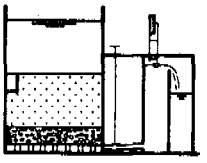
S.S.F.
Research and Demonstration
Project on
Slow Sand Filtration



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IRC – Water and Sanitation Centre

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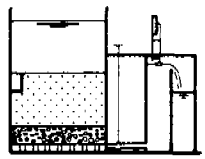

Report on duty-travel to the

Rahad Irrigation Scheme, Sudan

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Dr. A.T. White

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International Reference Centre
for Community Water Supply
and Sanitation
WHO Collaborating Centre

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Introduction

Since a number of years the International Reference Centre for Community Water Supply and Sanitation is coordinating an integrated Research and Demonstration project on Slow Sand Filtration in Thailand, India, Kenya, Sudan, Colombia and Jamaica. The project aims to promote the application of Slow Sand Filtration as a simple and reliable purification technique which often can be used to advantage when surfacewater provides the only available source for the production of drinking-water.

Slow Sand Filtration Project 1977-1980

After an initial research period of two years in which the existing knowledge on the subject was tested and adapted to the circumstances prevailing in developing countries, the project moved into a demonstration phase.
In this phase each of the participating countries selected a number of communities as demonstration villages.

In order to ensure successful and continued operation and maintenance of the water supply the community is involved to greatest possible extent in implementation of "their" scheme.
A Health education programme shows the population the link between health and safe water so that the need for environmental sanitation and the value of clean water becomes clear to them. This understanding generates motivation and commitment to the proposed project.
Community education and a participatory approach renews and sustains the interest of the villagers. Finally, though still assisted by the engineering and health education agencies, the responsibility for the water supply scheme will be transferred to the community.

This brief description of the Slow Sand Filtration Project shows the methodology used: integration in the community of a water supply system including Slow Sand Filtration through an extensive community education and participation support programme.

In general, this methodology has been successfully applied in the countries which are participating in the Slow Sand Filtration Project.
However, in the Sudan where the Rahad Corporation, in cooperation with IRC, is testing Slow Sand Filters in the Rahad Irrigation Scheme, Community Education and Participation has as yet not been integrated in the project.
This is mainly due to the fact that the Rahad Irrigation Scheme is a fairly recent development * in which a lot of support agencies have only just been established.

In the context of the SSF-project Dr. A.T. White was invited by IRC to visit Sudan and prepare a background report on the state of affairs in the Rahad Irrigation Scheme with special reference to:

- the socio-economic objectives of the scheme, and the extent of the realisation of these objectives so far;
- the services provided by the Sudanese Government and/or the Rahad Corporation;
- the effect of the fixed settlement pattern on the formerly semi-nomadic population.

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* 1970, first people been resettled in 1976

In addition Dr. White would discuss the health-education procedures in the Sudan and specifically in the Rahad Irrigation Scheme with:

- the Health Education Division, Ministry of Health
- the Chief Public Health Officer, Rahad Irrigation Scheme
- the Blue Nile Health Project.

Furthermore he would pay attention to operation and maintenance of Slow Sand Filters and the scope for community participation in the SSF-project in the Rahad.

The report Dr. White has submitted is the result of a very fruitful trip to the Sudan and contains a good number of interesting observations.
If not for the kind cooperation and the warm hospitality extended by all the persons he met, his visit to the Sudan would not have been so worthwhile.

On behalf of Dr. White I would therefore like to express my sincere gratitude to all those who have added to the success of this trip.

The report is divided in two parts, the first part deals with a number of specific subjects while the second part reflects the discussions which Dr. White had with various people.

H.A. Heijnen
Project manager
Slow Sand Filtration Project

PART 1

Analytical Report on Questions Covered

The Rahad Irrigation Scheme

In size the Rahad irrigation scheme will be 2nd only in the Sudan to the Gezira, and its development is being given high priority by the government. Its organisation follows approximately the model of the Gezira scheme, though with some differences. That is to say, the land has not been distributed in smallholdings (or small tenancies of about 5 acres each) as in some Egyptian schemes, nor kept under direct control of the government corporation as a kind of state farm, as with some sugar schemes in the Sudan. As with the Gezira Board, the Rahad Agricultural Corporation will exercise close control at least in the early years over all aspects of production, but the land is distributed in tenancies of a larger size to tenants who hire labour. A special feature of the Rahad scheme is the even greater emphasis on mechanisation by comparison with the Gezira or other schemes.

The overall plan envisages a second stage, with a second main canal and further irrigation to the northeast of the area irrigated in the first stage. But, depending on financial resources, it will be many years before this second stage is implemented. For the first stage, the main irrigation works have been completed, and the initial investment cost is put at something of the order of $500 million (US).

Actual settlement and agricultural production began at the southern end of the scheme in 1976 and has been extended northwards. It is currently at the stage of settlement of the 8th of the 9 "blocks" into which the scheme is divided. At present, the settled population is 100,000.

One objective is to grow cotton for foreign exchange. Another is to "modernise" the Rahad area by transforming semi-nomadic pastoralists into commercially-oriented and efficient farmers. A third is to test mechanised techniques of production, which might then be adopted in other irrigated projects in the Sudan. One must also mention that it is a prime objective to benefit the local population, with regional balance being achieved by locating other schemes in other areas. I see some problems in each of these objectives except the first. (Incidentally, I was unable to obtain any written document outlining either objectives or progress: the objectives stated here were mentioned informally in interviews.)

The tenants are not given any individual choice as to what to grow nor what methods will be used. The mechanised operations are carried out by the Corporation, and charged to their accounts. Manual operations (where the Corporation decides that manual methods will be used) may be carried out by the tenant himself or by labour he employs; however, the Corporation undertakes where required to obtain the labour for him, and advances him for each operation the amount the Corporation decides he needs to cover the cost of the labour: for the wage itself, for food, and for building temporary huts to house seasonal labourers. The relation of the field inspector to the tenant is thus one of issuing detailed instructions, rather like a foreman. The tenants, with few exceptions, have no past familiarity with the crops they are to grow: they have been pastoralists, herding camels, cattle, sheep and goats (with an emphasis on camels in the northern part and cattle in the southern).

Note: When "acres" are mentioned in either part of this report, the reference is actually to the local measure of land area, the feddan. 1 feddan = 1.038 acres = 0.420 hectares

They have also grown rain-fed durra (a sorghum) but their interest has been in their animals. It is said to be difficult for them to appreciate the needs of the scheme's crops.

These remarks apply in particular to the main type of tenancy, the agricultural. This consists of 22 acres of land, of which in any year 11 are planted to cotton, 8 to groundnuts and (according to the plan) 3 to fodder, for the limited number of animals tenants are allowed to keep in the scheme. A request by tenants to grow durra instead of fodder is under consideration. The overwhelming majority of tenancies are of this type, but in each of the 45 villages there will also be 17 horticultural tenancies (5 acres, 1 to fruit and 4 to vegetables), with double that number of horticultural tenancies at the villages which are the nine block HQs. Block HQ villages will also have an "animal production complex" consisting of 120 animal production tenancies of 10 acres each, planted to fodder crops, with cattle kept in pens.

In a few cases at the northern end of the scheme, villages already existed within the area to be irrigated, or so close by that tenants could remain in their pre-scheme villages. For the most part, however, the tenants have been resettled in new villages each of which has a population of about 3,000. The majority of the population in each village consists of tenants and their families, but up to about 40% are permanent labourers. At present, both tenants and labourers are living in huts of similar construction (from poles and reeds, of cone and cylinder type, a temporary form of housing but similar in appearance to the permanent mud and thatch huts of the area). This contrasts with the modern brick housing which the Corporation builds for its employees in the villages which are also block HQs. Eventually, however, it can be expected that the tenants will build brick houses for themselves on the house plots which they have been allocated and where they now have their huts. Whether the labourers will be able to do the same is more doubtful. At present the labourers have a standard of living comparable with that of the tenants (doing much more physical work, particularly in the case of female family members). Whether this position will continue depends on Corporation policy and on the market factors which determine the price of labour, but in the Gezira the tenants have gradually become prosperous whereas the labourers have conspicuously not done so.

There is a wide ethnic and social division between most tenants and most labourers. The tenancies were granted as a matter of policy to the local population living along the section of the Rahad valley where the project was located. There were some exceptions, particularly in the case of horticultural tenancies where it was considered desirable to bring in some people who were familiar with such crops. Horticultural tenants, even within one village, tend to come from a wide variety of original places. The agricultural tenants in each new village come from 3 or 4 original local villages. The majority of the labourers are called "Western Sudanese": they mainly come, in fact, from areas of Eastern Kordofan not far across the White Nile, i.e. from the closest part of the Western Sudan.

The new villages are spatially divided into sections or wards, in each of which live people of similar origin. The population from each of the old villages lives separately, and there is a separate section for the Western Sudanese who are almost all labourers. They have, in practice, no say in village affairs. However, they are at least located at the main village site and will benefit from the services provided there. In the case of water, for instance, the Civil Engineering Department of the Rahad Corporation is laying down the distribution system with standposts in the labourers' sections, despite comments from tenants that they are "only labourers" and there is no need to provide standposts for them.

Seasonal labourers come in for the cotton harvest which lasts from December until April. There is said to be a shortage of seasonal labour: this will be discussed in a separate section as it is closely related to the question of mechanisation. In the 1979-80 cotton harvest there were 56,000 labourers altogether according to the Corporation's statistics, and the great majority of these were seasonal (probably ¾ or 42,000). These seasonal labourers are mostly housed in temporary huts at the fields, not in the villages, so that time is not wasted in the morning in getting to the place of work. Almost ½ of the seasonal labourers come from the Western Sudan (i.e. the same closer areas of Kordofan), but rather more than ½ come from areas adjacent to the project or other parts of southern Kassala Province.

The project HQ is an entirely new town, El Fau, where there are at present about 150 non-manual employees, many with their families. There is also a cotton ginning factory and various other institutional groups of buildings, many of them temporary, such as the housing for the Macalpine employees building the project's road system; there is also a market, but not yet any non-institutional housing other than the huts of labourers, which are "illegal" and under threat of removal.

Among the problems which have had significant adverse effects on the project in its initial stages is a sharp fall in the cotton yield, due in part to pests such as whitefly. A yield of 7 - 7½ kantars (kantar = approx. 100 lbs of ginned cotton) per acre in 1977-78 dropped to 4 - 4½ kantars in 1979-80. In part this low yield is also related to problems of picking, which will be discussed in relation to mechanisation. There have also been problems with the marketing of groundnuts (and, less importantly, horticultural produce), and this year with the growth of weeds during a very wet rainy season which did not allow weeding to be carried out. There have also been delays such that, it is said, the project is about one year behind schedule in terms of harvesting the first crops and repaying the heavy investment.

The services provided

The scheme is still in its early stages, and many of the planned services are still lacking, particularly in the northern and middle "groups" (the project area is divided into 3 groups) which are still being settled or have been setiled more recently.

Water is the service which has been most rapidly extended. With two exceptions, all the villages settled have a water supply. In a few cases (11) of villages closer to the Rahad river this is a groundwater borehole supply, but the great majority of villages have a slow sand filter supply. The two exceptions are cases of technical difficulties. In one of these cases, a borehole was made but the groundwater has apparently already been exhausted: this awaits technical confirmation, and if confirmed a SSF system will be installed. In the other case, the problem was caused by a change to the planned irrigation system: a slow sand filter was constructed next to a planned canal, but in reality only an inadequate irrigation ditch was dug in that location: again the remedy is under study.

Until now many villagers have had to walk a considerable distance to the filter installation itself to obtain water (and many of them will have preferred to go to closer canals). Currently, however, distribution systems to standposts in each section of the villages are being installed. There are still some complaints about the distance to standposts. The biggest problem of the water system has, however, been in operation and maintenance, and this will be discussed separately.

Health services are separated into curative and preventive: the Sudanese plan for Primary Health Care, with village health workers providing both

curative and preventive health services at village level, has not been implemented in the Rahad project. This may be because there are sufficient resources available for what is seen as a higher level of service: the plan provides for the stationing of a nurse to man a dispensary in each block HQ, with a dressing station in each village. The 3 group HQs will have Health Centres, staffed by medical assistants and visited by a doctor for 1 hour daily. El Fau will have a hospital. It has not been possible to see this system in operation, since little of it is a reality as yet, but it is clear that it will be almost exclusively a curative service.

Preventive health services are divided into three areas: malaria, schistosomiasis, and sanitation. The Blue Nile Health Project, which is in its initial stages and covers the Rahad area as well as the Gezira, will reinforce this structure and bring additional resources to bear. In the field of schistosomiasis, it will also introduce new preventive methods. For malaria, pre-DDT methods will be re-emphasized.

The preventive health services are headed by a Chief Public Health Inspector. For malaria, there is a Public Health Inspector, a sanitary overseer, a misroscope man, 4 assistant sanitary overseers, and 20 mosquito men. About 20 casual labourers are also hired for the annual spraying of DDT before the rains. The rest of the year there is larval control in the small irrigation channels.

For schistosomiasis there is a Public Health Inspector, currently undergoing training in Denmark. Also a sanitary overseer, 2 microscope men, an assistant overseer ("sheikh") and 10 "bilharzia men". Prior to the Blue Nile Health Project, the only activity was looking for the vector snails and molluscicide when they are found. Since the Blue Nile Health Project started work in the Rahad, the people have been checked for the disease and those found infected (a high proportion of those who come from the Gezira or the New Halfa irrigated areas) are treated with oxamniquine.

For sanitation the organisation differs somewhat in each of the three groups. In all villages, public latrines have been constructed, sometimes 4 latrines x 4 compartments, but the plan is now changed for the last group to 8 latrines x 2 compartments. There has been a problem with latrines left uncleaned, and it is clear that by no means all the population uses the latrines provided. In the southern and middle groups, they are cleaned as campaigns, with the sanitary overseers hiring casual labour. In the northern group, the plan is to appoint a man in each village to clean them. In all cases, those who clean latrines are Nuba - non-Arabs from the Western Sudan - who can be found among the labourers in El Fau. There is no provision for sanitation for the seasonal labourers.

Education. The plan provides for a primary school in each village, but in the middle section at least, schools have so far started only in block HQs and because of distance few children attend from other villages, from which they have to walk. Thus paradoxically, the aim of settling a semi-nomadic population in order to bring them within reach of services and in particular education, has at first led to probably greater difficulties in getting to school (no comparative figures are available). Another problem is with reluctance to send girls to school. It appears that the reluctance manifests itself as they grow older: the figures for registration at the primary school in Village 3 (in the oldest-settled southern group, where schools exist in more villages) are as follows:

Class	1	boys	55	girls 60
	2		30	18
	3		30	5
	4		23	7
	5		32	3
	6		24	4

So far there are seven primary schools in the scheme. Also, intermediate secondary education is available within the project area. There is a secondary school for girls at El Fau and one for boys at Group III HQ.

All these services are free to the population and are available to labourers as well as tenants (though there will undoubtedly be a differential uptake as between these groups). Even drugs are free within the health service in the Sudan generally, but there is said to be a problem in that the medical assistants are overloaded with patients and do not have time to give enough individual attention to each one, so that although they are well trained the history taking and examination of patients is cursory: in this situation many people have recourse to private doctors and pharmacies (which are indeed everywhere in evidence in the towns).

In addition to these services, tenants have been provided with food from World Food Programme sources for their first two years of settlement.

There are as yet no agricultural or social development extension services, and no health education or mother and child health care services.

The seasonal labourers will be able to call upon the health services (there will presumably be an overload), but not in practice upon the water supply, since they are housed at the fields. It is suggested that water might be provided to them in barrels loaded on donkeys, but so far they obtain their water direct from the undoubtedly polluted canals. Similarly, although in most cases whole families are involved, the children will not in practice be able to go to school (they will not be admitted even when they apply).

Effect of fixed settlement pattern on formerly semi-nomadic population

The whole objective of "sedentarising" a "nomadic" population in order to bring them within reach of services such as education and in order to "modernise" their way of life is conceptually questionable. First, the population of the Rahad area from which the tenants are drawn have not been fully nomadic. They have their settled villages along the Rahad River, and they plant rain-fed durra in the vicinity of these villages (this grain, their staple, is adapted to the short rainy season). But they are primarily pastoralists and they take their herds to graze the grass which grows during the rains in a large area to the northeast of the river, including the area now occupied by the irrigation project and stretching a considerable distance further to the northeast. This is a seasonal movement as there is no permanent water available in these grazing areas. On the basis of making this fully rational use of the pastoral resources of the region, the Rahad pastoralists have what appears to be a reasonable standard of living, not a bare subsistence level. Although children do sometimes follow the herds in their migrations, there would probably also be every possibility of providing education, and also other modern services, in their existing villages. It is not the case that pastoralists have to be converted into cultivators in order to be brought into the "modern" economy and social system.

On the other hand, the project will undoubtedly improve the standard of living of tenants, once the initial difficulties are overcome and the financial returns appear. Tenants will receive the market price of their produce (except in the sense that a differential exchange rate may represent, as it can be said to do at present, a de facto export tax on cotton), less the Rahad Corporation's costs especially for mechanised operations, and less a charge for land rent and for irrigation water. In the current initial stage the charge for irrigation water is subsidised to the tenant (he pays 50%), and in the first seasons this subsidy has been necessary for the tenant to show a profit at all (while the Rahad

Corporation itself has been running at a loss on annual accounts). But this is a result of early organisational difficulties which will certainly be corrected.

Thus, when profits do appear there is every expectation that they will accrue to the tenants. The fundamental question will then be: is the project in effect converting a productive pastoral population into an unproductive rentier or landlord class? This concern is also voiced in the Rahad Socio-Economic Research Project's proposals for research: "There is often the accusation that the tenant in irrigated schemes has gradually changed into a landlord, implying that his direct physical effort, and that of his family in agricultural operations in the tenancy is increasingly shrinking with more dependancy on hired labour. How far does the Rahad stand from this situation, is an issue that needs investigation."

It is already clear that the female members of tenants' families are doing little work in cultivation: in many cases they do not take part even in the cotton harvest, despite the urgency of that work. This contrasts with the active role played by women and even girls in the pastoral economy, in which they take part both in tending animals and in growing durra. It appears possible that the project may be re-enforcing male dominance in various ways. In the pastoral economy, women own animals as well as men, and receive the Moslem $\frac{1}{2}$ share on inheritance. In contrast, the agricultural tenancies have been granted to men as heads of families, and will presumably (as in the Gezira) be inherited after the death of both parents by one son, the other children including the daughters not receiving any part. Female tenants are not totally excluded, and some animal production tenancies may be granted to women, but the normal granting of rights to "heads of families" will strengthen the reality of that designation. Women do not vote in the election of village councils ("production councils"). Currently there is no organisation of women in the villages. The Corporation has been insisting on tenants' wives' joing their husbands within the scheme, but this may in reality be curtailing their activities and reducing them to household chores alone. In the villages visited, questions on handicraft production by women also drew negative replies.

In the Gezira, as the tenants have received an increased income, they have tended to withdraw from physical work and even from the direct organisation of work. Thus, groundnuts there are normally grown on a sharecropping basis, the tenant receiving half the produce without having contributed any of the factors of production except "his" land (possibly also the seeds but these account for less than one tenth the value). All the conditions exist for the same phenomenon to appear in the Rahad, and cases of sharecropping are already found. Representation of tenants on the production councils and in other ways will ensure that their interests are upheld, but it is unlikely that any parallel representation will exist in practice for the labourers.

It might be said, in sum, that one group of Sudanese is being selected for a benefit which will not be available for others. There may be indirect benefits in opportunities to work as labourers, but there is no doubt that on the Rahad labourers will continue to be very much "second class citizens".

The question of mechanisation: example of cotton picking

The Rahad Corporation is currently making a purchase of 50 cotton picking machines from International Harvester at a total cost (including spares, the sending of technicians etc.) of $3.5 million (US), which is being obtained as a loan from USAID. These machines have the capacity to pick 700 acres per season, so 35,000 acres will be picked by machine. The experience in the Rahad will be taken as indicative not only for the

remaining acreage (about 80,000 acres were planted to cotton last season, and this total will increase as the project is fully settled), but for other irrigated schemes in the Sudan. It may therefore be regarded as an important test case for the Rahad's policy of mechanisation.

The rationale for the purchase is a "labour shortage" in the cotton picking season, and the question therefore turns on whether anything could be done to overcome this apparent shortage.

A case for the purchase of the machines is set out in the First Progress Report of the Corporation's Technical Committee for Mechanical Picking. According to this report, the total cost of mechanical picking according to experiments made in the 1978-9 season and at the prices prevailing then, is £28 (Sudanese pounds) per acre*. By comparison, the cost of handpicking one acre in that season was £21. These figures take into account all relevant costs, including the cost of prior defoliation by chemical spray of cotton plants to be picked by machine, a procedure not required for hand picking.

However, the report uses a figure of £47 per acre for hand picking, on the basis that owing to a shortage of labour, 22% of the whole cotton crop in that season was lost. On average, this represented a loss of £26 per acre which was added to the £21 cost of handpicking. It is on the basis of the comparison between £28 for machine picking and this £47 that the report recommends machine purchase.

No consideration is given in the report to the possibility of increasing the wage for cotton picking and thereby attracting more labour. The figures are, however, given that in the 1977-8 season 35,000 labourers were available (including tenants' families and permanent local labour as well as seasonal labourers), out of 50,000 needed, a shortage of 30%; and in the 1978-9 season, 47,000 were available out of 80,000 needed, a shortage of 41%. This seems a real enough shortage, until it is realised that the figure "needed" is the same as the acreage planted to cotton, in other words it is assumed that one labourer is needed to pick one acre of cotton - in the whole season!

In the most recent season (1979-80) the payment for cotton pickers started the season at £0.300 per guffa and ended at as much as £0.600. There are 9 guffas of unginned cotton to the kantar of ginned cotton, so that at an average yield of 6 kantars per acre, a labourer was able to earn £13.500 - £27.000 per acre. A picker may pick 2 - 4 guffas in a day. Thus, the more proficient picker (4 guffas) at the wage prevailing in December 1979 (£0.300) would only earn £S1.20 ($1.50 US) per day. He would, incidentally, pick the equivalent of one acre in 11¼ days. The picking season lasts from December until April.

It is the low wage, particularly at the beginning of the season, which seems to be the real problem. The current wage rate for other work, and for a shorter working day than assumed above for picking 4 guffas of cotton, is about £1.50 rising to £2 in periods of labour shortage such as the period just after the rains when labourers were urgently needed for weeding groundnuts. It appears, in fact, that seasonal labourers transported to the project by the Corporation for the cotton picking are in fact doing little work in cotton picking because it is less remunerative than other work which is available. And that this is the main reason for the 20% loss of cotton and also an important reason for low yields, since timeliness of picking is an important factor in total yields: the cotton should be picked first in December and then more cotton will appear for subsequent pickings later in the season, up to 4 or 5 pickings altogether. In the Rahad, often only one picking has been made, and that a late one.

There is a problem in getting the seasonal labour to the Rahad in December: those who come from Eastern Kordofan have been cultivating

*in the report itself, an error of calculation is made and the figure of £18 is given; but this was realised, and £28 is the figure used.

their own crops there in the rainy season, gathering and marketing them from October to November. There is then a customary period of relaxation: the season for marriages. They have customarily come to the irrigated schemes as labourers only in January.

The Rahad Corporation officials are convinced that it is such "institutional" factors which prevent them from getting sufficient labour for the cotton picking: local people including the tenants themselves are said to be reluctant to take on the work. One explanation for the low wage is that the Western Sudanese seasonal labourers bring the whole family, and with the whole family working a sufficient income can be earned.

One of the problems with increasing the wage for cotton picking (and particularly at the beginning of the season when it is most important but may not appear so urgent to the tenants), is that the cotton pickers are employed by the tenants rather than the Corporation directly. The figures given are the payments sanctioned by the Corporation, and advanced to the tenants for paying their workers. The tenant is free to offer a higher amount to the labourer (if he offered a lower amount, he would not get any labour). In the Gezira, the tenants do pay their labourers substantially more (sometimes double) these amounts advanced by the Board, needing to do so in order to obtain labour in competition with one another. The problem may well be that the Rahad Corporation is already making payments which are higher than those of the Gezira Board or other schemes, and is apprehensive of being taken to task for increasing them further, while the Rahad tenants, being new to the business and with less cash, do not appreciate the need to supplement the payments made for labour by the Corporation - in particular they would not appreciate the effect on yield of a good picking in December. Thus the Rahad has a greater apparent labour shortage than the older schemes.

However, in the final analysis the decision to mechanise cotton picking appears to reflect the ideological emphasis in favour of mechanisation and the lack of any consideration given to the desirability of raising the market price of labour by retaining or creating opportunities for work. No consideration appears to have been given, either, to the fact that the cotton picking machines are a foreign exchange cost whereas the wages paid to labourers would recirculate in the Sudanese economy.

Community Participation and the Water Supply

Hitherto, the approach to water and health questions has involved very little community participation, and no health education. The water system has been provided, free of charge, and decisions have been taken by the Civil Engineering Department according to technical criteria. The main element of community participation has been the willingness of the Department to heed representations made by villagers, as in the case of the distribution system at Village 29, discussed in Part 2, P. 16. Also, the village operators are local residents, mostly sons of tenants.

In view of the experience in the Managil (Gezira), it seems undesirable to go over to a system of direct village responsibility for the water supply system, at least until a system of operation and maintenance has been well established, with operators and others fully aware of the tasks required of operators. The Managil villages exercise little control over their operators, and their work is said to be poor.

However, there are some ways in which increased community participation could be very useful, and these were discussed with the Civil Engineering Department. It was agreed, for instance, that the scraping of the filters could be done by the voluntary labour of villagers, under the supervision of one member of the department who would need to be there in any case in order to pump away supernatant water (given the existing design, see below).

This will help to solve one of the main problems of slow sand filters in the Rahad, namely the clogging which occurs during the rainy season when water of very high turbidity, originating in the Rahad itself, replaces the water brought from the Blue Nile. Currently, the maintenance team cannot deal quickly enough with all the clogged filters. Judging by the reaction in one village to this suggestion, there is little doubt about the willingness or ability of the villagers to organise voluntary work for this purpose.

Secondly, it was agreed that water and health committees should be organised in each village. It was thought preferable that these should be committees of women, who are more directly concerned. It appears that in the Gezira women's committees (on other problems) work well, often better than those of men. It would, however, be difficult to organise effective mixed-sex committees. The women's water and health committees will, it is suggested, concern themselves with questions of water use and hygiene, and with child care, as well as with difficulties with the water system. Misuse of taps is, for instance, an obvious problem but one which probably requires only the dissemination of knowledge concerning correct use among people who have not previously been accustomed to taps.

The committees will be able to liaise not only with the Civil Engineering Department concerning the water system itself, but with the Social Development Department (see Part 2, Pp. 23-24) and with any possible programme to be established by the MoH Department of Health Education. The Chief Public Health Inspector may play a role also. Eventually, it might be possible for the committees to supervise and assist in the work of village health workers, particularly in the area of MCH, incl. nutritional surveillance (weighing of young children monthly). These suggestions require, however, further orientation of the senior staff involved. A short technical assistance assignment of an expert with experience in this type of programme and specifically of the nutritional element would be indicated here. Further training requirements, particularly for intermediate level staff such as extensionists, depend on the form of extension programme adopted by the Rahad Corporation in general. If it takes the form now under consideration, of training villagers as extension workers in their own villages (see Part 2, P. 23), there will be a need for supervisors at group and block level, and it is suggested that the training programme for these supervisors should include a preparation to implement the above, i.e. to orient women's committees and village health workers concerning health education, child care and nutritional surveillance. This training could be imparted by the Ministry of Health, in particular the Department of Health Education, with some external assistance. In the area of hygiene and sanitation there will be a need for liaison with the Blue Nile Health Project.

Water supply operation and maintenance, and filter design

As the Civil Engineering Department would readily agree, the operators work poorly, with little understanding or pride in their work. In fact, they do little more than turn the pumps on and off, and the surroundings remain in a very untidy condition, despite the fact that they have been told that their other tasks include the tidying of the area. They have been given no formal training so far, but it is questionable whether their poor performance is primarily due to the lack of formal training - they have been told what to do but they do not do it. To some extent, certainly, they may fail to do it because they do not appreciate the need, but it seems likely that even a short training programme could do relatively little to remedy this. More important, probably, is the low importance given to the job coupled with the inevitable lack of supervision. The operators are paid £S28 per month plus £S15 "hardship allowance" (an allowance given at varying rates to all Rahad employees for the initial construction period, an important inducement for higher-level staff to

come to this pioneering project). In addition, where pumps have to be on in the afternoon, operators get about 3 hours' overtime. To qualify for this not exactly exciting task of switching pumps on and off, the operator must have a minimal educational qualification (be literate).

It appears to be thought that, the higher the educational level the greater will be the appreciation of the hygiene and other requirements, and the better therefore the work done. This is questionable. The problem is that those with primary school qualifications consider the operator's work as of low status and will often have other more remunerative opportunities. In fact, it is likely that the main attraction of the "work" is that there is not much actual work involved, and they can in practice get on with something else. Mosquito men are paid a similar salary but in their case there is good supervision, and there is a need to complete a specific task each day: there is no complaint about their performance. The SSF water supply operator, on the other hand, even if he did conscientously carry out all the duties asked of him, would still be standing idly for much of the day. With supervisory visits very rare (necessarily), and with the ultimate sanction of dismissal accorded little importance, it is not surprising that the operator fails to do more than he does, and a training though desirable would probably make little difference.

The need is to increase the relative attraction of the employment in order to make dismissal a real threat. This could be done by increasing the salary, but such a course has been turned down by the Corporation on financial grounds: quite justifiably, since so little real work by the operator is involved. Similarly, a suggestion that the operator might be provided with a house at the SSF site would not be acceptable to the Corporation. It is suggested, therefore, that the operator should be given an opportunity to work on his own account at the SSF site: the responsible engineer has considered providing a plot of land for cultivation adjoining it. An alternative which could be more attractive is the use of a pond for fish-breeding, combined with training in fish-breeding techniques. Subject to technical confirmation, the same pond could serve for this purpose and as a pre-sedimentation pond to reduce the turbidity (see below).

Another approach would be to recruit operators for whom this employment is more valuable relative to their alternative opportunities. This might mean waiving the requirement for an educational qualification, but there are apparently government regulations which reserve regular government employment, even manual employment, for those with some schooling, or at least literacy. A suggestion which was received with some enthusiasm by the responsible engineer is that woman might be appointed as operators: he thought they would be more conscientious. The problem, of course, is that it might be difficult to get any female applicants to come forward.

The question of training of operators was also discussed. The responsible engineer will hold training sessions at El Fau lasting about 3 days for about 10 persons at a time, and agreed that it is desirable to include from each village not just the operator but the guard and perhaps another villager, a potential assistant or replacement.

Each SSF system has a guard or night-watchman, paid the same amount as the operator but (as a guard) not required to be literate. Whereas the operators are generally tenants' sons, the guards are apparently often sons of labourers. Their duties were stated as being "to sleep near the engine to prevent theft". Before they were employed, a number of pumps were stolen.

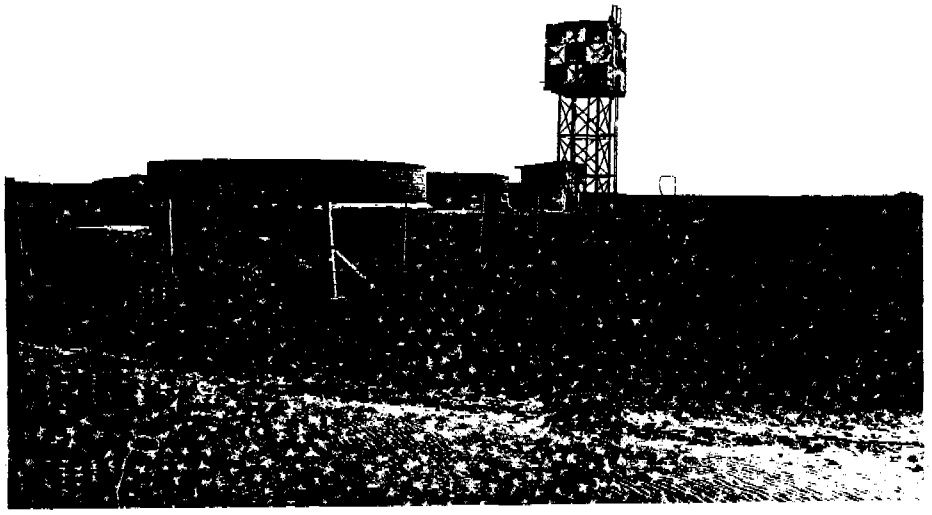
The design of the slow sand filters in the first 15 villages where they were built (Villages 1 - 18, with the exception of those which have borehole water supplies), is inadequate: there is only one filter with a diameter of 5.2 metres. Subsequently, filters were built in pairs with a diameter of 8m each. It is intended eventually to add another filter in the former villages.

Even in the villages where the capacity is apparently adequate, there have been many cases of problems of inadequate supply, especially since the distribution system was installed in some villages and consumption increased from very low levels. However, this is a problem of operation and maintenance: currently, the filters are allowed to flow with no control of rate (but intermittently, as pumping empties the clear water tank once or twice daily) until they clog, which until now, with low consumption because of the lack of a distribution system, has happened at the time of high turbidity during and after the rainy season. Then the maintenance crew is called in to scrape the filter(s). The Civil Engineering Department maintenance crew consists of 15 men but they also have other responsibilities (staff and institutional housing). An immediate constraint has been the inadequacy of their transport. They cannot always respond promptly, and villagers have often had to use canal water direct while waiting.

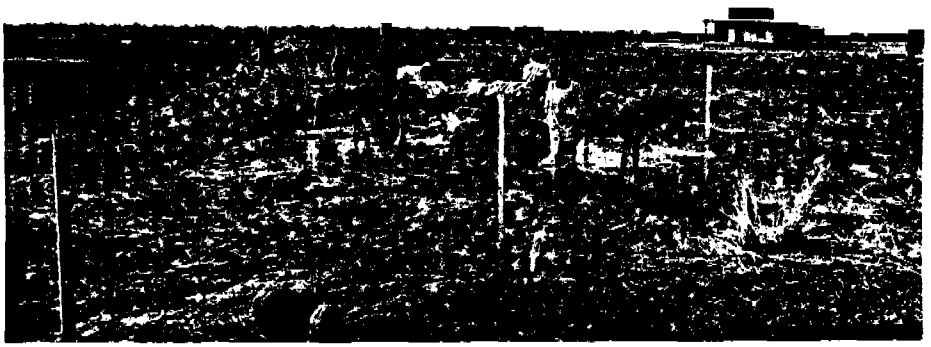
One might therefore think not only of introducing a controlled and monitored rate of filtration, but of instructing the operator (working together with village voluntary labour) in scraping the filter. Unfortunately, there is a design difficulty here. The pipe between the filter and the clear water tank is brought up to just above the topmost level of the sand, presumably in order to avoid accidental drying-out of the sand: however, this means that supernatant water must be pumped off the sand filter before it can be scraped, and a pump must be brought to the site for this. This means that a vehicle and at least one maintenance man must come from HQ (El Fau or Group HQ) anyway, so the scraping remains dependent on the maintenance team and its transport. There is no real need for this feature of the design, since the canal level never drops below the top sand level in the filter, which is filled by gravity from the canal. It could and should be changed even in the existing filters, so that the water can be drained through the filter by the existing pump to the high level tank.

In order to reduce the clogging during and after the rains, the responsible engineer suggests the construction of a large sedimentation pond - a simple hole in the ground which, with the prevailing clay soil, need not be lined. This would feed into the existing sedimentation tank by gravity and would not be expensive. It is this pond which might also serve for breeding fish for human consumption.

A final design question concerns the rate of pumping. The existing pumps empty the clear water tank in a few hours, necessitating an intermittent mode of operation which is highly undesirable; it appears that no appropriate smaller pump was obtainable (all smaller pumps had specifications that they should only be used for a few hours at a time). Thus the existing Kirloskar (indian) pumps were chosen as closest to requirements. Given this situation, the possibility might be considered of adding a wind-pump if any can be found (or designed, for they would presumably have applications elsewhere), which would at least in the greater part of the year when light winds prevail, ensure a more continuous pumping and therefore filtration, even through the night. Powered pumps would have to be retained as auxiliary in case of no wind, but there should be savings on fuel as well as gains in bacteriological purity of the filtered water.



Standard Treatment Plant in the Rahad.
Sedimentation tank, 2 Slow Sand Filters and an Elevated Tank.



Carrying of water by head-load and transport by donkey-drawn water carts.

Part 2

Duty-travel report on visit to the Sudan

27th September - 14th October 1980

The Rahad Irrigation Project

Mr. Seif ed Din Mohamed Babiker, Deputy Head, Civil Engineering Department

Took me almost immediately after my arrival, that is after breakfast which is taken between 9 and 10 a.m., on a visit to a village where he was going in order to solve a problem with the community, Village number 29.

First we called at a SSF on the way, at a block HQ (Village 27). (The 45 villages planned, 34 of which are already established, are divided into 3 groups and each group into 3 blocks; thus each block has 5 villages. Rahad Corporation officials live only at group and block HQs, each of which has a village attached. But at present there is no difference, as there is in the Gezira, between the way the block HQ water supplies and those of the villages are operated. A villager is appointed as operator but comes under the direct authority of the Corporation, i.e. of Seif Babiker and the Civil Engineering Department.)

The pump was on, but the operator came only after we had been looking around for 10 minutes or so. Clearly there is nothing like 8 hours' actual work a day involved. He starts the pump at about 6 a.m. and stops it about 9 a.m., when the level in the clear water tank is very low. Then he restarts it at about 2 p.m. (highly variable, according to how low the water has got in the storage tank). The pump is then on for another 3 hours, and that's all. Very little other work is done at all, and the fenced-in filter area is left very untidy. At the time of our visit, 12.50 p.m., the level in the clear water tank had reached the level of filter tank, sedimentation tank, and source canal before the pump was restarted for the afternoon: this means that filtration comes to a stop twice a day. Seif Babiker was not aware of the argument that the cessation of filtration is bad SSF practice. Also, the valve chamber was flooded with dirty water (after the rains): there is no adjustment of the rate of filtration, which is left to vary according to how recently the filter was scraped. There were goats grazing inside the enclosure: Seif said that he had repeatedly told the operators not to let this happen, but they are not impressed. He had dismissed at least one when he found a donkey and a lot of muck inside the fence, but dismissals from such a post are not a serious threat. Other equally valued work is readily available.

The scraped sand is piled around the edge of the filter, with no special place to wash it for resanding. A more important design fault appears to be the lack of an outlet from the filter to facilitate cleaning (see separate report).

At Village No. 29 we again went to the SSF first. This was an even more depressing sight, because it wasn't working. The filters were clogged, and only a trickle of water was getting through: 2 days to fill the storage tank. It appeared that the operator was not even making much effort to get this amount pumped through, but he said he would do so.

The reason why Seif was coming to this village was that a problem had arisen over the pipes which were being laid to connect the SSF tank to the various sections of the village. (Hitherto, here as in the other Rahad villages, water has only been available at taps next to the SSF tank; but connections are being made to standposts at other locations around the villages. Even so, the villages cover a very wide area in proportion to their population, and many huts will still be at considerable distances from standposts. The huts are widely spaced within sections of villages, and there are also considerable spaces between sections.) In this case, the pipes had been laid out on the ground in roughly the positions where they were to be buried, and the villagers could see that a 4" pipe led away from the SSF tank to one section, while a 2" pipe continued to other sections, completing approximately a semicircle. It was the villagers of the latter part who had complained: they were afraid the water would not always reach them. Seif told me that from an engineering point of view the layout was all right and the cheapest solution, but that for social reasons he would accede to the request of the complainants and bring another pipe straight across to their part of the village. I concurred.

We went to talk to the people in the complaining section, and an informal meeting was held. (Seif greeted the people with familiarity, since they are from a village north of the Rahad which used to supply seasonal labour to his own tenants' village in the Gezira, and some of them had worked for his family.) All the tenants in Village 29 are from the same large Shukria tribe, but each section of the Village consists of people from a different original village. This is the pattern throughout the project, and results from the policy of granting tenancies to the local population, in practice to all those who actually farmed the land on which the project is located, together with selected members of other communities in the Rahad valley and immediately adjacent areas. All those from one original community were allocated both farming land and houseplots together in a new project village. This means that the real community spirit exists within each section and not in the new village as a whole. The ideological emphasis of the project, of course, is to create a new spirit of community in the larger village and to give a formal impression that it has already been created.

50 tenancies were granted to the village in question in this case, so that 50 "families" have come while about 100 stayed behind in the old village. By a "family" is meant an adult man with his wife or wives and their children. Each new village is to have 300 tenancies so this section forms less than ¼ of the whole village: it is typical for a new village to be divided into about 4 sections of tenants, apart from the labourers who form a further section. In the Rahad, the labourers are at least physically located in the same village, and they are Sudanese rather than foreigners, but many of the same attitudes are encountered towards them as in the Gezira.

Many more villagers from this village would have liked to come, though some with large herds of sheep wanted to stay anyway. The allocation of 50 tenancies was made on the basis of proximity to the irrigated area: for those who actually cultivated land that was taken over, tenancies

were granted to all families, irrespective of any other consideration (tenancies of uniform size: 22 acres). Within a narrow elliptical radius outside this area, villages were allocated a certain number of tenancies in proportion to population, and individual family heads who wanted a tenancy were listed. Allocation to individuals was then made by the Corporation on the basis of a points system according to criteria such as the size of the family, age of head etc. This refers to the ordinary or "agricultural" tenancies, the 22-acre plots which were by far the most popular. There are also 5-acre "horticultural" tenancies: these have caused problems; finally, there will be "animal husbandry" tenancies but none of these have been allocated yet.

The section has its own traditional chief or headman: he was present. He has responsibility over internal disputes. He also used to collect taxes but that will not be done by him in the Rahad. The section elected representatives onto the council of Village 29 in proportion to their population: there was a contested election, but only males voted. However, they said that the council does nothing, unlike in other places.

When the SSF is not working they get water from the canals and they do not seem to mind much. They do not boil it even for babies although doctors have told them to do so. (Of course, in their home village they have a deep dug well, which would be much purer than canal water even without boiling.)

Mohamed Al Hassan Sid Ahmed, Sudan Government Food Aid Organisation

The World Food Programme has been providing food for the tenants during their first 24 months' settlement at Rahad. According to the plan, it is enough to feed 5 people, and it is certainly enough for 3; of course, after 1 year at least the tenants have other sources of income, and they keep some of their small animals with them.

The informant had also obtained some WFP food aid for the cotton pickers - this would be a help to tenants too, since they would otherwise have to pay higher wages. It has so far been provided in one section and for one picking season.

Based on his experience in the Gezira, he thinks wheat should have been part of the rotation in the Rahad (instead of just cotton and groundnuts). In the first year, when things were ready too late for the planting of groundnuts, wheat was sown, and he has never seen it grow so well.

Heinz-Gerhard Jansen, Inst. für Phytomedizin, Univ. of Hohenheim

He has been at the Rahad for a total of 9 months spread over 3 years, studying weeds. In the afternoon I went with him to one of the fields he is examining regularly. Groundnuts had been planted but they had become overgrown with weeds and this field has been given up as not worth weeding. Apparently the problem this year was that the rains fell in quick succession, leaving insufficient time in between for the ground to dry sufficiently for hand weeding to be done. No doubt also, however, there is a lack of experience and incentive on the part of tenants who have not grown crops other than durra before (and durra is said to grow "virtually by itself", with little attention) and whose interest is in animal husbandry. Herbiciding might have been done aerially, but the rapid succession of rainstorms left the airstrips too muddy to use also this year! (There are several airstrips serving the Rahad from north to south, the pesticiding being run by groups and blocks in response to the pests locally monitored). Selective herbiciding from the air could also be carried to a fine art but one would need to choose one's herbicide at the last moment from a wide selection available on the spot, and this would cause logistic problems here.

Mr. Talaab, Chief Agricultural Officer

My questions were directed in particular to the question of mechanisation, since this is a principal feature of the Rahad scheme but one which runs counter to much current thinking in agricultural development in underdeveloped countries. I focused in particular on the rationale for the purchase currently being made for $3½ million (US), of cotton picking machinery from International Harvester under a USAID loan. (See separate report.) This relates, of course, to the impact which the Rahad project will have on the local population, in particular the actual or potential seasonal cotton pickers who might be displaced by machinery.

We also discussed the horticultural tenancies. Under the plan, an area of 85 acres has been set aside in each village, for 17 five acre horticultural plots. It was necessary to bring in people from other areas who knew about these crops: the local people did not favour this form of tenancy anyway. In some cases, however, the agricultural tenants have asked for the incoming horticultural people to be evicted and the tenancies given to "local" people.

Tenancies were allocated spatially in such a way as to minimise friction. Agricultural tenancies are in a uniform pattern whereby 8 depend on the same irrigation ditch. So the new tenants in a village being established were asked to group themselves in groups of 8: they group as relatives or at least from the same tribe. Then the land was distributed among the groups by toss of coin. In this way, a pattern of minor cooperation is easily established, e.g. when one man is away or another is more expert at a particular task. Villages which had a history of antagonism were allocated to different new villages.

Tenants are allowed to keep a limited number of animals with them in the scheme, but this is another issue between the Corporation and some at least of the tenants. Animals have been doing damage to crops, even eating cotton plants. The damage is done largely at night, but Corporation officials think that the animals could be better controlled if the tenants wished to. Agricultural tenants have almost all been pastoralists, so they will have either sold their animals or left them with relatives outside the scheme, apart from those they are allowed to keep. In some cases, wives remained outside to look after the animals, but the Corporation has insisted on the wives' coming into the scheme (note: this means in practice that their economic activity is reduced).

Ahmed Hassan Yousif, Agricultural Economist

Ahmed Hassan Yousif is the only economist on the staff, at least at El Fau. His Agricultural Economics Department employs 10 enumerators who collect costs from the tenants. It has also completed a survey of the number of animals kept on the scheme.

He gave me detailed cost breakdowns for the two crops of cotton and groundnuts. This I requested in order to understand the rationale for mechanisation (see separate report, i.e. Part 1).

There has been in these early years a problem with the marketing of groundnuts. Whereas the price "guaranteed" by government to farmers for the 1979 crop was supposed to be £S4.05 per kantar (approx. 100 lbs), the actual average price received by Rahad tenants was only £S2.45. This, with a yield of 0.8 tonnes per acre, made the gross return on the groundnuts £ 44.1 per acre, while costs of production were £ 51.2 per acre. Only the value of the hay as fodder, calculated at £ 6.4 per acre, brought the account into approximate balance, on average. With this kind of returns, it is not surprising that the tenants have not as yet manifested any great enthusiasm for efficient farming, but look upon the "advances", or payments by the Corporation for each operation such as watering or weeding carried out, more as if it were a wage.

Ahmed Ali Hassan, social development officer

Ahmed Ali Hassan joined the Rahad Corporation as a field inspector. He has an agricultural qualification from an Egyptian university. But he also has a qualification in sociology and has worked as a community development worker in another project in North Khartoum. Since 1979 he has been employed not directly by the Rahad Corporation but a joint Rahad Corporation-Ford Foundation Socio-Economic Research Project, whose secretary is M.O. El Sammani. Also currently employed at El Fau by this Project are two other graduates, Ahmed Ali Hassan's wife Sharma and another lady, and three non-graduates.

This group has played an important role in the settling of tenants into the villages following their selection (itself handled by a separate committee). They are given house sites as neighbours according to their own wishes and lists of old neighbours and extended families taken from the chiefs.

Tenants generally built first two huts on their house plots, one for living in and the other for "non-family guests". Those with more than one wife, about 20% of all tenants, have an additional hut for each additional wife (some have 3 wives). The tenants intend to build brick houses but none have done so at this early stage.

As mentioned before, each village has 85 acres set aside for 17 horticultural tenancies of 5 acres each. For these tenancies people familiar with horticulture have been given tenancies, from places of origin in the Gezira, Gedaref (within Kassala Province) and even from Darfur Province, in the Western Sudan.

With Ahmed Ali Hassan I visited Village 20. In this village, according to the agricultural tenants with whom a meeting was held, "the horticulturalists didn't stay". This was because the agricultural tenants were allowing their animals to graze the land intended for horticulture, a gesture of hostility. (I was later told that these horticulturalists had been given tenancies elsewhere in the project.) I saw the animals still grazing this land, adjacent to the village site, on my visit.

Village 20 has few if any services other than the SSF water supply. On driving to the village we had picked up the 5 or 6 boys who were apparently the only children attending school, at the block HQ. The plan is to provide schools and drssing stations in each village, as well as other services, but many are still without them now.

At the meeting, which was called with the village council ("Production Council") but appeared to be attended by a more random group of tenants, some complaints were voiced about the SSF water system. It was said that the filter is "always clogged", and that there's only one hour's service a day because the flow is so small. But the complaints seemed rather vague and exaggerated. When I tried to get exact information, somewhat contradictory statements were made. I was told that the filter had only been given any maintenance once in the two years since it was built, and that 5 days before my visit - this was clearly not so. On leaving the village, we drove to the filter. One of the two filters was badly damaged and out of commission, while the other was working; the overhead tank was leaking, making a large pool and muddy area, and the clear water tank had a temporary but adequate cover: later Seif Babiker told me that what had happened was that the wind had blown the overhead tank down, and it had fallen on one of the filters; temporary repairs had been done, while a permanent repair would be carried out in the future. Perhaps the strength of occasional storm winds needs more attention in the design stage: it was the same problem that put an end to the borehole windmills in the Gezira.

The villagers also complained that, even though standposts have been set up, they are still too far from the homes of many people. I tried to get more details of distances and numbers involved, but there was, I thought, exaggeration in the replies. More promisingly, they said that if the Corporation did not set up more standposts, they would be willing to buy their own pipes and taps in the market and set them up.

They also said that they would be very willing to do the scraping of the slow sand filters. They would be able to do it well, because one of them had worked in the maintenance gang and knew the procedure. All they need is the permission. (This is not quite true: they also need the water to be pumped out first, given the existing design: see Part 1).

At the moment Ahmed Ali Hassan's department is settling people from block 8 (of the 9). There are still 2 villages to be settled in this block, and the whole of block 9, but at that Northern end which is the last to be settled, there are several villages already located within the project, and these will simply be incorporated, with tenancies distributed to the inhabitants - in a few cases some people will be moved to other new villages from villages 39 and 40.

Ahmed Ali Hassan is now concerned also with another task given him by El Sammani: survey work. Two surveys are under way:

(1) A "demographic" survey, i.e. a complete census with questions on age of tenant and wife, number and ages of children, and educational levels. A card is being filled for each family, with some data initially taken from information collected by Habboob's health team, and the rest filled by enumerators in the villages.
(2) A survey of the services existing in each village, including schools etc. and also shops and markets, carpenters etc.

Dr. Idris, Head of Animal Husbandry Department

Dr. Idris arrived only a few months ago and is preparing to implement the animal production plan. In each block an area of land of 1,200 acres has been set aside, to be divided among 120 animal husbandry tenants per block, i.e. in 10 acre plots. The land is to be cultivated with fodder the animals will be kept in pens and there will be no grazing in these units. The emphasis will be on dairy cattle. These "animal production complexes" will be expected to serve as demonstration farms for other tenants, who will continue to raise some animals.

At present tenants own 70,000 cows, 23,000 of which are now on the scheme (there are about 20,000 tenants). Dr. Idris spoke of the need for more agricultural extension: the field inspectors "don't teach, they enforce rules". There is as yet no Agricultural Extension Department in the Rahad, while there is one in the Gezira where it is no longer needed. In the area of animal production, Dr. Idris says that extension services are needed "to teach them quality rather than quantity."

For agricultural tenants the plan is that each will grow fodder on 3 acres out of the 22, leaving 11 for cotton and 8 for groundnuts. So far this has not been done, and tenants are arguing that it is not necessary: they want to grow durra on the 3 acres, and say that enough fodder will be available from the durra stalks together with the groundnut hay. Durra is their staple, but they are having to buy it. The argument against growing durra on irrigated land is that it is the one crop which can grow rain-fed in this area during the short rainy season.

Each tenant will be allowed to have 1.6 animal units per fodder acre, with a cow counting as one animal unit, a goat as one sixth. Thus a tenant might have 3 cows and about 10 sheep or goats. Each tenant also appears to have a donkey to transport him to his field. Camels, which are central to the pastoral economy of many of those who have joined the scheme, have had to be left outside (though one does see a few within the villages).

On selection of tenants for the animal production complexes, Dr. Idris said he would offer them to local people with more than 12 cows, so that he could select the best 12. When I tentatively suggested a credit scheme to enable poorer people to benefit he thought it reasonable. The emphasis on local people is because the alternative in his mind is already prosperous outsiders such as merchants or Gezira tenants, who would leave others to do all the work.

Kabbashi Ibrahim, Manager, Rahad Research Station

The Research Station is working in various technical fields connected with agricultural production, though in the important area of pest control the Rahad relies on a research facility in the Gezira.

We discussed the question of mechanisation, and in particular the question of the purchase of cotton picking machines. He showed me the First Progress Report of the Technical Committee for Mechanical Picking - aptly named, because the committee had a clear bias toward mechanical picking. This is shown, for instance, by the report's reference to negative social effects of seasonal migration of cotton pickers: "Seasonal migration of labourers deprives their homeland of the human element for part of the year and this accordingly affects settlement and socio economic development programmes in these areas. The cultural diversity between pickers and residents of the scheme area leads to security problems and other undesirable effects." There is no reference to the positive role of cotton picking in providing a source of income, spreading the benefits of the irrigation scheme beyond the narrow local area. (The economic arguments are discussed in Part 1).

Seif Babiker: Visit to Group III HQ and horticultural station

We discussed and agreed on the desirability of founding water and health committees in the villages, preferably women's committees for the main village and the labourer's section separately (because it is most unlikely for social reasons that the labourers' section would be integrated in the work of a general village committee). He thinks that women's committees work better than those of men, and that it would be desirable to get local more educated women to start them because the other women will listen to them.

We also discussed the training of operators and other questions addressed in Part 1.

On the way to Group III HQ we stopped at a small additional slow sand filter plant which serves a group of Corporation employees' houses not in a village. An operator should have been there but he was not and we had to climb in over the fence. This was hardly surprising because there are so few tasks the operator has to do (even fewer that he actually does), and no supervision apart from the occasional visit like the one we were making. This SSF was working satisfactorily: the water demand is extremely low even for a filter of the small design which it is.

Group III is the longest-established Southern group (confusingly, because the individual villages are numbered from South to North), and I was shown round the horticultural nursery which covers a 120-acre site and appears to have been very well developed in the last year by the horticulturalist in charge. In this early stage he has to give a lot of attention, rightly I think, to the growing of ornamental plants for the HQs. This can be seen as necessary in terms of attracting staff to an area where there is at present no natural shade (the acacia and other bushes which formed the natural vegetation were cleared away, perhaps too thoroughly). But the

nursery is also growing seedlings for the horticultural tenants, and a large number of plants on an experimental basis. At present, the horticultural plan involves the 5-acre plots being planted with 4 acres of vegetables and 1 of fruit trees (7 rows of 10 trees, each row of a specific citrus or other tree uniformly everywhere). The varieties of vegetables are constrained largely by marketing factors.

While I was talking with the horticulturalist in his office at Group HQ, an old man came in with a complaint. As was explained to me afterwards, he was a Western Sudanese who was sharecropping (!) on a horticultural tenancy, and came to complain about the tenant coming to demand his half without doing any work. (I understand, though, that these are the usual terms of the sharecropping anyway.) He was told to bring the tenant to the office. If something could not be worked out, the horticultural department head told me, "I shall deprive him of the tenancy and give it to someone who will work on it himself." When I enquired if he could give it to the old man who was actually doing the work, he said the policy was to give the tenancies to local people and he would have to satisfy first those who had been resettled in the villages but had not got tenancies. This was the first I had heard of such people, apart from traders. It appears that some of these may be given tenancies, but also there are sons of tenants, too young to be given their own tenancies 3 - 4 years ago but now old enough.

Khedir Babiker, Group Inspector, Group III

The head of the administration in Group III.

We had only a short conversation as we met at the Group III waterworks before Seif drove me back to El Fau for lunch. We discussed the formation of water committees and the question of tenants' wives and their reluctance to do field work. 85 - 90% of Group III tenants' wives have now come into the scheme because the tenants have been threatened with eviction if they did not. Apart from those who were tending animals or growing durra outside, others remained outside so that their children could go to school (!).

He has proposed a change to the animal production plan: he would like to devote 3 of his group's villages entirely to stockraising. This would capitalise on the tenants' expertise.

Sheikh Sim Saa, in charge of mechanisation

Mr. Sheikh Sim Saa has completed his M.Sc. thesis on the problem of the use of labour or mechanical equipment for cotton picking, and this is what we discussed in the Rahad context (see Part 1).

It also emerged that the field inspectors have had to take over from many tenants direct control of the contracting of labour for all sorts of jobs, including picking: these tenants have neglected them. There is then a penalty taken from the amount paid to the tenant, and there is a threat of dispossession, but clearly these sanctions have not worked well enough, and a high proportion of the labourers resident in the villages are working directly under the field inspectors.

Seif Babiker: monitoring of SSF water quality

Seif had not yet carried out any monitoring of the quality of village SSF's. He does, of course, need a technician assistant for this work, which is time consuming. For a regular programme of monitoring, there would also be a need for an additional vehicle.

We went to Village 19 to test the supply there for turbidity and bacteriological quality. This village is close to El Fau (8 - 10 km., as close as any of the project villages). It is also the village where the operator has shown himself most conscientious.

The results of the test are enclosed.* It was carried out by Seif, with the operator (a tenant's son) and also the night watchman or guard (from a labourer's family) looking on with interest. It seemed to me that with instruction, even technically unqualified people could do the job, and that in the Sudan this is necessary because those with technical qualifications have many more lucrative openings.

He also gave me the construction costs of the village SSF's:

	small design villages 1 - 18 built 1976	large design villages 19 - 30 built 1978	villages 31 - built 1980 -
Masonry construction	£13,000	£46,000	£50,000
Tank and tower	11,000	11,000	11,000
Pump and chlorinator	500	500	500
Distribution @ £5,000 per km	15,000	15,000	15,000
	39,500	72,500	76,500

These costs are expressed in current Sudanese pounds. The reason why the three latter elements do not rise with inflation is that they were bought under a single contract at the beginning. But the main difference between the earlier small design and the later large design is that the smaller one involved only one filter of about 6 m. diametre whereas now two filters are built each of about 8 m. diametre.

Meeting on health education and related subjects

Prior to leaving El Fau, I called a meeting to discuss health education needs. Present were:

Mohamed Habboob, Chief Public Health Officer
Ahmed Ali Hassan, social development officer
Sharma Mrs Ahmed Ali Hassan, extension worker
Seif Babiker, deputy head, Civil Engineering Dept.
Ahmed Hassan Yousif, Head of Dept. of Agricultural Economics

In my introduction, I pointed out that there are unmet needs which fall between the responsibilities of the personnel already appointed or to be appointed in the villages, namely:

1) the nurse of the dressing station, whose duties are curative
2) the assistant sanitary overseer, whose tasks relate to the latrines and to mosquito breeding sites etc.
3) the water operator, whose responsibilities will probably be extended from the filter plant to the distribution system incl. advising people on correct use of taps.

There is, for instance, a need for Mother and Child Health Care (MCH) and for health education in the area of hygiene and sanitation.

The meeting concluded that:

Part of the need can be met through the planned appointment of 45 social extensionists, one for each village. They will be of primary school standard, given 3 months' training, and members of the village. They may be male or female. They will cover agricultural extension as well as all social aspects. On health

* Annex 1

matters, the meeting suggested that the supervisors should be given training by the Health Education Department of the Ministry of Health.

Nevertheless, in the area of hygiene and child care this will not be enough, especially where the social extensionist is male. There should also be extension work by a higher level female extension worker, who will probably work from Group HQ. It would be desirable for one to be appointed at each block HQ but it will be difficult to recruit qualified female staff at this level. It was agreed that, to start, Sharma should select some villages close to El Fau, found women's committees in both the main tenant section and also the Western Sudanese (largely labourers') section of the villages, and discuss with them the needs for changes in hygiene and child feeding practices. The experience in these villages will enable Sharma to orient the programme in other villages when further staff are available.

In addition, it was agreed that the area of MCH, including nutritional surveillance (regular weighing of children, with special guidance to mothers of those not gaining in weight), could be dealt with by a village health worker assisting the nurse who will be posted to villages. The nurse will be largely occupied with curative care for the minor complaints of the 3,000 population. Such MCH workers require training which may be given in part by the Chief Public Health Officer. The Ministry of Health has a programme of Primary Health Care, and other training possibilities may exist under this. It is already planned that a Health Visitor will be appointed to each of the three group HQs: they will be able to act as supervisors of these personnel. They could be paid, like the social extensionists under the existing plan, from a fund of 2% of cotton proceeds which it is intended to set aside for social purposes.

On the question of latrines, it was agreed that the public latrine system is inadequate. Some improvement is expected from the appointment of a sanitary labourer who will clean the latrines in each village, but at present this is envisaged for blocks 7 - 9 only. It was agreed that the encouragement of private latrines is preferable, but that there are financial constraints in meeting the full cost for all residents. Therefore the meeting concluded that latrine slabs should be made available and delivered free to any resident who has dug his pit from his own resources.

Finally, it was considered that a recreational pond for bathing could be provided in each village, to discourage the use of the irrigation canal by boys. It would be of simple construction, and protected against bilharzia transmission.

Visit to a pre-existing village

In the late afternoon I went with Ahmed Ali Hassan to a village close to El Fau, not within the irrigated area, some of whose inhabitants have received tenancies but where the traditional pastoral economy is maintained. It involves some seasonal transhumance (semi-nomadism) to take advantage of the pastoral resources of the area to the north which is too dry for permanent settlement but has a good growth of grass in the short rainy season. After some conversation, I was surprised to be invited into a hut. It was now after dark and the light was better inside, but it was a domestic hut with women present while on the previous visits to villages (except for the Fellata village at Barakat) women had always kept well out of the way. The round mud hut with a

conical thatched roof, typical of the area, was neat and clean inside, with not only an iron bed and a radio, but a tall kitchen cabinet full of glasses and dishes, with a closed glass front. Separate vessels for drinking and other water stood near the door. It struck me that if changes are needed in hygiene practices, they will require personnel with considerable respect for the existing way of life (in order to judge sensitively just what changes are really needed.) Ahmed Ali Hassan, however, said afterwards: "You see what a lot of work there is to change the habits of the people", pointing out in particular the free access the animals are given as far as the entrance of the huts. He also worried that children are given milk straight from the cow.

I also broached with Ahmed Ali Hassan the clearly rather delicate topic of female circumcision, which is known to be responsible for much suffering and even death (from infection) in the Sudan and should therefore presumably be one of the main topics of health education. He said it would be very difficult to change this practice, common to all Sudanese except some of the urban groups, until levels of education improved much further. He did agree, when I asked, that his wife could try to do some educational work in the project villages on this subject.

Rahad Corporation HQ in Khartoum

Mr. Osman Beleil, Managing Director

He described the project's aims as going beyond growing cotton for foreign exchange: the long-term conception is to transform the semi-nomadic pastoralist into a modern farmer with an agri-business approach. This is why the unit of 22 acres was decided upon: it is a size which will provide an efficient unit when the farmer does skilled work like watering for himself, but can call upon both machines and hired labour. He envisages that they will do about a third of the work for themselves. Eventually it should be possible to allow the tenants to make all the decisions for themselves even on what to grow, merely providing extension services and selling the irrigation water to them. That is why the model of the Gezira has not been followed, whereby the tenant is given only a proportion of the proceeds from cotton, but instead a charge is made for land rent and water for all crops. He also envisages that the tenants' sons will become the operators of the mechanised equipment which is to be used. The Rahad scheme is also a kind of experiment in mechanisation for the Sudan.

Gezira Board

Shown two publicity films on the Gezira scheme. Irrigation started on a large scale around 1925 and has expanded since, particularly with the Managil extension around 1960. Total area is about 2 million acres, and it is described as the largest farm under unified management in the world. This is divided into 40-acre "tenancies" (Gezira proper: 15-acre tenancies in the Managil extension). The crops to be sown and the agricultural methods to be used are determined by the Board, so that the role of the "tenant" is reduced to little more than the supervision of labour, with perhaps the contribution of some labour by his own family. Most labour is provided by either permanent or seasonal labourers. The permanent labourers live mainly in settlements separate from those of the tenants, though in some cases adjoining them. A high proportion are Hausa-speaking people from Nigeria, known in the Sudan as "Fellata". The seasonal migrants come mainly from areasnot far away across the White Nile, and are usually referred to as "Western Sudanese".

Cotton is the main export crop, and Gezira cotton is the main source of foreign exchange of the Sudan. Following a rotation system, each year about ¼ of the total area is planted to cotton, and the main requirement for seasonal labour is in cotton picking. Other crops grown are wheat; the durra variety of sorghum which is the local staple; groundnuts; and vegetables.

The Sudan Gezira Board is a government agency but its 15 members include 3 representatives of the tenants. There is also a representative of the trade union of the Board's own labourers, but the agricultural labourers have no union and are not represented.

Following the films I was able to spend a couple of hours in the Board's Archives, and consulting literature to gain a fuller understanding of the system of production, especially on labour and the social organisation of the residents and seasonal labourers.

It is clear that the tenants of the older-established areas of the Gezira have prospered. They have been able to educate their children to at least secondary school level, and have provided a significant proportion of the educated elite at university level too. Recently, indeed, a new University of the Gezira has been established at Wad Medani. Before the establishment of the Gezira scheme, Wad Medani was an insignificant place. Naturally, with prosperity has come a degree of political weight.

At present, the sources of the tenants' income are the full proceeds of the sale of all crops other than cotton, and 47% of the net proceeds of cotton after deductions for all costs. Since, however, the tenant cannot choose what to plant, the difference in the distribution of proceeds between cotton and other crops is not as important as it seems: it might be said that the tenant receives a politically-determined stream of income in return for his supervisory function over his plot. In the case of groundnuts, the usual practice is for the tenant to come to a sharecropping agreement with a Fellata labourer, who does all the work in return for ½ the product: it is difficult to see any real economic function performed by the tenant in return for his half of this crop.

Barakat villages

In the afternoon I walked to the main village and to the Fellata village near the Barakat Gezira Board HQ. There is a great contrast between the green gardens watered by irrigation ditches around the administrative

buildings and senior board officials' houses, and the dry and dusty aspect of the villages; but there is an equal contrast between the broad roads and brick houses of the main village, and the mud huts and narrow lanes of the Fellata village. Through a local schoolteacher, I was able to ask a few questions in the Fellata village, though this was not very successful because of the large crowd which soon formed. It seems that the usual rate of pay amounts to about £1.500 (Sudanese) equivalent to $1.88 (US) for a working 6-hour day (6 am - 12 noon). They maintained that the women do not do field work, only a bit of trading. Some odd jobs for money may be done in the afternoon, such as collecting weeds for sale to goat herders.

Mr. Adam Abdulla, Chief Civil Engineer

Mr. Adam Abdulla attended an SSF project meeting in the Hague about four years ago. Following this and based on the discussions, he changed the design of the filters being built in the Managil.

There are nearly 200 slow sand filters in the Managil extension - none in the Gezira itself (as the old-established part of the project is known) because groundwater sources can be used. New filters are still gradually being built, not all of the settlements in the Managil have a supply yet. The settlements tend to be small, some having only about 500 people, but close together so that a single filter can serve more than one. There are 51 filters under the direct control of the Gezira Board: these serve the "group" and "block" HQs with their adjacent villages. There are also approximately 140 filters constructed for the residents by the Board, but whose operation is the responsibility of the village (tenants') councils, under a local authority system at the head of which is the provincial commissioner or governor (Gezira Province, Wad Medani).

Adam Abdulla stated that the 51 filters for which his department has direct responsibility are well operated and maintained, with regular monitoring of bacteriological contamination showing negligible levels. He also affirmed positively that the intermittent mode of operation does not affect water quality: this is in contradiction with the findings reported at the Nagpur meeting*(Paramasivam et al.)

It is a different matter with the "village" SSF plants. Currently, Adam Abdulla's department undertakes an annual maintenance of these filters, and will sometimes go to scrape clogged filters at other times. The most conspicuous problem is clogging but there are many other problems of inefficient operation. The operator is employed by the village - the opinion at the Gezira Board is that this means there is virtually no control over his activity.

Mr. Mohamed Abdel Rahim, Deputy Head, Social Development Department

The Social Development Department, which coordinates all services provided to tenants and other residents, also has a responsibility for the water supplies. In construction and in maintenance of the village supplies, Adam Abdulla's Civil Engineering Department acts as its executive agency.

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* Meeting of Representatives of Slow Sand Filtration Project Countries NEERI, Nagpur, India, September 1980

Mr. Mohamed Abdel Rahim said that there is still a need for about another 250 filters in the Managil (this seems an excessively high number). The limiting factor, he said, is the lack of foreign currency. He also stated that at the beginning of November 1980 the provincial authorities are to take over direct responsibility for the village water supplies, including the filters. According to Mohamed Abdel Rahim, a team is even now being formed at Wad Medani, with two engineers who have been in the centralised Rural Water Corporation, and skilled maintenance workers in Adam Abdulla's department are being asked if they wish to transfer to this new organisation being created by the decentralisation of the RWC.

Visits to two more Gezira villages

In the company of a young agricultural officer of the Gezira Board, I visited the tenants' village of Es Soriba and its Fellata labourers' village located about 1 kilometre away. Again there was a great contrast between the relative prosperity of the former and the poverty of the latter. It appears that because of the influence of the tenants on the Board's policy-making, few services are extended to labourers' settlements. The situation is in some ways reminiscent of the relationship between the caste Hindu village and Harijan sub-village in India. In this Fellata village, the residents collected their water from a canal. In formal terms they are entitled to use the water and other services, but these are located at the main village. It was said that the children "do not go to school", but help their parents in agricultural labour. This is generally remunerated at piece rates, and children's work can be an important source of income.

The "Fellata" belong not only to the Fulani groups to which this term strictly applies, but to the Hausa and other Nigerian tribes. They have in common their knowledge of the Hausa language (they are now mostly bilingual, speaking Arabic also). They came to the Sudan as pilgrims on their way to Mecca, working their way overland, and stopped at the Gezira where there was plenty of work. The intention to move on to Mecca or return to Nigeria was gradually lost as they had children and became settled. My informant himself came 40 years ago. The children are entitled to Sudanese citizenship, and others can become naturalised, but few have done so. The significance is that few non-citizens are given tenancies in irrigation schemes: the Fellata have left behind their lands in Nigeria and have become virtually landless. They rear their own goats and sheep, but not cattle. The largest single source of income is in the sharecropping of groundnuts: each adult male Fellata will have one sharecropping agreement with a tenant.

In the main village the conversation was largely with tenants' sons. A very high proportion* of tenants are now over 50, but the sons do not usually work on the land. If they are not educated and in non-manual employment, they will get manual work outside the village, so that they are paid a wage rather than working for fathers who do not usually pay a wage as such.

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* As of 1973, 70%, in the Gezira as a whole.

This is part of the explanation for the much-discussed "shortage of labour" in the irrigated schemes as a whole. Another is that the female members of tenants' families do not do field work, except possibly in the cotton harvest. There is another factor, mentioned by Dennis Le Tray in an article which I read in the Gezira Board's library: "Research topics suggested by a re-examination of 'labour shortage' in the Gezira", Ch. 3 of University of the Gezira, Faculty of Economics and Rural Development, Occasional Paper: Report of a Study Group, Agricultural Labour for the Modern (Irrigated) Schemes, Feb. 1979. Le Tray suggests that the method of dividing the proceeds from cotton production, as compared with other crops, gives the tenant too little incentive to employ labour for thorough picking of the cotton crop.

This can be illustrated with some statistics (not from Le Tray's article) which refer to the Managil in season 1973/4 but which may be regarded as representative: the net return from each crop, after deduction of the costs of production which are borne from joint account, is compared with the amount received by the tenant: (per acre)

Crop	Gross return	Costs of production	Net return	To tenant
Cotton	S£67.928	£36.561	£31,367	£15,370
Wheat	32.267	14.545	17.722	17.722
Groundnuts	34.922	15.581	19.341	19.341
Durra	16.963	8.760	8.203	8.203

The table shows cotton as by far the most profitable crop, and it is the crop producing foreign exchange in which the Government has the greatest interest. But because the tenant receives the whole value of the other crops, but less than half the proceeds from cotton, it is a less valuable crop to the tenant than groundnuts or wheat (durra is grown for the tenants own subsistence and does not enter the comparison). The tenant being the direct employer of labour, there is a diversion of labour away from cotton, with fewer and less efficient pickings.

There is currently under discussion (i.e. under negotiation between government and tenants' representatives) a proposal to change to a system under which the tenants would not receive the whole value of the other crops. However, the tenants with whom I spoke at Es Soriba were under the impression that this is the only change proposed, with no balancing concession over cotton proceeds or otherwise. Naturally, they are therefore vehemently hostile towards it. When I outlined a possible alternative arrangement under which the government would take the same total amount as at present, but distributed between all crops, they immediately and unanimously agreed it would be preferable to the present arrangement. It is, incidentally, also necessary to mention that the government's share of the cotton proceeds is understated because of differential exchange rates. The current division is stated as follows:

To tenants	47%	(29.4%)
tenants' reserve fund	2%	(1.3%)
Gezira Board Social Development Department	3%	(1.9%)
Gezira Board	10%	(6.3%)
Local Government	2%	(1.3%)
National Government	36%	(60.0%)

However, a rate of exchange of 50¢ (US) to the Sudanese £ is used for cotton exports, whereas the tourist rate corresponding closely to a free market rate is 80¢. The figures given in parentheses above represent my recalculation of the real division taking this foreign exchange factor into account. It is not surprising that the growing of cotton is regarded by tenants almost as an onerous imposition, and this must be a factor in recent low cotton yields, which are a matter of great current concern, one might even say an atmosphere of crisis.

Another factor, perhaps the most important in accounting for low yields, is the growing damage caused by pests, in particular whitefly.

Grombach's mid-1960's consultancy

Before leaving Barakat, I was also able to see the report of H.E. Grombach to WHO in September 1966: "Study on Rural Water Treatment Plants in the Sudan Gezira" (EM/ES/79/Add.2 Sudan 42/R. 3 parts). It contains such statements as "most clear water tanks contained frogs, dead rats, snakes, worms, leaves, algae, and silt". It seems that it was as a result of Grombach's recommendation that the Rural Councils agreed to technical supervision of waterworks by the Gezira Board on their behalf. A WHO training scheme was also implemented following the report, according to Adam Abdulla, who was then Deputy Chief Civil Engineer. However, it covered the operators only of the Board's "Block HQ" SSF's, not the village operators. It is also interesting to note that Grombach advised: (Part 1, P. 2) "The discontinuous operation itself is not appropriate for slow sand filters and specially bad for the bacteriological results. Continuous low draw-off as found in some windmill plants would improve the results."
I enquired about windmills, and was told that those which had been used until the 1960's for borehole supplies had been replaced by powered pumps. There is a problem with high winds and another with certain months of very low winds, and clearly the engineers are reluctant to think of windmills, even as an auxiliary source to pump clear SSF water to the high level tank and thereby make the operation more continuous, and incidentally save fuel.

Another suggestion of Grombach's is worth reproducing. It is for a simple test of water quality: "In this test a given amount of water is filtered through ordinary chemical filter paper. The degree of darkening of these filter papers is an obvious measure of water purity, easily understandable also to such people who cannot find any meaning in numbers such as ppm of suspended matter. It is expected to be of eminently educational value to attendants, villagers and supervising bodies." (Part 1, P. 4). I doubt if this was taken up.

Blue Nile Health Project

Dr. A.A. el Gaddal, Director General of International Health and Director of the Blue Nile Health Project
Dr. Osman el Zubeir, Chief Epidemiologist, Blue Nile Health Project

Dr. el Gaddal is to take up residence at Barakat in the Gezira at the HQ of the Blue Nile Health Project from early October. This indicates that the BNHP is entering its main phase of field activity after initial preparations, and that it is being accorded high importance.

Dr. Osman el Zubeir has hitherto been resident at El Fau. He was the first to tell me something of what has and what has not been done by way of health services in the Rahad. There has been little or no community participation as yet, and no health education, nor have the social service schemes which exist in the Gezira been extended yet to the Rahad.

Schistosomiasis has, however, come to the Rahad now. In the first months of 1980 the monitors employed by the BNHP reported the presence of both bulinus and biomphalaria snails in the Northern part of the Rahad scheme. Molluscicides were applied, but it does nevertheless appear that there has been some internal transmission - cases of bilharzia in a few individuals who have not left the project area, in addition to the many 'imported' cases. Dr. Osman el Zubeir emphasised that in the Rahad it is still the case that often people have to take raw water from canals because of breakdowns in the water supply.

Mr. William Jobin

Mr. Jobin is the American Public Health Engineer who, prior to Dr. el Gaddal's arrival in Barakat, has been in day-to-day charge of the BNHP in the field. He intends to remain the full duration of the project, namely 10 years. He is basically a schistosomiasis expert, having been involved in the eradication of the disease in Puerto Rico.

He was highly appreciative of the support given by the Sudanese government to the BNHP. The most capable people have been made available.

He had expected the spread of schistosomiasis to the Rahad. There are many means by which the snails can spread, since they infest the Blue Nile up to Lake Tana, while there is much migration of people between the Gezira and the Rahad, including camel herders who fill goatskin water bottles in the Gezira canals and then next in those of the Rahad. The BNHP had not expanded its activities sufficiently rapidly to be able to act on a large enough scale upon the first appearance of the snails.

Mr. Jobin favours the use of the predator snail Marisa Cornuarietis, used in Puerto Rico, which he thinks could eradicate schistosomiasis throughout the whole Nile basin at negligible cost. It attracts miracidia harmlessly to itself, and also displaces the bulinus and biomphalaria species which transmit the disease (it is much larger). The only important counter-argument is that the introduction of a new species would have unpredictable ecological consequences. Mr. Jobin considers enough is known about the marisa especially from Puerto Rican experience, to be able to say that although it would eat much of the water vegetation, the only crop which would suffer is watercress. There is fear for the rice paddies of the delta in Egypt, but he thinks that because of the methods of cultivation used there it is groundless. The snail will only attack rice in its young growth stage, and if it is not inundated at that period there is no damage.

Until this argument is settled the BNHP will use many other methods of schistosomiasis control, including those which require considerable community participation. For instance, a village will be asked to agree to confine all bathing and other activities with water to just two sites instead of five or six, and continuous molluscicide carried out at the two sites.

We spoke of possible collaboration between the BNHP and any 3rd phase of the SSF project. He would anyway eventually include training of water supply operators in the BNHP, but it's a 10-year project and this will not be a top priority, therefore it is not likely to begin in the first 5 years in the Managil, the more distant area from HQ but the area where the slow sand filters are. (I was told it was "5 hours' drive" to the Managil from Barakat.) The Managil is a lower priority for the BNHP because the incidence/severity of schistosomiasis is lower than in the Gezira proper. But he welcomed the idea of the IRC coming in in that area. There could also be collaboration on health education. Of course, there is also a need to improve maintenance, to evaluate and very likely to make some change in the community's involvement in operation and maintenance, and to speed up the construction of the filters still required.

On this last point, I spoke of the desirability of insisting upon supplies being extended to the labourers' villages as well as to those of tenants. Jobin said that one cannot change the social structure with just one project. I replied that it was not a question of changing the social structure, but of water supply only. He said it would still be difficult because the village supplies are under the control of the local councils, and these are in the hands of the tenants. It seems, however, that one advantage of slow sand filtration in this respect is that it is seen as an inferior sort of water supply, and one which can therefore be made available to labourers, whereas a borehole supply to labourers would be more strongly resisted on the grounds that not all tenants have been supplied yet!

Annex 1

Date October 8, 1980
Village 19

Physical

Turbidity of Canal Water	86 NTU
Turbidity of Sed. Tank Water	40 NTU
Turbidity of Treated Water	2 NTU

Bacteriological

Sample 1 - Treated water 5 per 50 ml i.e. 10/100 ml
(no chlorine)

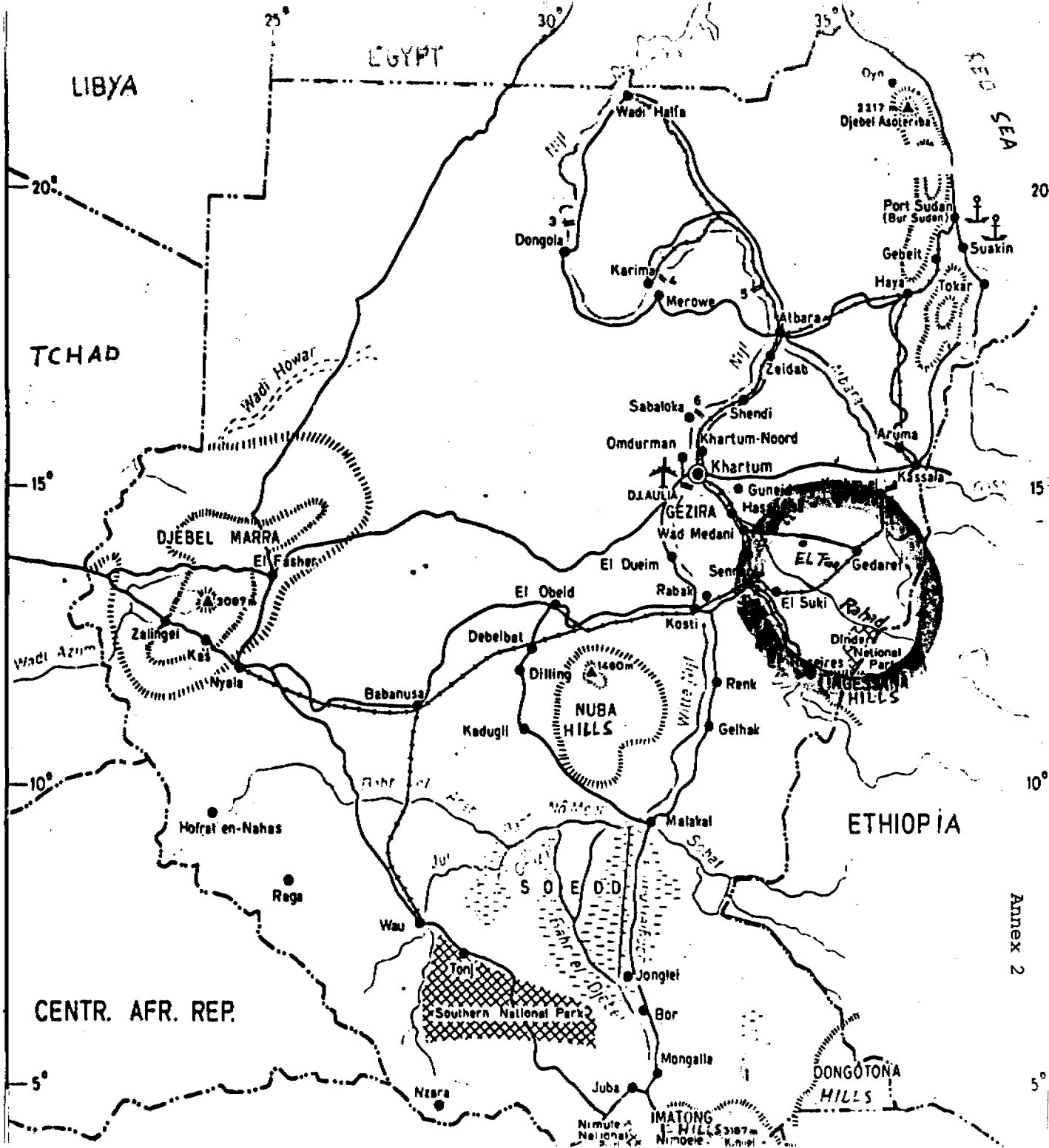
Sample 2 - Treated water 6/50 ml i.e. 12/100 ml
(no chlorine)

Sample 3 - Raw water from canal 740/25 ml i.e. 160/100 ml

SUDAN

0 100 200 300 400 km

- Capital
- Town
- Road
- Railroad
- River
- Canal (planned)
- Swamp
- Reservation
- Barrage
- Cataract
- Mountains
- Summit
- Harbour
- Airport
- State boundary



Annex 3

Persons met but not mentioned in the report

Dr. Beshir M. El Hassan	University of Khartoum Faculty of Civil Engineering
Dr. Rufique - Khan	WHO-Representative
Dr. Abu Obaida	Director Health Education Division Ministry of Health
Dr. Abdel A'al Ahmed Saeed	Deputy Director Health Education Division Ministry of Health
Mohamed El Amin Abu Bakr	Head of Social Development Department, Gezira Board
Ali Yousif Ali	Officer of Social Development Department, Gezira Board
Dr. Sati	Director, National Medical Laboratories
M.O. El Sammani	Secretary General Socio-Economic Research Project, Rahad Corporation
Dr. Tadj Din Ibrahim Omar	Head of Social Affairs Department, Rahad Corporation

Annex 4

Documents Consulted

- Slow Sand Filtration in the Rahad Scheme
  Seif Mohamed Babiker 1978

- Research - document on SSF
  Beshir M. El. Hassan
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  September 8 - 14, 1979, Frank Carroll
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- Study of Rural Water Treatment Plants in the Sudan Gezira
  August - October 1965
  H.E. Grombach,
  World Health Organization EM/ES/79 Sudan 42/R

- Effect of Intermittent Operation of Slow Sand Filters on Filtered Water Quality
  R. Paramasivam, N.S. Joshi, S.S. Dhage and D.S. Tajne
  Indian Journal of Environmental Health
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Dear Han,

Thanks very much for the copies of my report. I would like a few more copies: I'll mention this in my next letter to IRC. Incidentally, I'd also like a copy of that report of the 1978 SSF meeting, published only recently, which you mentioned in India. If it's convenient for you, perhaps you could get this sent to me.

The main person I would like you to add to your list of recipients is Mr. Talaab, the Chief Agricultural Officer of the Rahad Corporation. I don't know any other name, but I don't think this is important: some Sudanese appear to be known by just one, and I think this is true of him. Anyway, he is the most important person normally to be found at El Fau, I think, though between him and Osman Beleil there is also a deputy managing director whom I did not meet. I want him to be able to read what I have to say on the mechanisation question in particular.

It might be a good idea to send a copy to Dr. Abu Obaida (but only after correcting the spelling of his name in Annex 3!) in order to keep him thinking about his promise of a proposal on health/education; perhaps also to Beshir el Hassan, unless you are certain you want to leave him out of any future plans. El Sammani is a rather different category, but I think the academic-style research project should in principle have a copy of this report so I would say send one to him too.

If you are short of copies you could leave out Ahmed Hassan Yousif but really this would be a pity too.

If you have no difficulties about copies, then I suggest also the Provincial Commissioners for Gezira and Kassala Provinces (especially the former, in view of the impending takeover of village water supplies); and the libraries of the Universities of the Gezira at Wad Medani and of Khartoum, and the library/archive of the Gezira Board at Barakat. (It's conceivable the universities don't have general libraries, only departmental ones, but a covering letter could presumably get it sent in a direction where it can be found by those interested).

The British Council must also maintain a library in Khartoum - I'm trying to think of places where public access by those interested in such things is possible and likely, not to flood the Sudan with unnecessary paper!

I'm grateful for the sensitive way in which you have rearranged the material. I think it was a good idea to leave it to you*: if I had undertaken self-censorship I might have left more out, from unwarranted fears of possible sensitivities on questions of criticism of policy.

I've noticed two slight mistakes which might be worth correcting on some copies sent out: on P. 18, para 2, line 2, I wrongly wrote "11" instead of "17". This is in fact corrected on the following page anyway. Then on P. 21, para 5, you have left "Part 2" rather than changing it to "1".

I hope you have a merry Christmas and a happy new year.

* But I'm sorry about all the trouble!

Yours, Alastair