Paper No. 141

Impact of salinity control and reclamation projects on rural development

By

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IMPACT OF SALINITY CONTROL AND RECLAMATION PROJECTS ON RURAL DEVELOPMENT

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ABSTRACT

Irrigation systems often bring with them the dangers of waterlogging and salinity and Pakistan is no excaption to that. A lot has been written and done to eradicate this often called 'twin menace'. In 1960, the Government embarked on a programme to address salinity and waterlogging problems through a series of Salinity Control and Reclamation Projects (SCARPS). By now more than 12000 public tubewells are reported to have been installed in fresh groundwater zones and 1300 in saline zones. An estimated 200,000 small private tubewells have also come into use in the same areas. These tubewells are claimed to provide relief to rising water tables, and, in fresh zones, these also complemented surface water supplies for irrigation. Total pumpage from private tubewells has so far been five times more than by the public tubewells. This happened despite the low utilization factor of the private tubewells . The high annual investment made in operation and maintenance of the public tubewells was justified on the plea of equitable distribution of water to large and small farmers, the latter constituting about 66 percent of the farming community. The high utilization was another factor which justified the public sector operation and maintenance of these wells in the last twenty five years. This was also considered essential to accomplish effective sub-surface drainage.

Since late seventies questions have been raised on the economic viability of the policy of continuing operation and maintenance of public tubewells in the freshwater zones. This led to the present SCARP Transition Programme under which installation of small capacity private tubewells by the farmers would be encouraged in freshwater zones. In the past private tubewell development was not considered

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feasible becasue of the reasons discussed above and, in addition, due to high power transmission cost. The question now arises whether a farmer would be in a better position to get power connections at locations far from the main transmission line than was possible in the public sector, and if it is possible now, why was it not in the past? These and many other questions come in the minds of many engineers engaged in SCARPS. There is an imperative need to seek answers based on facts and figures.

This paper setsforth some ideas for further discussion. The basic objective here is to evaluate the past role of SCARPS in rural development and determine their operational starategy under the proposed Transition Programme. The whole question revolves around the operational stability of SCARPS which does not seem to have been given a chance in the last twenty five years. Have we ever considered farmers, participation as essential element for the success of these projects and to what extent? Have we made a systematic approach to solve technical, social, and economic problems that cropped up during the operation of these projects or have we simply depended on Consultants and 'Advisers' reports which put almost whole emphasis on engineering aspects and projects economic feasibility?

BASIC CONCEPT OF THE PROJECTS

The SCARPS development programme was proposed to be a joint programme with the farmers whose cooperation was considered central to success. In each pro-project some hundred thousands farmers were estimated to be involved in economic and social development. It was, therefore, emphasised to have increased understanding of the social dynamics of change in an impoverished rural community of the porject areas. Which devices for education and persuasion are most effective under our conditions? What kinds of desirable change do the farmers adopt readily and what kind do they resist? What factors influence the farmers' readiness and their

resistance? Fuller understanding of answers to these questions were suggested to be obtained by highly specialised social research. Especially important was the transfer of technology to farmers and the study of techniques of such transfer. Major economic incentive proposed for the farmers were: (1) ample credit facilities to make farmers' participation possible; and (2) efficient marketing and distribution of facilities for both farm supplies and produce to make their (farmers) work worthwhile.

On the technical side, early emphasis was placed on improving tubewell performance and reducing costs, and on operational analysis of the kinds of data needed to assess hydrologic and soil changes. Long range studies to improve the mechanism of groundwater recharge and to control seepage were also proposed. Major monitoring and evaluation effort in the last twenty five years has been on these engineering aspects. Very little or nothing was done to gain farmers' confidence in the projects.

THE HARD REALITIES

Engineering solutions to waterlogging and salinity problem in the projects were planed and implemented by public agencies and the non-engineering aspects, such as distribution of tubewell water and reclamation of land was left to the farmers. Since farmers' participation was nil, they (farmers) did not bother to respond to the responsibilities of rehabilitation of water courses and reclamation of their affected lands. The situation got worse when additional water for reclamation was stopped. However, the public agencies went ahead with the claim of reclamation of affected lands when the water table went 10 ft. below the ground surface. Reclamation was thus related to the position of the water table on the presumpion that additional tubewell water would flush down the harmful salts. It can thus fairly be said that if rising water table was the cause of the 'twin menace' of waterlogging and salinity, the declining water was a solution for the same.

The transfer of the latest technology did not reach the extension staff and the latter did not bother to visit the farmers. They were therefore, forced to use the traditional agricultural practices evolved through experience. The absence of farmers in projects management led to increase in water course losses due to overspillage and to operational problems of the large capacity public tubewells. The Operators from other areas did not settle near to the tubewells, which gave freedom to the disorganised rural community to run them for twenty four hours a day. Frequent breakdowns were therefore, the natural outcome. According to a survey (1) conducted by the Centre of Excellence in Water Resources Engineering in 1982, a tubewell remained idle for several months after a breakdown because of non-availability of spare parts or due to some administrative problems. In most cases the farmers themselves managed to get rewinding of burnt motors. But what can they do in case of a missing Transformer? An analysis (1) of tubewells in SCARP-1 has shown that large reduction in discharge or specific capacity of these tubewells has occurred during the initial idle period between wells development and their actual energization. If this was the case one can only imagine the plight of a small farmer venturing to have an electric tubewell of his own. The distribution of private tubewells in SCARP-1 according to the 1982 survey is shown in Table-1.

Landholding (Acres)	Percent applied for lisence	Survey(%)
< 5	0.5	0.0
5 - 25	30.5	48.0
> 25	69.0	52.0

There is a significant difference between the recorded and surveyed date. This is due to the fact that farmers with landholdings in the range 5 - 25 acres apply jointly and show combined holding in this range to be able to get loan from banks or other credit agencies. The joint application is usually made by brothers or close relatives. During the survey each farmer quoted his own landholding. There was thus a shift of 17% from the >25 acre to 5 -25 acre holding.

Farmers apply for a tubewell license to get power connection. However, the procedure for getting the connection is so lengthy that many farmers used diesel engines. This can be judged from the survey of SCARP-1, which showed 64% of diesel wells and 36 percent electric wells. The continuing increase in oil prices has led to the use of diesel wells more sparingly than in the past. The oil prices are expected to decrease the rate of development of private tubewells in the projects provided immediate steps are taken to simplify procedure to get power connection at reasonable cost to the farmers. This is manifested in the recent (1985-86) increase in crude oil price and its later withdrawl by the Government.Under these constraints one doubts the development of private tubewells at the same rate as in the past. We committed a mistake in underestimating the growth of private tubewells in the early sixties, let us ascertain that we are not making another mistake in over-estimating the same.

Public Tubewells in SCARPS were proposed to fulfill two purposes:(1) lower the groundwater table and thereby control waterlogging and salinity; and (2) provide additional water for irrigation and for leaching salts in the affected soils. Although it is believed that much of the unexpected growth was to meet the increasing shortage of irrigation supplies after the initial boost beyond the farmers requirements. The farmers took some years to adjust their cropping intensity to the additional supplies, and by the time the irrigated area was expanded the supplies started to reduce due to the deterioration in tubewell performance. The farmers therefore, had no alternative but to meet serious deficit by installing their own wells.

The farmers did not adopt the high capacity public tubewell technology. A very large number of private tubewells are of centrifugal pumps type with coir rope strainer and 100 ft. deept below the ground surface. These tubewells are reported to last longer than the high cost public tubewells This could go in favour of the Transition Programme, but what about the drainage objective. Can it be believed that

fractional tubewells with 15% utilization can maintain groundwater table at the desired level of 10 to 15 feet below the ground surface? To maintain this level about 34000 private tubewells will be required in SCARP-1 if saline zone tubewells are ignored. The present number is about 7000 wells. Will it be possible to develop this number in the private sector to replace gradually abondoned public tubewells? The risk is too high, which cannot be taken without insuring success on a pilot scale. Pilot projects have been established in the country; whether we have taken any benefits from these, is a different matter. The experience is that many large scale projects were developed when their pilot projects were still in their initial stages.

DEEP VERSUS SHALLOW TUBEWELLS

While the public sector advocates shallow tubewells in the private sector, it appears to be reluctant to adopt this technology itself in the saline zones. In these zones freshwater layer overlies the saline layer. The salinity concentration increases from an acceptable limit at a depth of 30 - 40 ft. Gradually till it reaches a hazardous limit. (Fig. 1). The present system of deep drainage tubewells pump out water from this hazardous layer which cannot be disposed off into natural drains. To overcome this problem many engineers and scientists suggest installing small shallow tubewells to skim off the fresh layer and maintain water table at a depth of 10 -15 ft. below the ground surface. The second alternative is using horizontal tile drains if terrain and economics permits. The top six feet of soil layer would be flushed of the harmful salts by growing high delta crops and supplementing canal supplies with the shallow tubewell supplies. The drainage effluent can be recirculated after a year when the soil layer is free of salts. However, research studies are needed to prove practicability of these ideas. Our salvation lies in the development of a technology best suiting to our field conditions, and which is acceptable to our rural community.

FARM MECHANISATION

The 1982 survey of SCARP-1 as a sample case indicated 16.8 percent of the farmers owning private tubewells and 14.6 percent having tractors. The distribution of private tubewells and tractors is shown in Table. 2.

TABLE -2 Distribution of Tubewells and Tractors according to landholding (1982)

Landholding (acres)	% of total number of farmers having tubewells	Tractors
< 5	0	0
5 - 25	8.2	3.4
> 25	8.6	11.2
Total	16.8	14.6

It may be noted that unreliability of irrigation water forced both medium and large farmers to install their own wells. The small farmers could not afford it and had to depend on whatever supplies were available from the canal and public tubewells.

Data was also collected on the number of private tubewells in a village. The distribution of tubewells is shown in Fig. 2 It is apparent that there are no private tubewells in 20 percent of the villages. A maximum of 35 percent villages have only two private wells.

It is estimated that with a pair of bullocks 12.5 acres can be easily cultivated. In contrast one tractor can take care of 195 acres. The tractor, therefore, gained some popularity in the last few years. However, most tractors have been purchased by the large farmers. These are not accessible to the vast majority (75 %) with less

than 25 acres. It is especially for this group that more attention is needed to be given for multifarm use of this machinery.

There are five tractors in a maximum of 41 percent of villages; the average also being five tractors/village. In 8 percent of the villages there are no tractors. However, farm equipment is readily available to the tractor owners as this is largely manufactured locally. The survey data showed that the medium farmers are using a tractor for 19 acres of land and the large farmers on 73 acres. This shows that tractors are being grossly underutilized for agricultural purposes both by the medium and large farmers. As a result many of the tractor owners also do contractual work for soil preparation, threshing, transport and to some extent for land grading. It appears that major effort of tractor owners is on contractual work because of immediate monetary gains than those obtained from crops. Consequently the annual operational and maintenance cost of Tractors varies from 15 to 25 percent of their capital cost.

Table-3 shows cropping intensity 'with' and 'without' tractors and private tubewells as well as average values for the project (SCARP-1) for the three farm sizes

TABLE-3 Cropping Intensity 'with' and 'without' Tractors and tubewells

Cropping Intensity (%)

Landholding	Project	Tractor		Private T/W		Tractor + TW
	average	with	without	with	without	with
<5	152.4	-	-	-	-	-
5 - 25	136.6	143.2	126.8	145.5	125.5	156.9
>25	125.0	127.0	120.1	127.4	118.6	113.2

The small farmers have achieved the target cropping intensity of 150.0 percent. The cropping intensity is inversely proportional to landholding. The cropping intensity of medium farmers is of 143.2 and 145.5 percent with tractors and tubewells respectively. In both cases cropping intensity is higher 'with' than 'without' tractors and tubewells, indicating thereby that these are making significate contribution in agricultural development in rural areas.

The average size of medium and large farms having tubewells is 17 and 69 acres/tubewell respectively. The overall project average for these farms is 15 and 45 acres. The average discharge of private tubewells is one cusec. The utilization factor of these wells within and outside the project is 15 and 25 percent respectively. This gives average duty of one cusec per 90 and 270 acres for medium and large farmers. The average duty for which the project was designed was one cusec/150 acres. It is much higher now because of reduction in the discharge of public tubewells. The above duty for medium and large farmers would be much higher if irrigation supplies from canals and public tubewells are also considered. This gives an impression that it is largely the medium and large farmers, having tubewells, who can reclaim their lands than the small farmers or those dependent on public supplies only.

SOCIO-ECONOMIC IMPACT

Change in land tenureship is a reflection of the effects of socio-economic incentives and institutional measures required for rural development and for the achievement of economic and social benefits of any water resources project. Data on this is presented in Table-4 which compares land tenure for the 1972 census and the survey of 1982.

TABLE-4 Change in Land tensureship in SCARP-1

Land tenureship (%)

Landholding (acres)	Owner		Tenant		Owner-cum-tenant		Total		
	1972	1981	1972	1981	1972	1981	1960	1972	1981
<5	13.5	2.8	8.1	0.6	2.6	0.4	45.1	24.2	3.8
5 - 25	19.9	46.0	26.1	12.6	19.8	11.9	47.9	65.8	7.5
>25	4.6	21.7	2.4	1.8	3.0	2.2	7.0	10.0	25.7
Total	38.0	70.5	36.6	15.0	26.4	14.5			

The Table shows that land ownership has increased from 38 percent in 1972 to 70.5 percent in 1981. There is a corresponding decrease in tenants and owner-cum-tenants. It may also be noted that ownership in the range 5 - 25 (medium farmers) and >25 acres (big farmers) has increased, whereas there is a signficant reduction in the range <5 acres (small farmers). The tenants and owner-cum-tenants have decreased for all classes of landholding. This shift in ownership is abvious becasue of the Agrarian Reforms Law in 1972 and again in 1977. The Reforms do not seem to have made any positive impact on tenants as was envisaged in the Law. In fact the Table shows that the number of small farmers reduced from 24.2 percent in 1972 to 3.8 percent in 1981. There was a substantial increase in the number of large farmers (10% to 25.7%). This raises doubts about the provision for free distribution of land to benefit the tenants under the Reforms.

Some of the reasons for the ineffectiveness of the Reforms are reported (2) to be as follows:

(2) The legitimization of transfers to future heirs by the Law reduced the areas in individual ownership considerably. Most landlords divided their land among family members. With the large number of legal heirs, even big estates could be brought under ceiling limits.

(b) A considerable percentage of land held by large landlords was waste or culturable waste. As the right to select the land for surrender was vested with the landlords, they gave up such tracts which could reduce the size of their holdings, but not their cultivated area. Such wasteland, on the other-hand, was not fit for distribution to tenants because of high investment required for its reclamation.

Therefore, the law did not result in a large scale transfer of ownership from landlords to tenants. However, it appears to have induced an increase in self-cultivation by landowners and abolition of tenancy, thus putting a large number of small farmers out of work. This also helped the landlords to compensate for any loss of land in the reform and overcome the impact of tenancy regulations.

The direct effect of the Reforms, in fact, was on the tenant-owner relationship. The small number of tenants became a strong political group and threatened ownership of big farmers. The consequence was that the landlords deprived the tenants of the right of cultivation as they refused to pay the landlords' share of produce. The landlords managed to get removed the names of their tenants from the revenue record. This shows that the stipulation to increase security of tenure under the Reforms did not produce the desired results.

The landlords took advantage of some basic flaws in the law. For example, the law made it obligatory on the landlord to pay water rates, bu was silent on private tubewell water. Above all, it did not stipulate the rent. Thus although a tenant

could not be simply evicted by changing the tubewell water rent, he could be induced to give up tenancy. As the new technologies required changes in the rent system in any case, because of new and different inputs, the landlords exploited this in disguise to the disadvantge of the tenant. The present practice is that the tenants are paying water rates as well as 50% of the fertilizer cost. In some cases the tenants are paying the full cost of fertilizers.

The landlords have devised various ways to exploit the tenants now. For example, they keep on changing tenant from year to year from one brother to another. There are some who use tenants as permanent labour for cultivation of their additional land and for keeping livestock. There are others who pay them loans on marriages of their daughters/sons and force them to tenanacy until they pay back the loan to the landlord. If they want to give up tenancy they are involved in criminal cases.

The insecurity of tenancy and victimizing attitude of the landlords has forced many farmer tenants to take up carpet weaving and industrial employment. As a result labour costs have risen very rapidly in the last few years. Consequently all farmers - big or small - have started using agricultural machinery. For example, hundred percent of the farmers are using wheat thershers and paying at the rate of one-tenth to one-eleventh of the wheat yield in addition to providing their own labour; A large number of wheat threshers have been brought in the villages purely for commercial purposes.

The percent increase in ownership in 1981 is the consequence of the Land-Reforms (1977) Law which established upper ceilings of land ownership in the measure of one hundred irrigated acres or two hundred unirrigated acres. Big land-lords holding more than these ceilings transferred part of their lands to their sons and daughters. This resulted in increase in the number of landowners in 1981 as compared to that in 1972.

The Agrarian Reforms were characterised by such a high degree of inertia that the strained relations between land lords and tenants have not yet established, resulting in low rate of agricultural growth. It is, therefore, very essential to take new initiatives to harmonize these relations and to strictly enforce the rights and obligations of both the landlords and the tenants.

The basic objective of Land Reforms was to increase the number of small and medium holdings so that they could have a significant impact on agricultural production. On the contrary, there is reduction in small holdings and a slight increase (65.8% to 75.%) in the number of medium ones. Small and medium farmers can contribute significantly to the agricultural production if supported by proper service structure. A development policy focussed on these holdings would have immense benefit of distributing the gains of progress by assuring participation of the large majority of rural population. In addition to promoting employment and agricultural production, such a policy would eventually lead to abolition of share-cropping system which constriants tenants in applying more labour and new technology to improve their performance and level of living.

REPAYMENT CAPACITY OF FARMERS

Repayment capacity depends on the benefits farmer's derive from the development. An analysis of the data collected in SCARP-1 during the 1981 survey showed the farmers paying water rates at 8, 14.7 and 17.6 percent of their net income from wheat, rice and sugarcane (1981-82). At present water rates are 25 percent higher than those in 1981-82.

The above results may present a bright picture on the economic returns that the farmers receive in relation to the water rates they are paying. In this situation one should keep in mind the large variation in yields from the average. A large number of farmers have wheat yield of 15 maunds/acre; there are others obtaining

31 maunds/acre; For these farmers water rates are 32 and 12 percent of their net income. These are the low yield farmers who have to stand greater impact of any increase in water rates; on the other hand, this increase makes very little difference in the net income of high-yield farmers.

The low-yield farmers are generally those having affected land. Since they have to face the brunt of any increase in water rates, they cannot invest in the improvement of their lands. This is a flaw in the present system of water rates in the projects. There are many low-yield farmers who have been reported to be paying water rates by selling their animals or getting loans from Market Brokers (Arhitis).

The water rate system based on cropped area was evolved since irrigation system was first developed in the Indo-Pakistan subcontinent. At that time all land was fallow and productive. Waterlogging and salinity problem created a completely different irrigation environment which varied from one area to another in all projects. The development of the projects led to control of waterlogging but eradication of salinity took a long time. In fact 100 percent land productivity (3) has not been achieved so far. The farmers in the less productive areas cannot produce to the same level as those in the productive areas, although both receive the same quantity of water. Therefore, it seems unfair to levy the same revenue on all project farmers. The farmers should pay the project cost according to the benefits they derive from the development. This does not mean considering lethargic and progressive farmers at different levels. If all land were productive to the same degree there was no need for any differentiation in the level of payment. The revenue system should be such that it acts as a deterrent to those who are not progressive and as incentive for land improvement to those having affected lands.

A rational system of land revenue based on Produce Index Unit is not difficult to evolve as this criterion already exists and is being applied in land consolidation

as well as in Land Reforms. The only difficulty one can foresee is that of continuous updating of land records as project lands improve in their productivity. The experience is contrary to that. One of the major reasons of ineffectiveness of the Land Reforms in the country was that land classification was based on 'Produce Index Units' of the pre-Independence period when irrigated land was severely affected by water-logging and salinity and had low productivity. Since then land records do not seem to have been reassessed. Therefore, large farmers managed to hold large areas. There is a need to update these records every five years in these projects and to levy water rates according to the productivity of lands. Such a policy will encourage farmers of affected lands to improve their lands and to recover the revenue thus lost from the farmers who have productive lands. It will also impede unnecessary extension of irrigated area to compensate for low yields, especially when there is a shortage of water. The farmers will not apply water thinly to aggravate the salinity problem.

DOUBLE WATER RATES

In canal commanded areas of SCARPS, double water rates (abiana) were levied due to increased irrigation supplies from public tubewells. This was applied so cruelly that even farmers using water from their private tubewells only were not spared. This created a great deal of resentment against the project authorities for putting unjustified tax on them. This factor will have to be taken into account initially if we want to encourage rapid private tubewell development. The problem would vanish with the gradual abolition of public tubewell development in fresh-water zones.

SUMMARY OF CONCLUSIONS

The results presented in the paper make it obvious that, in the past, we have attempted to find short-term solutions to our long-term problems of rural development, particularly in reference to SCARPS. We put high hopes on public tubewells

as a means to supplement canal irrigation and to lower the groundwater table. On the contrary, private tubewell development made more contribution than the public tubewells. The growth of private tubewells went much beyond the expected rate. However, we justified the existence of public tubewells for the last twenty years on the plea of equitable water distribution even to the small farmers and effective subsurface drainage. We faced the probelms of public sector tubewell development without making an effort to determine the causes and thus find the solutions. Solutions in reorganization were proposed and implemented, but the problems continued. This was probably due to lack of systematic study of the interaction of technical, social and economic problems.

It is feared that the policy to shift tubewell development in fresh water zones to the private sector will carry with it, the present problems in addition to the new ones that would crop up. These include power connection, payment of power bills, reforms in owner-tenant relationship, and levying of taxes according to land capability, at least in the first few years.

So far the amphasis has been on engineering solution. It is not the engineering solutions alone which can produce the desired results, but these have to be integrated with social and economic solutions to achieve optimum agricutlural production. An integrated study is needed to remove the present hurdles to obtain maximum performance efficiency of SCARPS. The sooner such a study is carried out the better it would be in the shift under the proposed SCARP Transition Programme. Short term studies by Consultants only give clue to the present problems and their solutions and cannot be regarded as permanent for the problems that would arise in the future.

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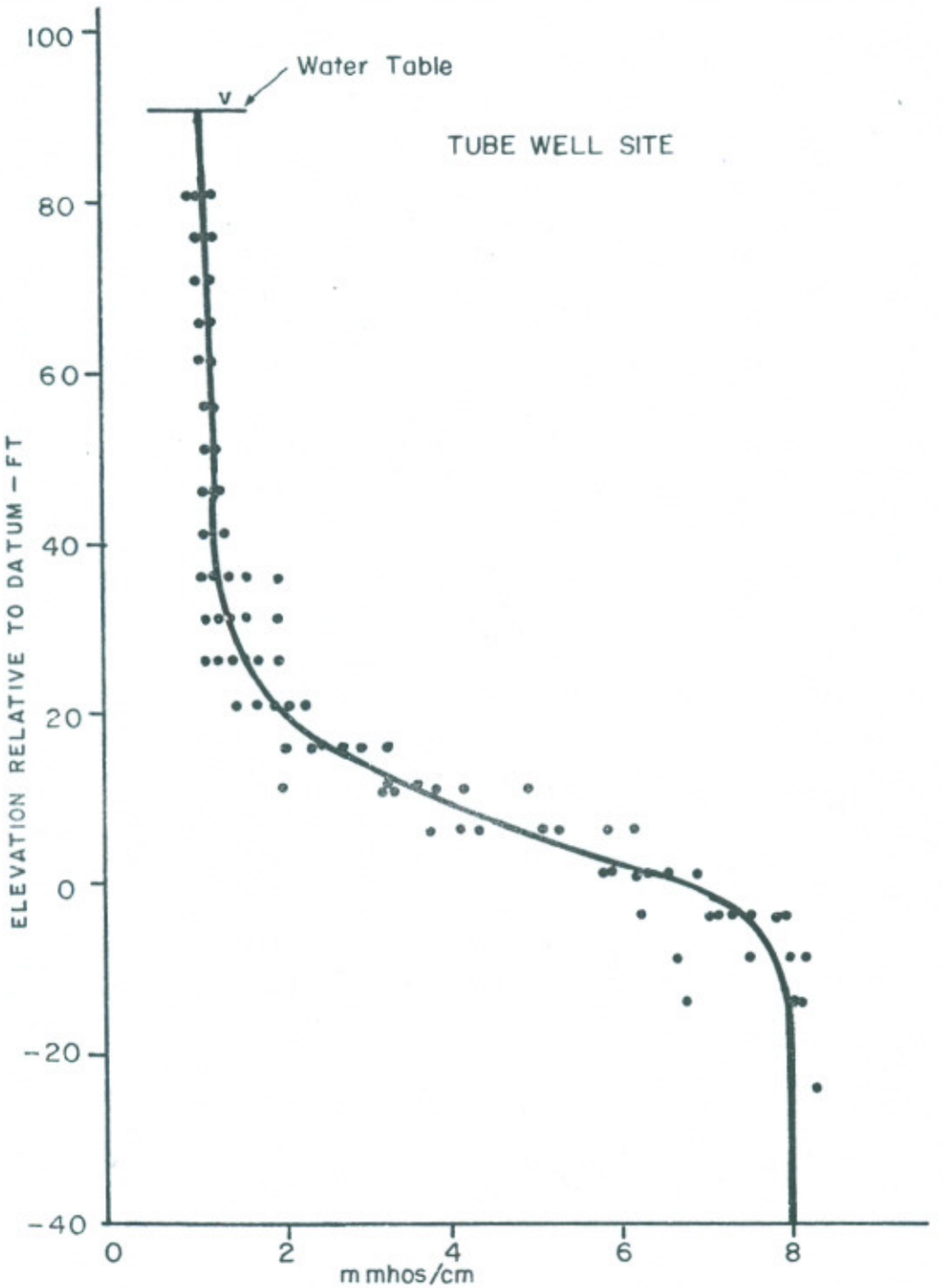

FIG. I SALINITY PROFILE AT SKIMMING WELL TEST SITE

FIG. 2 DISTRIBUTION OF PRIVATE TUBEWELLS IN VILLAGES WITHIN SCARP – I (1981)

