	3	-
3.	No. of mechanic/ mistry	-	31	36	47*
4.	No. of caretakers	569	2614	-	-
5.	No. of pumps-per mobile team	900	803	711	-
	- per block mechanic	-	104	59	55**

* There are also departmental mechanics (8)

** Per Handpump Mistry.

TABLE - 24

WORKING OF THE REPORTING SYSTEM

Sl. No.	Particulars	(Percentage of pumps) Mayurbhanj	Tirunelveli	Jhabua	Ajmer
1.	Pumps not in working order by time of reporting-				
	a) One week	7.14	5.41	Nil	3.92
	b) Week to fortnight	14.29	4.05	20.00	23.53
	c) Fortnight to one month	14.29	5.41	40.00	17.65
	d) One to three months	21.43	10.81	Nil	31.38
	e) Three months and above	21.43	27.73	Nil	19.60
2.	Pumps reporting maintenance of log sheets (%)	13.40	21.43	0.93	1.72
3.	Pumps reporting maintenance of log sheets by type of persons maintaining (%)				
	a) Caretaker	97.56	97.22	Nil	20.00
	b) Departmental mechanic	2.44	Nil	100.00	Nil
	c) Villagers	Nil	2.78	Nil	80.00
4.	Agency doing the repaire-				
	a) Departmental mechanic	96.79	95.54	100.00	44.98
	b) Villagers	1.92	11.15	Nil	3.21
	c) Local mechanic	1.28	6.69	0.33	1.61
	d) Hired mechanic	1.28	-	Nil	6.83
	e) Trained mistries	-	-	-	52.21

ANNEXURE - I

SCOPE OF THE STUDY

1. HOW MANY % OF PUMPS ARE FUNCTIONING?
   - 1.1 Type and age distribution of pumps (B+D)
   - 1.2 No. of functioning pumps (A+B+D)
   - 1.3 No. of Non-functioning pumps(A+B+D)
   - 1.4 Main reasons for non-functioning(age, overuse, no maintenance, bad installation, damage, no water. others) (B+C)
2. MAINTENANCE AND REPAIR PERFORMANCE?
   - 2.1 Kind of maintenance system(who repairs, who reports main bottlenecks, accessibility, transport, spare-parts, tools others) (C+D)
   - 2.2 How many breakdowns during the last 12 months(since installation %) (main reasons: Cylinder, rod, chain, head, pipes, others) (C+D)
   - 2.3 Actual annual allocations and expenditures incurred by maintenance system and repairs (C+D)
   - 2.4 Down time until repaired (Main reasons) (C+D)
3. HOW WAS INSTALLATION DONE ?
   - 3.1 Type of installation(on new tubewell, rejuvenation)
   - 3.2 Time between drilling and installation(C+D)
   - 3.3 Is installation done by district mobile team, contractors, others properly (B)
   - 3.4 Is the platform constructed-is it in working order(B)
   - 3.5 Is the drainage constructed-is it in working order (adequate length, stagnant water) (B)
   - 3.6 Is the pedestal firmly mounted (B)
   - 3.7 Is there a soakage pit constructed(B)
   - 3.8 Is the sitting technically acceptable(drainage, enough place, others) (B)

3.9 Is the siting accepted by the users(Do women find it suitable) (C)

3.10 Do all have access to the pump (C)

4. IS THE PUMP GIVING ENOUGH AND GOOD WATER?

4.1 How many potential users are there in pump area (A+B+D)

4.2 How many get water from the pump % (getting all its water, getting part of its water, do not use at all) (A+B+C)

4.3 Main reasons for not using the pump(distance, other sources, salinity, not permitted, bad taste, defunct, other) (C)

4.4 How many hours per day is the pump utilised and mostly when (C)

4.5 How many litres of water per day is taken from the pump (A+B+C)

4.6 Influence of settlement problem on siting and use (D)

5. HOW IS THE WATER UTILISED

5.1 How many litres of the pumped water are carried home (for drinking, cooking, bathing, washing utensils, others) (A+B+C)

5.2 How many metres (average) is the water carried (A+B+C)

5.3 Who collects % (women, children, men) (A+B+C)

5.4 Utilisation of water from the pump not carried home (1) (washing clothes, bathing, feeding cattle, others) (A+B+C)

5.5 Time spent per household per day collecting water for household(A+B+C)

5.6 Vessels used for collecting and or storing water, litres and % (earthen pots, metal pots, plastic buckets,others) (B+C)

5.7 Mode of inside cleaning, collecting and storage vessels before use % (with water, ash, soil, not at all (C)

As indicated above four methods of collecting data would be used :

A - Measurements,
B - Observations,
C - Questionnaires,
D - Statistics and studies made.