



COLONIAL OFFICE

REPORT ON THE ABYAN SCHEME 1951

LONDON: HER MAJESTY'S STATIONERY OFFICE

1952

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To the Right Honourable James Griffiths, M.P.,
Secretary of State for the Colonies.

Sir,

We have the honour to submit our Report on the
Abyan Board Development Scheme in the Western Aden
Protectorate.

We are,

Sir,

Your obedient servants,

G. F. CLAY

GERALD LACEY

H. GREENE

J. W. CUMMINS

Aden,
14th February, 1951.

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REPORT ON THE ABYAN BOARD DEVELOPMENT SCHEME

- by -

THE ABYAN MISSION

CHAPTER I

I N T R O D U C T O R Y

TERMS OF REFERENCE

1. The Abyan Mission was appointed in January, 1951, by the Secretary of State for the Colonies to advise upon the Abyan Scheme in the Western Aden Protectorate with the following terms of reference:-
2. On the basis of the results so far obtained in the Abyan Development Scheme:-
 - I. To examine:-
 - (a) The technical problems which have arisen in the development so far achieved;
 - (b) the agricultural problems involved in the development, collection, processing and disposal of the agricultural produce from the Scheme;
 - (c) the method of financing the existing scheme, the relative responsibilities of the Government, the States, the Landlord and the Tenants within the Scheme, and the lines on which the produce is allocated to the various participants.
 - II. In consultation with the Aden Government and the Board of the Scheme, to make recommendations:-
 - (a) for any modification in the existing organisation of the Scheme;
 - (b) for the further development of the areas capable of being brought under irrigation;
 - (c) for the establishment of any research essential to the proper development of the Scheme.
 - III. To consider and advise on the best method of financing the Scheme in the future in respect of both short term and long term needs.

COMPOSITION OF MISSION

3. The Mission was composed of G. F. Clay, C.M.G., O.B.E., M.C., Agricultural Adviser to the Secretary of State for the Colonies, J. W. Cummins, formerly Deputy Financial Secretary in the Sudan, Dr. H. Greene, Adviser to the Colonial Office on Tropical Soils, and G. Lacey, C.I.E., M.I.C.E., Adviser to the Colonial Office on Drainage and Irrigation.

OUTLINE OF TOUR

4. The Mission left London by air on the 22nd January, 1951, and arrived in Aden on the 23rd January, where they were received by His Excellency the Acting Governor (W. A. C. Goode). On the following day (24th January) the members left by car for Abyan accompanied by B. J. Hartley, C.M.G., O.B.E., Director of Agriculture, Aden Protectorate and Managing Director of the Abyan Board and by Mr. M. N. H. Milne, the Senior Political Officer, Southern Area. At Zinjibar the party made a formal call on Sultan Hussein bin Abdullah, the Naib of the Fadhl State. It then proceeded to Lower Yafa' and made a formal call on the Lower Yafa' Majlis including Sultan Aidrus' nephew - Fadhl Abdullah - who is nominally the Lower Yafa' Naib and is being instructed in his duties as a ruler. At the headquarters at Giar, the party met Major J. L. Congdon, T.D., the Manager and Secretary of the Abyan Board, and D. Hall the Chief Engineer as well as the British Agricultural Inspectors and other members of the staff. Coincident with the arrival of the Mission was that of N. Simanski, M.I.C.E. Irrigation Adviser to the Kingdom of Jordan, who advises the Western Aden Protectorate in matters of irrigation. The morning of the 25th was spent in

receiving from Mr. Hartley and Mr. Milne an outline of the background to the Scheme and of the action taken by the Government up to now. In the afternoon a visit was made to the headworks on the Wadi Bana at the northern end of the Scheme and the opportunity was taken to see the experimental plots of dates and sugar. The following day (26th January) was devoted to a visit to the Wadi Bana Gorge in the extreme north where control works were envisaged but conditions of insecurity still prevail. In the afternoon the party inspected some magnificent cotton to the west of Giar and visited the nearby earth protection banks which are erected annually across the Wadi Bana to direct the course of the flood. The 29th January was occupied by an examination of the possible sites for diversion works, regulators and canals in the Wadi Hassan at El Khor and in the Wadi Bana at Fana. On the 31st a tour of Fadhli country in Lower Abyan was made and Oqmas in the Wadi Bana, empoldered lands near Zinjibar, and areas of lift irrigation from wells were inspected and ginnery under construction near Al Kod was visited. The remainder of the stay in Abyan was devoted to discussions with the Director of Agriculture, the Manager of the Board, the Lands Commissioner and the Senior Political Officer, Southern Area. Dr. Greene visited many wells in the area independently in order to test the suitability of the water for irrigation.

The Mission returned to Aden on the 6th February and on the 12th February the general lines of their recommendations were discussed with the Acting Governor and the senior members of the Government. The 13th February was devoted to a meeting with the Abyan Board at Giar and the general problem was informally discussed. The remainder of the time was spent in the preparation of this report.

PLAN OF REPORT

5. The Report deals in turn with the major aspects of the general problem. The specific recommendations made in the body of the report are summarised in Chapter II.
6. Prior to their visit to Abyan the Mission had the opportunity of studying the report on the Abyan Development Scheme submitted by Sir Herbert Stewart, C.I.E. Agricultural Adviser to the Middle East Office following his visit in March, 1950.
7. In this report, a copy of which is attached for reference, the general pattern of agricultural development being followed is described and some of the technical aspects of the Scheme are discussed and suggestions made as to the lines of investigation which might be followed.
8. Little point therefore would be served by retracing the ground already covered in Sir Herbert Stewart's admirable account.

CHAPTER II

SUMMARY OF RECOMMENDATIONS

9. The following is a summary of our recommendations -
 - (1) In order to minimise losses in transit through seepage, and to limit the rise in subsoil water levels, the project for a single main canal should be abandoned. In its place two new canals (the Upper and the Lower Abyan Canals) should be constructed (paragraph 45).
 - (2) The opportunity should be taken of extending and improving the existing El Khor canal (paragraph 46).
 - (3) Consideration of the construction of a "spate-breaker" should be postponed until essential hydrological data have been collected and a detailed study made of all the issues involved (paragraph 46).
 - (4) The maintenance of existing works as a source of revenue until such time as they are remodelled or replaced by other means of irrigation should be regarded as a first requirement. The indigenous system of irrigation by means of "Oqmas" and small river diversions in the Lower Abyan should therefore be maintained. It should be possible to maintain registers for these works in order to show clearly the financial implications of each work separately (paragraph 48).

- (5) Additional falls (locally known as "drops") should be interpolated at appropriate points on the Ba Tais canal in order to raise it to a reasonable state of efficiency. (para. 50).
- (6) The Naza' canal should be maintained and operated until the new Bana-Hassan feeder canal has been built. (para. 51).
- (7) On the Bana river the present system of improvising temporary heads to supply small canals relatively unambitious in scope should be followed until such time as further experience has been gained and the available supplies more closely assessed. (para. 52).
- (8) In view of the replacement of the Naza' as a feeder by the Bana-Hassan canal, it should be recognised in respect of the distribution of available water supplies, that the needs of the Ba Tais canal and the Lower Yafa' area in general should be met in full before surplus supplies are diverted through the Bana-Hassan feeder. (para. 53).
- (9) An experimental system of drains should be constructed in the Upper Abyan area and the reduction in subsoil water levels observed. The water from these drains it should be noted can be discharged into the Hassan river. (paras. 54 and 103).
- (10) To prepare the way for using tube wells to the best advantage it is urgently necessary to build up a body of data on subsoil water levels. Regular and reliable observations should be made at certain sites chosen in consultation with a geologist. Beyond this there should be a tube well reconnaissance of from 12 to 20 trial borings suitably dispersed throughout the area. On the basis of the knowledge thus gained a 'pilot' battery of from 6 to 10 wells can be considered. (paras. 56 and 101).
- (11) The lining of canals in the Abyan can be dismissed as an entirely un-economic proposition (para. 57).
- (12) The desirability of lining tube well water courses could be considered once the final and most economic layout had been definitely established. (para. 58).
- (13) Eventually, if tube wells prove to be economically sound, power could be distributed from local electrical installations or alternatively generated in Aden and transmitted to Abyan. (para. 59).
- (14) Ultimately a policy aimed at a stable system of canals and distributaries serving land systematically laid out and capable of even depth of watering might be practicable. (para. 66).
- (15) In addition to the existing two 'pilot' areas in the north east and south of the Scheme, a third pilot area of approximately 1,000 acres should be developed in land immediately adjacent to the south east of Khanfar Rock to study the technique of land reformation and controlled siltation and such matters as the size of fields, size of field openings and methods and time of watering. (para. 68).
- (16) Where possible, and continuing the present policy of the Board, the small perennial flow in the Wadi Bana should be diverted to irrigated lands laid out for specialised production of long term crops such as sugar cane and perennial crops such as bananas, dates and possibly citrus. (para. 69).
- (17) For the prosecution of the research requirements of the Abyan area the following specialists are needed:-
 Irrigation Engineer
 Soil Chemist
 Agronomist - Plant Breeder
 Entomologist (para. 73).
- (18) Insect pests and disease control should be the responsibility of the Abyan Board and the financing of the work should be one of the collective charges deducted from the proceeds of sale of the cotton crop. (para. 74).
- (19) Arrangements should be made whereby individual research workers are actively linked with established organisations and experienced research workers in the United Kingdom and in Africa. (paras. 75 and 76).
- (20) It would be advantageous if the Director of Agriculture, Aden Colony and Protectorate, were to submit annually the research programme and report on the previous year's work to a small Advisory Committee in London. Furthermore, the Empire Cotton Growing Corporation might be invited to agree to annual visits by their senior plant breeder and senior entomologist to Abyan for discussions with the research team. (para. 77).
- (21) For an initial period of five years it is desirable that research should be established independent of control of the Board and its directions vested in the Director of Agriculture, Aden Colony and Protectorate. For these reasons substantial assistance to the Government of the Aden Protectorate should be made available towards the cost of establishment and the recurrent costs of the research organisations for that period. (para. 78).

- (22) The new pilot area proposed near Khanfar Rock should form an admirable environment for the training of the Abyan Board's field staff and for short farmers' courses. (para. 79).
- (23) The preparation of cadastral plans and the registration of titles in the Abyan area should continue to be regarded as urgent necessities. The R.A.F. offer of assistance should be accepted. For research, engineering and agricultural purposes it would be extremely valuable to have an easily identifiable "grid" on the ground and this need should be borne in mind and satisfied without delay. (paras. 80, 84 and 85).
- (24) It is a matter for consideration whether the right of prior purchase of lands in favour of the States might be given legislative sanction. (para. 90).
- (25) It can be assumed that in an average year 25,000 acres in the Abyan area will be flooded. (para. 97).
- (26) The right to raise water by tube wells for irrigation should be carried out only under licence and subject to specified conditions. (paras. 100 and 185).
- (27) The programme of capital works financed against the Colonial Development and Welfare Loans of £270,375 can be regarded as completed by 31st March, 1951. (para. 110).
- (28) Now that the accounting staff has been strengthened it should be possible to make an accurate apportionment of expenditure between capital and recurrent heads. The institution of a Stores and Material Account would facilitate allocation between the different heads. (para. 111).
- (29) It is advisable that the position as regards the method of allocation of the divisible proceeds of the Scheme should be rectified at the earliest moment. The Joint Collective Charges and Expenses (as set out) might be embodied in a schedule to the new Abyan Board Decree. (para. 122).
- (30) It would be reasonable for the cost of seed and heavy ploughing to be treated as a Joint Collective Charge. (para. 125).
- (31) Should land need to be expropriated or leased for permanent works such as canals, buildings and regulators the cost should be borne by the States. (para. 126).
- (32) The introduction of Standard Conditions of Tenancy for application to Tenants on State Land and Tenants on privately owned land is an urgent requirement. (para. 129).
- (33) The maintenance of the partnership basis based on a share-farming system is of fundamental importance to the continued successful functioning of the Abyan Scheme. (para. 132).
- (34) It is advisable to establish a Price Equalisation Account to which shall be credited any appropriations of gross profits decided upon by the Abyan Board at the end of each season. (para. 133).
- (35) In the interests of self-help and economic stability it is advisable that a substantial appropriation for General Development should be made before division of the profits between the partners takes place. First priority should be given to the building up of this reserve. (paras. 135 and 142).
- (36) Consideration should be given to a scheme suggested for the appropriation of the Board's share in the net divisible profits. (paras. 137 and 138).
- (37) Consideration should be given to the change over from individual farmer's accounts to a 'final payment' or market system. (para. 144).
- (38) A definite scheme of advances to the cultivator at times closely following each agricultural operation should be worked out and applied. (paras. 145 to 148).
- (39) A detailed capital programme of the order of £350,000 should be worked out and considered for execution by the Board in the years 1951/52 to 1953/54. (para. 150).
- (40) The capital programme for each year within the three year period should be drawn up and approved by the Board. If the capital expenditure is included in the annual budget it should be shown in a separate section and not confused with the administrative and maintenance expenditure of the Board. (para. 151).
- (41) Every possible effort should be made to secure that the baling materials arrive in time for this season's needs. Beyond this the aim should be to lay in stocks for the ensuing season. (para. 154).
- (42) Subject to satisfactory safeguards a greater measure of financial autonomy should be enjoyed by the Board. Early consideration should be given to the introduction of Financial and Accounting Regulations for the Board. (paras. 162 and 164).

- (43) The financial year for the Board should be changed to the 1st October - 30th September. (para. 167).
- (44) It is felt that the success of the Abyan Scheme is being jeopardised by the present under-strength of the administrative staff in Abyan. It is advisable that the staff should be increased by one experienced administrative officer to assist the Senior Political Officer; by one officer of Assistant Political Officer or Administrative Assistant status; and by two clerks. Continuity during the next five years is most desirable. (para. 171).
- (45) It is advisable that there should be appointed an Assistant Manager. (para. 172).
- (46) An Executive Engineer and three new Assistant Engineers should be appointed. One of the Assistant Engineers would be employed partly on hydro-logical research and investigations. Two Surveyors posts could be abolished on the appointment of the remaining two Assistant Engineers. (paras. 174 and 175).
- (47) The financial system should provide (1) for a General Cotton Account and (2) for the establishment of Collective Accounts for each partner as a body; (3) for the creation of Price Equalisation and General Development Reserves. (para. 179).
- (48) Assuming the successful establishment of cotton as a money crop and its continued production without heavy losses from pests or other causes, the Abyan Scheme should be able to generate its own finance both for capital and for current expenditure during the next stage subject to help in seasonal finance from the Raw Cotton Commission and to power in reserve to borrow temporarily on overdraft from the Aden Treasury up to a limit of £100,000. (para. 180).
- (49) The hope is expressed that the relief from interest in respect of the Colonial Development and Welfare Loans of £270,375 will be extended to a period of five years and that even then no interest as such be charged but that the Board should undertake to repay the loans by annual instalments of not less than £15,000. (para. 181).
- (50) There is need for the establishment of Agricultural Courts with powers to impose fines in the case of agricultural offences. Such fines should be paid into the Tenants' Collective Account. (para. 187).
- (51) Opportunity should be taken whenever possible to lighten the task of the cultivator. For example, the introduction of hand root pulling instruments might be considered. (para. 187).
- (52) A Tenants' Welfare Fund should be established. (para. 187).
- (53) In due course the question of Tenancy Representation on the Board should be considered. (para. 187).
- (54) Local leave facilities for the Board's expatriate staff, and the introduction of a staff provident fund are desirable. (para. 190).

CHAPTER III

INCEPTION OF THE ABYAN DEVELOPMENT SCHEME

10. The Government of the Aden Protectorate entered the area in 1938 in order to bring the Yafa' and the Fadhli tribes together on a more peaceful basis. Close on a century ago the Fadhli tribesmen began to attack the goods coming down from the north. Eventually an agreement was arrived at whereby the Yafa' conceded a right to the Fadhli to take water from the Bana in return for annual gifts. It was intended that customs levies should cease but the intention did not materialize and a feud developed. Although the Abyan District has greater potentialities than the nearby district of Lahej (which is the best farmed and most productive coastal district in Southern Arabia) the personal animosities of the two Sultans of Yafa' and Fadhli and the prosecution of the blood feud between their respective tribesmen had resulted in an almost unbelievable deterioration of this compact agricultural tract. The lines of former irrigation channels can still be seen and these together with old deserted village sites testify to the decline in agricultural activity and in population. In 1904, Giar, the headquarters of the present Board, was laid waste by the Fadhli. Prior to 1938 a little over 1,000 acres were cultivated.

11. In 1940 a start was made with crop production in the Fadhli country with a backing of £10,000 for advances to farmers in the form of oxen, seed and food grains. Political security, however, remained unsatisfactory. When famine appeared in the Hadramaut efforts were made to induce the Sultan to open up the land but the result was insignificant, notwithstanding the offer of substantial advances.
12. In 1943, the Sultan agreed to the Government functioning in the area. No set shares in the crop were fixed. Eventually it was settled that the Tenant should receive one-half of the crop; the Landowner one-quarter; and the developing agency one-quarter. The old customary share was one-third for water, the other parties doing all the work.
13. In the first year 700 acres were opened up. A great impression was made and a stream of requests for further action ensued. There was a difficult period at the end of the four year period (1943-1947). The Fadhlis wanted the land returned to them. In fact it was returned but the people failed to maintain it and the Department of Agriculture took over once again.
14. Then, in March, 1947, the Abyan Board was created by an administrative order of His Excellency the Governor of the Aden Protectorate, and the Fadhli and Lower Yafa' States were formally advised to accept it on this basis. They did so but not without apprehension at the absence of clearly defined powers and duties. In the early formative stage it was impracticable to define the activities of the Board in very great detail. But as time progressed the need to specify the respective shares and duties of the partners became imperative. Accordingly, in 1950, an agreement known as the "1st April Agreement" was adopted by the Board and the States. A copy of the Agreement will be found at Appendix No. 1. This agreement, which had no legal basis, was not considered to be comprehensive or drafted in a form permitting easy interpretation. Steps were therefore taken to draft a Decree defining the powers and duties of the Board and its relationship with the other partners in the Scheme, namely, the Tenants, the States and the Landowners. The enactment of this Decree has been postponed pending the visit of the present Mission.
15. As the basis of the present working of the Scheme is the "1st April Agreement" it will be helpful to outline its main provisions. (Paras. 16 to 30 below).
16. The Agreement makes the general assumption that if all the land in the Abyan is irrigated by canals instead of "Oqmas" it will be possible to irrigate 'live' land with greater regularity and at the same time to bring abandoned areas under cultivation. The conversion of the irrigation from the old to the new method is stated to be one of the purposes of the Board.
17. Canalisation. The first main canal from Ba Tais has been begun but it will water no land until it reaches the vicinity of Zinjibar, where it will be possible to water most of the present 'live' land. Pending the completion of the canal the Board will take over and run the present "Oqma" system. In due course it is hoped to irrigate a larger area than in the past.
18. Crop Rotation. The rotation proposed will be one year cotton, one year grain or simsim and one year fallow. Small landowners whose holdings may be included in a fallow area, are to be given priority as tenants on State land in a fallow year should they so desire.
19. Type of Crops. The farmers are to agree to plant such crops as the Board may direct in each year.
20. Eviction Bad Tenants on State Land. Cases will be decided by the Land Settlement Committee comprised as follows:-

State Representative 1
 Abyan Board 1
 Political Officer

Bad Tenants on Private Land. Cases will be decided by the same committee and the landowner will be required to nominate a new tenant.

Owner occupiers. Cases will be decided by the same committee to which has been co-opted two good farmers in the neighbourhood. In such cases the owner may be required to nominate a tenant to work the land.

21. Basic Shares. The basic shares to be applied in respect of all crops planted after 1st April, 1950 are set out below. The assurance is given that these proportions will not be altered before the 31st March, 1955, prior to which the position will be revised.

	<u>On Live Land</u>	<u>On Dead Land *</u>
Tenant Farmer	50%	50%
Board	25%	25%
Landowner	20%	15%
State (Ushur)	5%	10%

* Dead land is considered to become live land when it has been cultivated for five years.

22. Method of Crop Assessment. An average crop of 24 Keilas Sirkali of grain per dhumd (acre approx.) and 10 keilas of simsim is assumed. Farmers producing less than this assumed yield for reasons beyond their control can appeal subject to a payment of Rs.5 per dhumd to the State if the appeal is unsuccessful. Farmers who grow more than this average will not be taxed on the excess.

23. Method of Payment. Payment of the States', the Board's and the Landlord's shares may be made in cash or in kind, or may at the request of the Tenant, be debited against his cotton account.

24. Price. Purchase of cotton by the Board for the years 1950/51 to 1954/55 will be as follows:-

Clean cotton	Annas 4 per lb.
Dirty cotton	Annas 2 per lb.
Ground sweepings and pickings	Annas 1 per lb.

Grading will be by a European Inspector.

25. Deductions or Adjustments. All debts due to the Board, the State and the Landlord will be deducted in the Tenants cotton accounts. On the other hand these accounts will be credited with harvesting charges on the Board's share at Anna $\frac{1}{2}$ per lb.

26. "Saif" Fodder Crop. 50 bundles per dhumd will be required of the Tenant or the cash equivalent.

"Ushur" on fodder will be paid in cash.

"Hubhub" Rs.26 per dhumd will be paid to the Board with right of appeal.

"Aqab" will not be taxed.

27. Functions. The functions ascribed to each partner are as follows:-

28. Board. Construction and maintenance of capital works, and of main and field channels. The making up of dead land prior to watering. The delivery of water to each section when possible. Advance indication of the crops to be grown in the ensuing season. Receipt of cotton and other shares and distribution of the money received. The provision of stack-yards and weighing stations for fodder. The making of advances to farmers when necessary.

29. Tenants. The making up of the banks and field channels on his tenancy. The cultivation of specified crops in such manner as the Board may direct. (This is deemed to include payment for mechanical operations on his land). The bringing of cotton, fodder and cash to the approved places in the Scheme.

Should any tenant neglect his duties the Board may do the work for him and charge double the cost to his cotton account.

30. Landlord. The cultivation of his own land or the appointment of tenants for this purpose. Responsibility to the Board and the State for debts to them incurred by his tenants.

CHAPTER IV

THE ABYAN SHARE FARMING SYSTEM BEFORE THE CREATION OF THE ABYAN BOARD

31. Share farming was commonly followed by farmers who took up the land owned by the larger landowner. Under this system the landowner supplied the land and improvements in the form of bunds and furrows while the tenant was responsible for the upkeep of the irrigation system.
32. Expenses for seed and other costs up to the time of harvesting and threshing were paid by the tenant; costs for harvesting and threshing were equally borne between the landlord and the tenant; thereafter the crop was divided equally between them.
33. Where a tenant farmer or a landowner failed to provide his share of labour or expenses on the main irrigation system and this share was undertaken by the Sultan, the defaulting party was liable to pay one-third of his crop as a water rate. Similarly, this charge was levied on lands which might be watered before letting. A case in point is that of the Lower Yafa' Sultan, who owns the permanent flow of the Bana for the six months September-April and supplies irrigation water in return for a one-third share of the produce.
34. Incidentally, on market garden land watered by wells a cash payment of from Rs.50 to Rs.100 an acre was usually demanded.
35. The Yafa' and Fadhli Sultans levied no direct tax on the Abyan crops but each field was subject to a religious offertory of one or two rows of crop in each field.

CHAPTER V

IRRIGATION

36. In this chapter an attempt is made to assess the water resources which the engineer has at his disposal, to review the problems with which the engineer is faced, and the methods open to him for their solution, and in particular, the sequence in which works should be undertaken to secure an orderly development.
37. It is correct to state that the great success recently achieved in establishing irrigation has resulted largely from a resuscitation of an indigenous system of canals and inundation works, but it would be wrong to assume that the unsettled state of the Abyan was alone responsible for the cessation of irrigation on a relatively large scale. In the Lower Abyan the system of inundation, either by embankments thrown right across the Bana and Hassan rivers, or by spurs projecting into the rivers which deflected the flood waters over the countryside, lent itself to yearly improvisation, but in the Upper Abyan the situation was entirely different.
38. The two main canals, the Ba Tais and the Naza', originally at approximately ground surface, and thus able to command 'flow' irrigation, had in the course of years scoured their beds until they had finally degenerated into deep drains unrecognizable as canals, which presented a dangerous soil conservation problem. This was due, not so much to neglect of the channels as to neglect of engineering principles, and the fact that control of water does not end when a controlled supply enters the canal, but must extend from head to tail of a canal system and from the agricultural view point must also be applied ultimately to the fields.
39. The annual rainfall of the Abyan is said to be approximately two inches, and is so irregular in its incidence that as a water resource it can be entirely ignored. Of the two rivers, the Bana and Hassan, the Bana contributes the greater portion of the flood waters, and so far only the supplies of the Bana have been measured. The floods on the Hassan are relatively small, and of short duration, and the Bana river is rightly regarded as the controlling factor in estimating the water resources of the Abyan.

40. The hydrographs (a) of the Bana river for the years 1948, 1949 and 1950, will repay careful study, and show not only the incidence of the annual floods but also the extraordinary variation from year to year. The discharges are recorded in cubic metres per second, but what is termed as the "total discharge" is, as a fact, the total annual volume of the water in cubic metres. It is useful to remember that the application of four thousand cubic metres of water to a level field of one acre would result in its being flooded to a uniform depth of approximately one metre, or say three feet three inches. It must however be remembered that for every four thousand cubic metres of water entering the head of a canal, a large fraction will be lost through absorption in the sandy bed of the channel, and a further fraction due to the highly irregular nature of the country irrigated.

41. The hydrographs show how necessary it is to obtain further observations of supplies during the coming years before drawing premature conclusions as to the "average" supplies available. It is in particular very dangerous to assume that a disastrous shortage in any one year can be fully compensated by a counter-ailing excess in the following year. Thus to strike an average from the three years 1948 to 1950 would be quite incorrect, as the year 1950 may well represent a record that may not be exceeded in the next twenty years, nor have we any assurance that the year 1948 represents the worst that might occur over the same period. It is however useful to note that if we assume average supplies of the Bana at 100 million cubic metres per annum, assume further that all these supplies can be diverted to irrigation during the year, and that every acre irrigated will demand four thousand cubic metres of water, as measured in the river, it should be possible to irrigate on an average 25,000 acres of land annually. This is a conservative figure and should be adopted as the present target.

42. Apart from the annual variation in the supplies available, the great daily fluctuations in the river supplies present a very serious problem. The ideal solution, if it were practicable both from the engineering and the economic viewpoint, and also politically feasible, would be to construct one or more great storage reservoirs, higher up the Bana river, and to release controlled supplies as required in the Abyan. Not only would this lead to the economic distribution of supplies but it would also lead to a reduction in the size of the canals required as the present violent fluctuations, and the need for seizing every opportunity of diverting supplies, necessitates designing canals for a fluctuating, instead of a steady supply, and all the evils that this system involves. The difficulties, other than political are very great as the river carries enormous quantities of silt, the slopes in the upper region of the river are very severe, and the reservoirs would soon lose a considerable portion of their storage capacity. Further the precise regulation of supplies through modern sluices would call for a permanent skilled regulating staff, and a degree of distant control that can hardly be envisaged in the near future.

43. A second solution, which has also been put forward by Mr. Simanski is an ingenious compromise. He suggests the construction of a barrage in the gorge a few miles upstream of the heads of the Ba Tais and Naza' canals, with gates which would permit of discharging the greater part of the silt, and permit of partial regulation of the supplies, and a spillway which would pass the larger floods. This work would lead to considerable reduction in the fluctuations in the supply during low floods and is termed by Mr. Simanski a "spate-breaker". With the execution of this work he contemplated a new main canal of some 30 kilometres in length which would command the Upper and Lower Abyan watershed.

44. There is however a certain objection to a large canal which would traverse both the Upper and Lower Abyan. A remarkable feature of the introduction of irrigation during recent years has been the rapid rise in the sub-soil water levels in the upper part of the Abyan. A glance at the general plan at the end of this Report will show the area involved, which embraces roughly all the land north of a line consisting of the southern boundary of the Yafa' state produced until it intersects the Khor Hill. It would be preferable if possible to command Abyan by two canals the Upper and Lower respectively, thus obviating the heavy losses in the upper part of the larger canal as originally proposed, and to rely on the Hassan river as a means of transporting the water for the Lower Abyan.

(a) Included as annexures to this report.

45. The Hassan river despite its small flood discharges is largely a boulder and shingle river and it is possible that at one time it formed a branch or even the main channel of the Bana. The losses therefore in water transport are probably not only much less than would be incurred on a sandy river but less than those of a main canal traversing sandy soil. It is proposed therefore, in order to limit the rise in sub-soil water levels, to substitute for one main canal, two canals the Upper and Lower Abyan respectively and to pass the supplies for the lower canal into the Hassan by means of a Bana Hassan feeder, and to pick them up at Khor where all the materials for boulder and shingle diversion works are available.
46. The opportunity would also be taken of extending and improving the existing Khor canal. Water would thus be diverted at two main river centres. The upper system of headworks would be based on the existing headworks of the Ba-Tais and the Naza' on the Bana, and the lower at Khor on the Hassan river. It is considered that the utilization of the Hassan as a means of water transport would have a far from negligible effect in moderating the intensity of small freshets passed down from the Bana, and increasing their duration. At the present juncture it would be preferable to embark on expenditure at Khor on a moderate scale, and to postpone consideration of the construction of a "spate-breaker" until such time as the essential hydrological data had been collected, and a detailed study made of all the issues involved. It should be noted that if subsequently found necessary or advisable the Upper Abyan canal could be arranged to "feed" the Lower Abyan canal by "tailing" into it, and the complete system would thus possess great flexibility.
47. It is now possible to outline a programme of reconstruction and moderate expansion in the next four or five years, which, if methods of economical distribution are to be initiated and sound agricultural principles are to be established, should form more than a sufficient task for the existing staff, even after strengthening, and which should also afford an essential breathing space in which the Board can take stock of its position, and consolidate it, rather than embark on large expenditure prematurely. "Spate-breakers" and storage works however desirable are problems of the future, rather than the present, and their necessity when the time comes must first be fully established.
48. The first requirement is the adequate maintenance of existing works as a source of revenue until such time as they are remodelled or replaced by other means of irrigation. It is essential therefore that the indigenous system of irrigation by means of "Oqmas" and small river diversions in the Lower Abyan should be maintained. Within their limitations these works are extraordinarily efficient, and since the expenditure incurred annually on each temporary work can be directly related to the area annually irrigated and the value of the crops produced it should be possible to maintain registers for these works which will show clearly the financial implications of each work separately.
49. In the Upper Abyan the immediate problem is that of maintaining and improving the efficiency of the Ba Tais and Naza' canals. The ground slopes throughout the Abyan are far too severe to permit of the construction of canals without masonry works, known in India as "falls" and locally as "drops" which absorb the excess energy of the flowing water. Briefly, the water-surface slopes which the canals demand are vastly less than the local ground-surface gradients and if the canals are to be constructed in such a manner that they do not scour their beds and degenerate into deep ravines the difference must be made good by falls.
50. On the Ba Tais, the Chief Engineer to the Board, Mr. Hall, has constructed a number of falls of cheap design, and the improvement in the regime of the channel is immediately apparent. The very heavy bed load carried presents an unusual problem and it is evident from the improved reaches of the canal that the silt laden water demands a broad and shallow channel, and that despite the construction of the falls the canal slopes are still excessive, and additional falls must be interpolated at appropriate points if severe action downstream of almost every fall is to be avoided. If these are constructed it should be possible to raise the Ba Tais Canal to a state of reasonable efficiency.
51. The Naza' canal has so greatly degenerated that it can hardly be recognized as a canal. It bears evidence of having been constructed mainly as a means of transporting water from the Bana to the Hassan. The Bana-Hassan feeder will relieve the Naza' canal of this original function. The Upper Abyan canal when

constructed will command the area previously served by the Naza', and the Naza' therefore must be maintained and operated until the new canal can be built. The Naza' thereafter will serve as the nucleus of a drainage system, very necessary if high sub-soil water levels are to be avoided. Some of the branches of the Naza' can be incorporated in the eventual Upper Abyan system.

52. It is proposed that the Lower Abyan canal should derive its supplies from the Hassan at Khor, where the existing Khor canal will be improved and extended for irrigation on the east bank of the river. The Lower Abyan will thus command the area between the Bana and the Hassan by means of a canal system which should extend beyond Zinjibar. The extent to which these supplies can be supplemented by diversions from the Bana river seems very uncertain. The Bana river in its lower reaches presents a great width of sandy bed, broken up into a number of subsidiary channels. Frequent changes in the course of the river suggest that the present system of improvising temporary heads to supply small canals relatively unambitious in scope should be followed until such time as further experience has been gained and the available supplies more closely assessed.

53. Finally, in view of the replacement of the Naza' as a feeder by the Bana-Hass Hassan, it should be recognized in respect of the distribution of available water supplies, that the needs of the Ba Tais canal and the Lower Yar'a' area in general should be met in full before surplus supplies are diverted through the Bana-Hassan feeder.

54. It has been suggested that the rise in the sub-soil water level of the Upper Abyan could be checked by the introduction of tube wells which would serve as an additional means of irrigation. In India, in the United Provinces, tube wells were originally introduced to serve areas which were uncommanded by the existing canal systems and this should be recognized as the primary function of tube wells. In the Punjab, where the rise in subsoil water levels threatened areas which were intensely irrigated the engineers were faced with the possibility of complete cessation of canal irrigation. The solution eventually adopted was that of discontinuing canal irrigation and releasing the volume of water thus saved for irrigation in other parts of the system. Simultaneously the canal irrigation was replaced by a system of irrigation from tube wells. These changes led to a reduction in wastage of water, in itself a cause of the evil of water-logging and the wells also served to reduce, to a limited extent, the rise in subsoil water levels. These heroic measures are hardly necessary in the Abyan at present.

55. It is now recognized in India and Pakistan that drainage must go hand in hand with irrigation, and in the Upper Abyan with its very high ground surface slopes the expedient of open drains as a means of checking a rise in subsoil water levels should certainly be attempted before other, and more expensive, methods are tried. An experimental system of drains should be constructed and the reduction in subsoil water levels observed. The water of these drains, it should be noted can be discharged into the Hassan and thus supplement to a small extent existing supplies.

56. The possibilities of tube wells should however be fully explored as a means of irrigation and of improving the quality of the local drinking water which by all western standards would be condemned as "unpotable". The first requirement would be a tube well 'reconnaissance' consisting of from 12 to 20 trials borings suitably dispersed throughout the entire area. From the knowledge thus gained it should be possible to instal a "pilot" battery of from 6 to 10 wells, according to the proved yield of the experimental tube wells, which would not only serve as a valuable source of local irrigation but should also make it possible to assess crop requirements and to ascertain the best method of tube well water distribution.

57. The lining of canals in the Abyan can be dismissed as an entirely uneconomic proposition. The case for lining water courses from tube wells is however on an entirely different footing. The first requirements for a canal, before its lining can be considered, is that its alignment should be permanent, and that its discharge should be approximately constant. Neither of these conditions is fulfilled on the Abyan canals. An excessively high discharge, or a local accumulation of silt, would lead to the lining being "topped" and irreparable damage being done. Also, if the canals are to be improved in the Abyan, and this remark applies particularly to many of the smaller canals, lining a canal means that the engineer burns his boats behind him and is saddled not only with an alignment which is faulty but the maintenance of the lining for all time.

58. The care and economy exercised by every cultivator who irrigates from a well stresses the desirability of lining tube well water courses, once the final and most economic layout has been definitely established. The discharge as compared with a canal is small and constant, instead of being large and fluctuating, controlled flow irrigation replaces hasty flooding, and all the conditions are established to warrant the expenditure on lining. Finally it should be noted that the tube wells will rely on absorption and wastage from the canals to maintain the subsoil water level on which they depend for their supplies.

59. Eventually, if tube wells prove economically sound, power could be distributed from local electrical installations or alternatively be generated in Aden, transmitted at a high voltage, and stepped down by transformers at the points of distribution. This is the system which has been built up in successive stages in India. For the present nothing more is envisaged than a tube well reconnaissance at the earliest possible date, followed by a small "pilot" scheme which would not only indicate the economic possibilities but would also provide an ideal means of estimating crop requirements through carefully controlled experiments.

CHAPTER VI

AGRICULTURAL POLICY

60. The main feature dominating the farming system in Abyan is the volume and period of the annual flood waters discharged down the Bana and the Hassan rivers for, while a limited amount of perennial water is available, and there are signs that the better spread of the flood waters over the land which has resulted from the work of the Department of Agriculture in the past few years has reopened springs and led to an increase in this perennial water, almost the whole of the agriculture in the Abyan triangle is based on the utilisation of flash floods and their dispersal over the land.

61. Under such conditions, where the total flood water available annually varies to a great degree both in its amount and the period of its incidence, the agricultural system must of necessity be very flexible and although the Board has as its objective the gradual establishment of a standard three course rotation of sorghum, cotton and fallow in a three field system, natural conditions will inevitably mean considerable modification according to the flood conditions in any particular year.

62. In its initial conception the Abyan Scheme was essentially a food producing scheme, and although the introduction of Egyptian cotton into the area has revolutionised the economics of the farming system, the fundamental necessity of ensuring an ample and safe supply of food for man and beast is still one of the most important considerations of the Board.

63. If the trials in tube well irrigation prove satisfactory, the increase in the area of land commandable by perennial flow irrigation should be a potent factor in improving the diet of both human and animal population by allowing extended production of protective foods and green fodder crops such as lucerne. (a) It is not possible to anticipate the pattern of farming in the main area between the Wadis which will evolve until the amount, quality and distribution of subsoil water is known, but it may be that a social system of scattered villages sited around tube wells with intensive agriculture practised in the "infields" linked with extensive three field systems in the "outfields" fed by flood irrigation may be possible with the development of more intensive livestock management and such activities as dairying and vegetable and fruit production both for local consumption and for sale on a cash basis.

64. The local people are accustomed to the flood irrigation and it is significant that the limited amount of lift irrigation practised is carried out by immigrants into the area. Much experimental work and education will be necessary in the development of tube well farming.

(a) (Lubia Dolichos has been tried experimentally but has proved undesirable as it is attractive as an alternative host to some of the major insect pests of cotton).

65. But whether the development is confined to basin irrigation from flood waters or to perennial flow irrigation from tube wells, or a combination of both, their full development will largely be governed by the topography of the area generally and the size and topography of the fields.
66. One of the striking features of the Abyan scheme is the relative ease with which under a system of sloshing, minor irregularities in topography are levelled out and even relatively high mounds built up around vestigial tree growth disappear with the intelligent empoldering of dead land and its controlled flooding. In the Upper Abyan, several years of this system have resulted in an impression in some areas of fairly uniform rectangular fields of up to 30 or 40 acres in area, and a fairly orderly system of canals and field distributaries. It would appear that ultimately a policy aimed at a stable system of canals and distributaries serving lands systematically laid out and capable of even depth of watering might be practicable. The Lands Commissioner in his draft Land (Settlement of Title) Decree has wisely provided for the compulsory redistribution of holdings to facilitate such a development, although it can be assumed that compulsion would only be used as a last resort.
67. No doubt much still remains to be learnt in the technique of land reformation and controlled siltation, and such matters as size of fields, size of field openings and methods and time of watering require study.
68. The Mission with this in mind discussed with the Director of Agriculture and the staff of the Board the possibilities of establishing a number of pilot schemes aimed at testing out these problems and it was agreed that in addition to the two areas already being developed in the north east and south of the inter-wadi zone a third pilot area of approximately 1,000 acres should be developed in land immediately adjacent to the south east of Khanfar Rock.
69. The Mission were impressed with the preliminary experiments in sugar cane cultivation and endorse the policy of the Board that where possible the small amount of perennial flow in the Wadi Bana should be diverted to irrigate lands laid out for specialised production of long term crops such as sugar cane and perennial crops such as bananas, dates and possibly citrus.
70. As to the question of research, the Mission appreciated fully that in the initial pioneer rehabilitation and development work which has been so vigorously and satisfactorily carried out, shortages of requisite staff and the uncertainty of the future of the scheme have prevented the development of any true research. Mr. Simanski has consistently referred to the need for the systematic collection of hydrological data and to the necessity for crop studies relative to water distribution.
71. Similarly, in the field of crop husbandry, much remains to be done in spacing and seed rate trials, introduction and testing of new crops and new varieties of existing crops, soil survey work and soil fertility studies, particularly the nitrate status of the soils under various treatments, the chemical and physical properties of the silt deposits, rotations, weed control and not least the investigation and treatment of plant pests and diseases. In this last connection, it is significant that whereas Sir Herbert Stewart was able to record the absence of any serious insect pests of cotton as recently as March, 1950, the present crop has in some cases been heavily attacked by American Boll-worm and in some areas, particularly on the lighter soils, a considerable Jassid population has been built up.
72. The Mission are fully confident that the main lines of research in the economy of water distribution, in soil studies, and in crop and animal husbandry are well understood by the Director of Agriculture and his staff and, rather than attempting to define a comprehensive list of the research problems, would draw attention to the organisation which in their opinion is necessary for the efficient conduct of research.
73. Whilst the total area of potential agricultural production in Abyan is relatively small and might be considered as insufficient to warrant the employment of specialist research workers, the Mission are conscious of the fact that agricultural research into the problems of agriculture in the arid zone has so far been relatively limited in the colonies. In addition to other areas in the Aden Protectorate there are considerable areas in the aggregate in African territories (as for example, in British Somaliland, the northern parts of Kenya

and Uganda, parts of Tanganyika and the arid areas of the West African territories) in which the results of research in the conditions existing in Abyan might find their application. They suggest that for the prosecution of the research needs of the area the following specialists are needed:-

Irrigation Engineer (part time) who in addition to the organisation of the collection of hydrological data throughout the area would, as a first charge on his services, be responsible for co-operation with the rest of the research team in the investigation of the technical problems associated with the economy of distribution of water.

Soil Chemist whose function would be the systematic investigation of the soil problems including nitrate status, hydrology of soils, fertiliser studies and the gradual production of a soil map of the agricultural areas. He would also take under his wing the examination of all existing and potential irrigation water.

Agronomist - Plant Breeder whose field would cover such investigations as rotation, spacing and seed rate trials, time and volume of water requirements of the major crops produced, introduction, study and establishment of variety trials with new and existing food crops, cash crops and fodder crops. An important part of his duties would be the maintenance of a pure seed supply for the cotton crop based on the policy of maintaining Abyan cotton as a type identical with the Sudan type or types involving the maintenance of pedigree stocks and their controlled bulking and distribution to growers.

Entomologist (with a knowledge of plant pathology) who would be responsible for the study of the insect pests and diseases of crops and their control.

74. The Mission have proposed that insect pests and disease control should be the responsibility of the Board and that the financing of the work should be one of the collective charges deducted from the proceeds of sale of the cotton crop. It is impossible to overemphasise the importance of this work and the associated research on which it must be based.

75. The Aden Protectorates do not conveniently fit into any regional organisation for purposes of research and the Mission appreciate that research workers in Abyan would be isolated from contact with senior specialists in their own particular fields and would in the nature of things probably be fairly junior officers with no particular background of research in arid climates. They feel therefore that arrangements should be made whereby the individual workers would be actively linked with established organisations and experienced research workers who might be expected to guide and advise them on the lines of research being followed.

76. For this reason they suggest that the Irrigation Engineer should consult freely and regularly with Mr. Lacey; the Soils Chemist with Dr. Greene at Rothamstead; the Agronomist - Plant Breeder with the Senior Plant Breeder of the Empire Cotton Growing Corporation in the Sudan; and the Entomologist with the Senior Entomologist of the Corporation at the Central Cotton Research Station at Namulonge in Uganda.

77. They also suggest that it would be of advantage if the Director of Agriculture, Aden, were to submit annually the research programme and report on the previous year's work to a small Advisory Committee in London which might comprise the Secretary for Colonial Agricultural Research, the Secretary of State's Agriculture and Irrigation advisers and the Adviser on Tropical Soils at Rothamsted, together with the Secretary of the Empire Cotton Growing Corporation. The Mission are not able to anticipate the reactions of the Empire Cotton Growing Corporation to these proposals, but they were informed that immediately prior to their arrival, the Senior Entomologist of the Corporation had made a valuable survey of the insect pests of the cotton crop and they feel justified in suggesting that the Corporation might be invited to agree to periodic visits, say annually, by their Senior Plant Breeder and Senior Entomologist to Abyan for discussions with the research team.

78. The Mission have been impressed throughout their visit by the significance of the Abyan experiment as a centre of economic development in an area where so far the functions of the United Kingdom as protecting power have been mainly confined to the development of peaceful conditions and the settlement of inter-tribal feuds. The work in Abyan is known throughout the length and breadth of the

Aden Protectorates and even further afield. Whilst political considerations are possibly outside the field of a technical mission, the Mission do feel that no effort should be spared in bringing the Abyan experiment to its full development and that in such development the place of research is essential. Whilst provision has been made in dealing with the shares to be allotted from the gross receipts from the cotton crop for certain collective charges including research, and the Mission believe that once the research results are apparent there will be no difficulty in persuading the Arab members of the Board and the States to allocate funds for research, the Mission recommend that for an initial five year period it is desirable that research should be established independent of the control of the Board and its direction vested in the Director of Agriculture, Aden. For these reasons they recommend that substantial assistance should be made available to the Government of the Aden Protectorate towards the cost of the establishment and the recurrent costs of the research organisation which they have suggested for a period of five years.

79. In the development of a progressive peasant agriculture one of the biggest factors is the education of the farmer through the medium of an extension service of trained sub-ordinate extension workers. So far no facilities have existed for the training of such staff in Abyan. If the proposed pilot scheme in land use near to Khanfar is developed it is suggested that this area combined with any tube well irrigation which might be developed around the bore hole now being sunk in the 30 acre parcel of land which has been made available to the Board at the foot of the Khanfar rock, would form an admirable environment for the training of the Board's field staff and for short farmers' courses.

CHAPTER VII

LAND

80. The introduction of a valuable cotton crop to the Abyan Development Scheme has accentuated the need for a survey of property boundaries and the preparation of a cadastral plan as a prerequisite to the registration of titles.

81. While an accurate survey based on a rigid triangulation might be an ideal first step, considerations of urgency and of economy render it advisable to devise a modified plan, relying on existing maps and local resources to achieve the real essentials in an inexpensive way.

82. A Lands Commissioner (V.V.W. Kenyon) is now functioning in the area and his proposal is to make a graphic triangulation to provide the framework for an overall map of Abyan. His scheme is to measure base lines in each village to control the lineal errors and to make a plane table survey of all topographical features combined with close tachometry and other graphic means to fill in the details to show the boundaries of individual properties. He recognises quite rightly in the local circumstances that the first requirement is to define without delay the limits of the State lands in order to stem the progressive encroachment that is undoubtedly taking place; and his intention is to give first priority to the survey of areas where encroachments are suspected. He has put the cost of a graphic-plane-table triangulation at £4,600. To this should be added £4,960 for land settlement and registrations bringing the total cost to £9,560 over a period of two years.

83. At the time of the visit of the Mission to Abyan, the Lands Commissioner has already taken the first steps in the survey and another surveyor was expected in a few weeks time. A start would then be made with the plane-table survey.

84. Apart from its relation to the ultimate settlement of titles in the land the Mission recognises the value of a "grid" system of demarcation to other interests concerned with the development and administration of the area. Ideally there should be a beacon survey in the course of which at every minute of latitude and longitude beacons would be erected with cross vanes on which are stamped the degrees and minutes of latitude and longitude. It is understood that while for the reasons stated (para. 81) the survey will not be in this form, there is no reason why in due course when the cadastral maps are available beacons should

not be inexpensively erected on the ground at the points of intersection of the grid lines to a sufficient degree of accuracy for working purposes. For research, engineering and agricultural purposes it would be extremely valuable to have an easily identifiable grid on the ground and it is recommended that this need be borne in mind and satisfied without delay.

85. An immediate aid to the present survey and one which, if completed within the next two or three months would save probably one-sixth of the Land Commissioner's time, would be an accurate air survey of the Scheme and adjacent areas. It is understood that the R.A.F. have offered assistance in this direction and it is recommended that the offer be accepted. The Board can be relied on to give the closest possible co-operation on the ground to the flight carrying out the survey.

86. The Mission are advised that the tribal ownership of lands in the Abyan area is a dying conception and in future it is not proposed to recognise any tribal title to the lands. Subject to certain exceptions such as "Waqf" lands (a) and Minor Rights held by Holy Sheikhs (b) three main systems of land tenure may be recognised namely, State Lands, "Mulk" (absolute ownership) and Share Tenancy.

87. As regards State Lands, prior to 1945/46, waste (dead) land, when subject to development, was as a rule claimed by the Sultans. But with the emergence of the government bodies in the Yafa' and Fadhli States, this kind of land is considered as being invested in the respective States and is known as Beit al Mal lands.

88. With respect to "Mulk" lands, the existence of private landlords in a scheme such as that of Abyan raises questions of great difficulty. Although the Abyan Board owns no land whatever in the Scheme, it is essential that the land should be made available to the Board by the States for the purposes of the Scheme. This has been done at the cost of allocating a 25 per cent share in the crop proceeds to the private landlords. But the private landlords are not all known and will not be known with certainty until the process of settlement and registration of title has been completed in say two year's time. No active responsibilities have been ascribed to the private owner. The result is that if he does not farm the land himself, he may drift into the position of an absentee landlord, and it is to be expected that in many cases he will not adhere to the general fifty per cent share basis with his tenantry. Should, as seems probable, the private landlords continue to function in the scheme, the interest of the cultivators on the private estates will need to be safeguarded by standard conditions of tenancy specially introduced for application in these cases.

89. The Mission understood that the possibility of expropriation of private lands coupled with the grant of crop tenancies to those qualified by virtue of previous tenure was considered some years ago but ruled out as revolutionary in a territory where the status of His Majesty's Government is of an advisory nature only. While, in the view of Mr. Hartley, the Managing Director of the Board, wholesale expropriation might have been possible in the early days of the Khanfar Development Scheme (1943-1947) the position has been radically changed by development and there can be no immediately practicable question of seriously interfering with the rights of the private landowners. Inevitably, it seems, the fact must be faced that private owners are a permanent feature of the Scheme. It is to be expected that they will be firm in their determination not to forfeit absolute title or even to move into the position of a lessor. Both expropriation or leasing by the States can at present be ruled out. The goodwill of the landlords is essential to the orderly progress of the Scheme and it is possible that the need for the parties to contribute in an equitable manner towards the capital cost of using to the fullest advantage the waters available may be in some measure satisfied in other ways.

90. It is observed that the custom of "Shifaa", whereby the Chief retains the right to purchase land coming on to the market locally, is observed in this part of Arabia. The right of prior purchase in favour of the States might well be given legislative sanction. It is understood that the draft land Decree contains provision for the reopening of a settlement in order to achieve the full beneficial use of the land through a rearrangement of holdings.

91. The Mission noted that the interim period between now and the completion of the land settlement had been covered by the Lands Interim Procedure Decree.

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- (a) Lands acquired as outright bequests by an individual or group of individuals for charitable purposes.
 - (b) Certain Waqfs held in perpetual tenancy by the holders of an hereditary tithe.

CHAPTER VIII

OBJECTIVES OF LAND USE IN THE ABYAN DELTA

92. The extent and general direction of agricultural development in the Abyan delta are rather closely determined by the physical conditions.
93. The alluvial cone approximates to an equilateral triangle with an area of 100,000 to 120,000 acres. The material apparently consists largely of silt and fine sand deposited by successive brief and violent spates carrying a heavy load of suspended solids. Dunes of coarse sand occupy part of the surface and encroach on its eastern side. Lenses and ribbons of coarse sand are no doubt buried within the delta as are also ribbons of boulders, up to 18" in diameter, marking former sites of the main flood channel. South of the Masana offtakes the alluvial cone drops 100 metres in the first 13,000 metres; this is approximately the radial distance of Khanfar rock and El Khor rock from the Masana offtakes. South of Khanfar and El Khor the alluvial cone drops a further 60 metres in about 17,000 metres. The upper slope is thus about twice as steep as the lower slope.
94. Steeply tilted tertiary limestones are exposed at the narrow gorge at Ligma and again at Masana about 2 Km further south where they rest on basement complex rocks. They are exposed also at Halima, Khanfar and El Khor. The Husn hills north west of Khanfar consist of basement complex schists. Mr. E. H. Jaques, the newly appointed Government Geologist, finds in the north part of the Abyan delta indications of a series of faults believed to run east and west, that is, more or less parallel to the main coastal fault which branches from the Red Sea-Rift valley system. The alluvial deposits have no doubt buried some of these disturbed rocks but there is at present no geological evidence of a buried rock barrier extending from Khanfar to El Khor. Something of this kind might be suspected since the Wadi Hassan between Masana and El Khor must at times have taken the main flood waters of the present Bana perhaps passing them through a gap adjoining El Khor. At any rate, this section of the Wadi Hassan is obviously an important channel in the natural water-control system of the delta. Apparently for thousands of years the flood waters of the Bana have pivoted in pendulum fashion first on the Masana outcrop and secondly somewhere near El Khor. It is likely that from remote times the delta has been an area of human settlement but, with or without human aid, the flood waters must have oscillated in this way gradually raising their bed level by successive deposits and then swinging to a new tract which in turn was gradually built up and temporarily abandoned.
95. The great year-to-year variation in the total volume of flood waters and their high silt content probably render impossible any close or complete method of control. It is probably a basic feature of the area that, even with optimal control of flood water, agricultural development should adapt itself to the natural conditions by aiming at the successive diversion of flood waters to broad tracts each of which would at times lie fallow. It appears that the average area flooded in any one year would be about one quarter of the whole, that is, about 25,000 acres. This kind of broad rotation is agriculturally desirable because it should permit lowering of sub-soil water levels by natural drainage where these have become too high and should facilitate destruction of weeds which follow application of water to the land. The broad rotation has the further advantage of presenting to the cultivator what is in effect a tract of virgin soil. The deposit of new silt may be considerably less deep than is sometimes supposed. The deposit laid down in 1950, say, is probably no worse and no better than deposits laid down a few hundred or a few thousand years ago. The succession of these deposits has built up in the Abyan delta a deep bed of slightly calcareous, slightly salty, readily permeable material evidently as fertile as that composing the delta of the Nile. There as here almost magical fertility is ascribed to a new deposit of silt but in Abyan this fertility depends mainly on the circumstances that pests of one kind and another are destroyed during the dry period or when the water comes, irregularities of the land surface are smoothed out and some metres depth of soil are brought to a moisture content ideally suited for plant growth. Probably the same conditions initiate microbiological processes which make adequate supplies of soil nitrogen available to the plants. Whatever may be the detailed nature of these changes their general outcome is known and highly appreciated by the skilled Arab farmers of the region who will gladly travel many miles to establish cultivation on newly flooded land. It has been noticed how closely the highly skilled indigenous methods for partial or complete diversion of flood waters correspond to the natural water-regime of the delta. The recent agricultural rehabilitation of the area has been correctly and successfully aimed at applying and improving these indigenous methods evidently based on long experience.

96. The soil of the delta must show a good deal of local variation in mechanical composition but the details of this variation may never be ascertained and, broadly speaking, it is the general uniformity of the alluvial deposits that is their more striking feature. If applied in a single flood one metre depth of water may be taken as the normal irrigation requirement, that is, about 4,000 metre cube per acre of crop. The average volume of flood waters is somewhere round 100 million metre cube so that the average flooded area should be about 25,000 acres. The water penetrates the soil remarkably quickly, 1 metre depth of water being absorbed in 1 day. This amount of water probably moistens to optimum moisture content some 4 or 5 metres depth of soil. Local experience insists that after flooding and as soon as the surface soil is dry the land must be harrowed but thereafter an interval of days or weeks may pass before sowing. During this period the soil retains the water it has received until in due course the water is tapped by the roots of the cotton or other crop. Considerable areas of perfect cotton have thus been grown. A specimen plant about 8 feet tall carried 112 well formed bolls, 65 small bolls, 73 flowers and buds excluding some small terminal buds not counted. Only 20 or so buds had been shed from the lowest branches. The leaves were large, dark green and free from any injury. None of these bolls had opened but lint of similar plants seen elsewhere seemed of excellent quality. Not all the cotton is equally good nor is it yet known what are in this area the factors mainly determining yield.

97. It was assumed above that in an average year 25,000 acres will be flooded at a rate of 4,000 metre cube per acre. This water is not evenly distributed over the land. Less heavily watered areas are used for sorghum of which the root development is probably large for its support, heavy regrowth after the first crop has been taken. It may be therefore that in land used for sorghum most of the water applied is consumed by the crop. On the other hand, the areas used for cotton probably receive more than 4,000 metre cube per acre. Even a luxuriant crop of cotton does not use in transpiration more than, say, 2,000 metre cube per acre so that in these areas there is likely to be a considerable net addition to the stock of subsoil water. At a guess this addition will be something like half the total volume coming on to the land as flood water, that is, on the average something like 50 million metre cube. The inflow of this water may be supposed to occur partly in the cotton fields and partly through the channels or canals by which water is led to the fields. If the area of cotton fields plus leaky canals etc. amounts to 10,000 acres the inflow corresponds to approximately one metre depth of water measured on the surface and might correspond to three, four or five metres measured by rise of subsoil water level.

98. This disproportion between depth of water absorbed and rise of water table occurs because the pore space, which has to accommodate the inflowing water, is only a part of the total soil volume. As the alluvial cone of the Abyan delta has a steep slope and as the material is known to be permeable it would be expected that any considerable addition to the subsoil water would be fairly speedily removed by natural drainage. There may however be obstacles to water movement such as layers of less permeable or more consolidated material or, possibly, some kind of rock barrier. Within the past two or three years there have been large rises of subsoil water levels in wells within the region Rumela - Khanfar - El Khor - Kubelia and natural drainage is taking place into the Wadi Hassan at places between Kubelia and El Khor. Elsewhere within the Abyan delta water is found within 30 or 40 feet.

99. These observations have led towards a second major agricultural development in harmony with the existing physical conditions. It has been urged that the only satisfactory way of using the flood waters is to divert them over wide tracts of land as speedily and as completely as is possible. This process, desirable on its own account, has the further advantage of increasing supplies of subsoil water in a natural reservoir which is already fairly well charged. It is possible that this underground reservoir has a somewhat cascade-like character owing to the East-West faults of which Mr. Jaques found indications. However that may be, it is clear that ample underground storage of water within the Abyan delta is a most valuable feature. If the preceding calculations are anywhere near the truth successful diversion of flood waters may automatically entail underground storage in an average year of something like 50 million metre cube of water. We do not have data that would permit a more accurate guess at this amount. Accepting it as a guess we may look towards utilization of this water by tube wells serving about 12,500 acres of crop in addition to the 25,000 acres served by surface flow. This probably means 100 to 150 tube wells. Local experience of irrigation from open

wells is in favour of a wide rotation perhaps 1 year cropping to 2 years fallow and even so an occasional flooding by free flow is welcomed. Since land is more easily available than water one might in the first instance envisage a somewhat similar rotation for tube well cultivation. It might however prove possible to establish some perennial fruit crops at the tube wells. Dates and bananas grow at Lahej; trials with citrus, hitherto unsuccessful, might be continued. Citrus, dates, vines, cotton and sorghum do well with tube well irrigation in California under rather similar conditions.

100. In the Western United States notorious and still unsolved difficulties have followed the private exploitation of underground waters. In the Abyan delta care should be taken to forestal these troubles which fundamentally spring from admission of private rights over a public resource of which the exploitation was not envisaged while property laws were taking shape. It is obvious that there can be no ancient tradition governing the operation of tube wells. That these concern the public and not the individual is indicated by the consideration that a man may injure his neighbour either by drawing too much water and drying up his neighbour's well or by watering so heavily that his neighbour's land is injured by seepage. Moreover the source of underground water is not in general precisely known although it is known that water may travel more than 500 miles underground. There is time in the Abyan delta to devise a licensing system to ensure as far as may be that tube wells are operated to the maximum benefit of the community. Whereas due weight may be given to all local customs touching use of water obtained by traditional means care should be taken to avoid extension of the customs to what is in effect a hitherto unexplored resource.

101. To prepare the way for using tube wells to best advantage it is urgently necessary to build up a body of data on subsoil water levels. Perhaps the best way of starting this would be to sink new lined wells with cemented tops to replace existing open wells. The new wells should have a good scatter over the whole Abyan area. Regular and reliable observations should then be made preferably by a soil scientist working in collaboration with an irrigation engineer. Secondly it is essential to put down between 10 and 20 experimental tube wells and thereby ascertain (a) the nature of the alluvial deposit at these points (b) the yield of water obtainable (c) the chemical composition of the water (d) its value for agriculture under local conditions (e) the effect of pumping on water levels in the vicinity. As regards (a) the tube wells should be scattered fairly well over the whole area, sites being chosen in consultation with a geologist. It should be noted that Dr. F. Dixey, Director of Colonial Geological Survey is particularly interested in problems of water supply; if he could not himself visit Abyan he would doubtless give valuable help in other ways.

102. In plans for rehabilitation of the Abyan delta thought is being given to the establishment of windbreaks by means of date palms or other trees. Windbreaks should benefit agricultural crops and increase the few amenities of the area; their more important effect will perhaps be to stabilise land consisting in the main of fertile alluvium. At the present time wind erosion is severe; deposits laid down perhaps 30 or 40 years ago and since abandoned have been scoured by wind until there remain isolated mounds of silt resembling anti-tank obstacles. Many of these are relics of embankments; here and there traces of old plough marks have persisted in spite of the wind. Perhaps they were protected for a time by an overlay of dune sand.

103. Observations were made on the depth and salinity of water in open wells and of the few surface waters. In many cases the adjacent ground was so uneven that it was difficult to recognise a local ground level. The general impression, however, is that ground water is encountered throughout the delta at moderate depth, in some places within a few feet of the surface. The observations were too few to give clear indication of the reasons for high levels of subsoil water. Patches in which the surface soil is damp or has a slight efflorescence of salt are found where the water table is high. Near former village sites there are likely to be areas containing potassium nitrate and other salts. These absorb water and facilitate upward capillary movement of water from an adjacent water table. Where the soil has a low salt content upward capillary movement of water is probably insignificant so long as the water table remains below 6 feet. Once started the upward movement will continue unless the water table is made to fall by cutting off inflow of water or by increasing drainage. In default of this a gradual accumulation of salts takes place on and near the soil surface as water is removed by evaporation. Rather suddenly this progressive accumulation of salt passes the

limit tolerable to crop plants. The occurrence of damp or salty patches is therefore a danger signal. Fortunately in this readily permeable material it should not be difficult to get water levels down to a safe depth. Thereafter it will probably be found that, in most cases, such salts as have accumulated can be removed by a few heavy waterings. This is very much a case in which prevention is better than cure. Urgent attention should therefore be given to promoting by means of cuts such natural drainage as is already occurring near Kubelia. Elsewhere the primary need is for more observations on water levels for until it is known what precisely is happening the most appropriate cure may be difficult to find.

A note on the Water Supply in Abyan by Dr. Greene has been included as Appendix No. 5.

CHAPTER IX

FINANCE AND ECONOMICS

FINANCIAL HISTORY

104. The financial history of the Abyan Scheme began in the year 1940 when in conditions of special difficulty the Government encouraged food production in the Abyan area by means of advances amounting to £10,000 (para 11). Results did not come up to the hopes entertained and in view of the famine conditions in the Hadramaut consequent on the lack of rain and the drying up of remittances from Hadrami interests in Singapore and Indonesia, plans were laid for the control and irrigation of the tract of land covered by the present Scheme. The Government entered the area and on the basis of a loan of £20,000 the Khanfar Development Scheme took shape. The progress of this scheme induced a lively realisation by the local inhabitants of the possibilities of peaceful development. By 1947 the time was ripe for the formation of the Abyan Board. This Board, on the 1st April, 1947, took over the assets of the Khanfar Development Scheme amounting to £7,932. Their financial position was strengthened by a revolving credit in the Aden Colony Treasury of £5,625, and interest free loan of £20,000 out of Colonial Development and Welfare Funds. In the following year (1948) a further loan of £250,375 from the same Funds was sanctioned. In both cases the loans were to be free of interest until July, 1952, when the terms were to be reviewed.

105. In June, 1950, the Governor estimated that a further £148,050 was needed to finance the activities of the Board during the ensuing 12 to 18 months. A virement of £30,000 was immediately approved. Later a further virement of £74,202 from existing Abyan Scheme money was sanctioned. Help with the seasonal finance requirements was received from the Raw Cotton Commission which made an advance of £90,000 to the Abyan Board on the security of the crop without a guarantee by His Majesty's Government.

106. The financial situation of the Board can be expressed in the following manner. The figures are as at 31st. March in each year.

	1948	1949 (a)	1950(a)	1951 (Estimated)
<u>PROVISION</u>	£	£	£	£
C.D. & W. Loans	7,021	60,473	188,112	270,375
Aden Colony Loans	<u>14,933</u>	<u>14,933</u>	<u>14,933</u>	<u>14,933</u>
Total	21,954	75,406	203,045	285,308
Profit & Loss				
Balance	- <u>2,420</u> +	<u>64</u> -	<u>9,398</u> +	<u>36,709</u>
	<u>19,534</u>	<u>75,470</u>	<u>193,647</u>	<u>322,017</u>

(a) Provisional

	1948	1949(a)	1950(a)	1951 (Estimated)
<u>FIXED ASSETS</u>	£	£	£	£
House & Buildings	463	11,532	35,875	40,838
Plant & Equipment	381	15,353	29,927	54,502
Irrigation Works	7,021	21,667	61,390	126,494
Installations	-	443	1,574	2,330
Ginneries	-	-	-	23,000
Date Plantations	-	-	-	1,500
	<u>7,865</u>	<u>48,995</u>	<u>128,766</u>	<u>248,664</u>
<u>FLOATING AND LIQUID ASSETS</u>				
Livestock	2,212	1,624	2,429	4,367
Produce	11,505	15,766	16,501	13,750
Seed Cotton @ cost	-	1,181	13,519	72,825
Sundry Debtors	115	162	1,974	1,282
Farmers debit balances (c)	4,534	5,478	10,059	84,909
Treasury Deposits & Cash in hand	970	3,217	33,533	47,901
	<u>19,336</u>	<u>27,428</u>	<u>78,075</u>	<u>225,034</u>
Less -				
<u>Current Liabilities and Provisions</u>	<u>7,667</u>	<u>953</u>	<u>13,194</u>	<u>151,681^(b)</u>
Net Working Capital	<u>11,669</u>	<u>26,475</u>	<u>64,881</u>	<u>73,353</u>
	<u>19,534</u>	<u>75,470</u>	<u>193,647</u>	<u>322,017</u>

107. It will be seen by reference to the profit and loss item under the head of Provision in the above table that only £24,955 on balance has been ploughed back into the undertaking. On the other hand the seed cotton in stock has been included at cost in the estimated position at the 31st March, 1951, namely £72,825. It is not possible to say how much of the 1950/51 cotton crop will be ginned and shipped by the end of March, 1951, but it is clear that, assuming the actual pickings come up to expectations, the bulk of the effect of sales to the Raw Cotton Commission at the prices negotiated will be reflected in the accounts for the ensuing year.

108. One important observation arises in connection with the accounts. They have been drawn up on the assumption that the whole of the ginning and marketing expenses are borne by the Board and not treated as a charge on all three partners. Reference will be made later in the Report (para. 120) to this serious deviation from the principle of sharing inherent in a joint undertaking of this nature. Generally speaking, the percentage share of each partner in the working results of the Scheme should be associated with commensurate obligations and duties. Already the Board has assumed very heavy obligations in the Scheme and it is hard to understand why in the draft accounts it has voluntarily shouldered the burden of expenses that can fairly be regarded as a charge to the three parties in proportion to their respective shares. The Scheme is at the formative stage and it is most important that the method of ascertainment of divisible profits and the individual or joint liabilities of the partners in the Scheme should be clearly defined.

Capital Expenditure

109. The capital estimate in support of the Colonial Development and Welfare Loans of £270,375 is shown below with the estimated expenditure to the end of March, 1951, in apposition -

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- (a) PROVISIONAL
(b) Includes £90,000 Raw Cotton Commission Advance, £10,222 Treasury Sub-Accountant's Cash, and £50,615 Provision for Cotton Purchases.
(c) Less Reserve for Doubtful Debts.

	Estimate £	Anticipated position at 31.3.1951 £
Irrigation Works	171,000	126,494
Plant & Equipment	40,000	54,502
Houses & Buildings	35,000	40,838
Installations	-	2,330
Ginneries	-	23,000
Date Plantations	-	1,500
Total	246,000	248,664

110. At the end of March, 1951, the programme of capital works, financed against these loans can be regarded as completed thus bringing to an end the first broad stage of development. A capital programme to cover the second stage extending over a period of three years should now be drawn up in detail. This new programme is estimated to cost £350,000 and reference to it is made in para. 150.

Recurrent Expenditure

111. Excluding the financing items(a), the Board's estimate in support of the loan for normal recurrent expenditure was £34,375. The 1950/51 budget provided for £50,064 on this basis - an increase of £15,689. It should be borne in mind, however, that the original scheme did not contemplate the introduction of a valuable cotton crop to the rotation. An upward revision to the early estimate is fully justified on this account alone. It is difficult to say precisely at this time what should be the total of the Board's administrative and maintenance expenditure owing to the arbitrary division of the expenditure between capital and recurrent heads. The distinction between capital and revenue expenditure is of much importance if the Balance Sheet is to be a true statement of the position. Now that the accounting staff has been strengthened it should be possible in future to make a reasonably accurate apportionment. The institution of a Stores and Material Account would facilitate allocation between the different heads of charge.

BULK SALE OF LINT COTTON

112. On the 6th. March, 1950, the Board entered into an agreement with the Raw Cotton Commission for the sale of the lint cotton from Abyan exported during the seasons 1949/50 to 1953/54. By an addendum dated 30th. November, 1950, to this agreement the period was extended to 1954/55. The main provisions of this agreement are summarised below.

113. Price. Season 1949/50
Types 4 and above 45.50d per lb. f.o.b.
Types 5 and 6 37.50d per lb. f.o.b.

Prices for the crops of the various seasons to be agreed annually. All relevant factors are to be taken into consideration in price fixing but for the seasons 1950/51 and onwards they will not vary up or down from the prices for the previous season by more than 20%

Contract

114. When the prices for each season have been agreed a formal contract will be entered into.

Revaluation

115. In the event of any change in the official dollar/sterling rate, the current seasonal price is to be re-negotiated.

116. The addendum dated 30th November, 1950, to which reference has already been made, contained an additional clause providing for the agreement to be automatically extended for a further year on the same terms unless notice to the contrary is given by either party. The notice may be either to the effect that no further extension of the (five year) agreement is desired or that an extension is desired on modified terms. In the latter event the parties will discuss and decide whether terms can be agreed for the extension of the agreement for a further season.

117. The full 20% variation was agreed for the season 1950/51, and the prices are as follows:-

Types 4 and above 55.00d per lb. f.o.b.
Types 5 and 6 45.00d per lb. f.o.b.

(a) Cash advances to farmers £12,000, and Purchase of crops £10,000.

Insurance

118. As regards insurance, the position is that Marine and Marine War Risks Insurance will be effected by the Raw Cotton Commission and the cotton will be at the Commission's risk when it is put on board the ocean-going vessel.

For its part, the Board insures the crop against fire and this Insurance operates until the baled cotton is in the hands of the shippers.

Financing

119. As a matter outside the sale agreement the Raw Cotton Commission on the 5th. April, 1950, agreed in principle to advance £30 a bale to be made as the Board buys the seed cotton. Subsequently, it decided to make an immediate advance of £90,000 (£15 a bale on an estimated crop of 6,000 (400 lbs) bales). The Raw Cotton Commission had advised in April that when the prices for the season are negotiated the question of interest will have to be taken into consideration.

Cotton Seed

120. The cotton seed amounting to some 600 tons in respect of the 1949/50 crop has been sold at a price of £20 a ton. Seed for sowing will be retained from this production.

WORKING OF THE SHARE-CROPPING SYSTEM AND PROPOSALS FOR REFORM

121. Although the basic intention appears to have been that the share-cropping system should be adopted, the scheme in operation discloses other features which should be reviewed at this stage. The percentage shares have been stated at para. 21. Nothing has been laid down, however, with respect to the method of ascertainment of the gross profits of the scheme, nor as regards the incidence of the costs of its operation. The result is that while the tenants, the Landowners and the States are credited with the value of the seed cotton brought in calculated at the price guaranteed under the "1st April, 1950 Agreement", (para. 15), the Board on the one hand receives the benefit of any margin between this price and the price paid by the Raw Cotton Commission, and on the other hand bears the whole burden of the ginning and marketing expenses as well as the cost of running and maintaining the undertaking. This is an irrational basis of working and one that if allowed to continue will in the view of the Mission result in the development of a lop-sided economy. While, fortuitously, the Board may be able to discharge its duties and meet these charges in present conditions, the future course of cotton prices and of crop yields is unpredictable and no prudent business concern would be likely to enter into a long-term arrangement on such a basis without reasonably adequate safeguards to ensure its continued stability..

122. This position should be rectified at the earliest moment possible. To this end it is advisable to lay down that the gross profits of the cotton crop shall be calculated by deducting from the total amount realised by the sale of the season's ginned cotton and cotton seed the joint collective charges and expenses. These joint liabilities could be set out in a Schedule to Abyan Board Decree or Charter and might be as follows:-

Joint Collective Charges and Expenses

- (a) The collection and transport of cotton, grown on the Scheme, from the collecting stations or markets of the Board.
 - (b) Ginning and baling.
 - (c) Warehousing
 - (d) Insurance of the cotton crop
 - (e) Usual and proper marketing expenses and expenses incidental thereto.
 - (f) Export duty (if any)
 - (g) Fertilisers
 - (h) Bulk pest control operations
 - (i) Agricultural research operations
 - (j) Any other expenses incurred for the benefit of the cotton crop as a whole.
 - (k) Provision for Depreciation and Replacement of Assets.
123. Similar provisions might be made applicable to any other money crop (e.g. sugar) produced within the Scheme and processed and marketed by the Board.
124. This leaves for consideration the liabilities of the individual parties.
Taking them in order -

Tenants

125. The functions of the Tenants have been indicated at para 29.

It is observed that while the Tenant is charged for mechanical operations on his land, such as ploughing, he does not pay for the seed issued to him. It would be reasonable for the seed to be treated as a Joint Collective Charge (para. 122).

The treatment of ploughing charges on a collective basis raises difficulties. The Board is not able to provide a mechanical ploughing service throughout the Scheme. Nor is it desirable that it should do so in normal circumstances. The position to be visualised is perhaps that the normal operation is carried out by the farmer himself using ox-drawn ploughs, but that heavy ploughing by mechanical means for the eradication of 'sidaa' grass which is a menace to the Scheme should be charged to the tenants as a body through the Tenants' Collective Account. This is a matter for consideration but if heavy mechanical ploughing is to be charged to the individual tenants the burden of the charge will have to be very carefully watched. A case might be made for treating heavy mechanical ploughing as a Joint Collective Charge (para. 122) on the grounds that the Landlords and the States would at least be contributing something instead of little if anything to the operation of the Scheme. This alternative should be given much weight. It can be argued that one partner should not bear the full expense of an operation which benefits the other two partners. On the balance of argument the Mission inclines in favour of making the cost of heavy mechanical ploughing a Joint Collective Charge.

States

126. A primary function of the State would be to secure that the land is made available to the Board for the purposes of the Scheme. Its own land it places at the disposal of the Board in return for a 25% share in the production of the Scheme. Should land need to be expropriated or leased for permanent works such as canals, buildings, and regulators the cost should be borne by the State. Under the 1st April Agreement the States are responsible for the debts of their tenants in relation to the Scheme.

Landlords

127. As has been stated (para. 30) the landlord may cultivate his own land or appoint tenants to do so. And as in the case of the States he is responsible for the debts of his tenants on the scheme. Where a landlord cultivates his own land the full 75% is credited to him by the Board, less 5% or 10% in respect of Ushur as the case may be (para. 21). In the cases where the landlord lets his land, the tenants are credited with 50% and the landlord with the 25% share less Ushur as above.

128. As regards crops other than cotton each party collects its own share. The Board by the charging of a water rate in the individual accounts, and the States and the Landlords direct from the Tenants.

129. In the absence of a statutory and detailed tenancy agreement it is obvious that the tenants of private landlords may be open to exploitation and it is known already that many of them do not receive the full 50% share. The definition of the rights and obligations of tenants and the introduction of Standard Conditions of Tenancy suitable for all Tenants whether on State or on privately owned land are matters requiring urgent attention. These conditions, *inter alia*, should provide that the land should be cultivated in a proper manner in accordance with the cropping scheme laid down by the Board; that the cultivator should not sell his cotton (of other main money) crop except through the Board; that the bunds and minor inlets to his land should be kept by him at his expense in sound repair; that normal oxen ploughing will be carried out by the cultivator while heavy mechanical ploughing would be done by the Board at its discretion for the Joint Collective Account; that while the Board will do its best to bring water to the land, the tenants (or the landlord) shall have no claim against the Board for any compensation on account of the water not reaching the land under cultivation or being insufficient in quantity for full and proper cultivation; that the tenant should comply with the sanitary regulations and clean the land during and at the end of each season in accordance with good agricultural practice; that advances may be made to the cultivators by the Board in its absolute discretion. Beyond this the marketing conditions and terms would need broadly to be specified as well as the functions of the Tenants' Collective (and, if these are continued, of the Tenants' Individual) Account. The kind of debits and credits to the Tenants' Collective Account should be stated and the use of the Price Equalisation Reserve covered. An important provision would be the steps to be taken if the Tenant consistently neglects or is careless in the cultivation of his crops. Termination of the tenancy should formally be provided for and the outgoing tenant should receive the value of the labour etc. put into the cultivation of the crops by him.

Board

130. Heavy obligations are ascribed to the Board under the 1st April Agreement - vide para. 28. Difficulties of interpretation have already arisen in respect of this agreement and the need for clarification has found expression in the draft of the Alyan Board Decree which the administrative authorities hope to introduce. The mission are not called upon to consider in detail the terms of this draft but it may be helpful for it to comment on some of the more important points and questions of principle involved.

131. The Board is the special agency for the agricultural development of the Abyan district within the framework of the objectives of policy set by the Fadhli and Lower Yafa' States on the advice of His Majesty's Government. The duties of the Board are the construction of permanent irrigation works, the management of the scheme and the promotion of the agricultural prosperity and stability of the area. Its aim is to secure the fullest utilisation and equitable distribution for the benefit of the people of the locality of the waters of the Bana and Hassan rivers and of any underground water resources that have not hitherto been drawn upon.

132. The Abyan Scheme began on the basis of a partnership between the States and the Landlords, the Tenants, and the Board based on a share-farming system. The maintenance of this basis is of fundamental importance to the continued successful functioning of the Scheme. No initial capital monies have been provided by any of the partners although the States and the private landlords are making the land available in return for a share in the crop proceeds. The Scheme has functioned on the basis of loans supplied by His Majesty's Government and there are justifiable hopes that the increased productivity of the land arising out of development and the high prices for cotton will of themselves ultimately provide the means of repaying the loans and establishing the Scheme on a self-supporting basis. Considering the almost complete absence of domestic capital in the two States and the need for capital formation, it is vital that the benefits and responsibilities of the partners in the Scheme should be clearly stated and understood. The most satisfactory course to be followed while the Scheme is feeling its way ahead, would be to lay down that the benefits and responsibilities in their financial aspects should be in proportion to the basic shares.

133. The implication of this principle is that from the gross proceeds of the cotton (or other main money) crop shall be deducted first, certain Joint Collective Charges and Expenses (vide para. 122) in order to ascertain the gross profits of the scheme, and secondly, certain Joint Appropriations of gross profit. The Joint Appropriations to which reference has been made refer especially to two appropriations that can fairly be considered as a charge against the three partners in proportion to their respective shares, namely, Price Equalisation and General Development.

134. Cotton (and other) crops are particularly vulnerable to the hazards of price, weather and disease. To these factors must be added the size of the annual flood. Large potential variations in the producers' income must be expected and should be provided for. To this end it is advisable to establish a Price Equalisation Account to which shall be credited any appropriations of gross profit decided upon by the Board at the end of each season. This account must be large enough to allow for the ups and downs of cotton production and it would be wise ultimately to build it up to sufficient strength to withstand the shock of two consecutive seasons of partial or complete crop failure. Drawings on the Account according to the decision of the Board by the partners would be in proportion to their respective shares. In other words, the benefit of the Price Equalisation Account in a bad year would be enjoyed by the Tenant, the States and the Landlords, and the Board.

135. The other appropriation of gross profits to which reference has been made is General Development. Very heavy capital outlay is involved in the construction of irrigation works, stores, offices, houses and in buying plant and equipment. Finance would not be forthcoming from private sources and the credit of the States is not such that a public loan could be floated. Cotton has been established at Abyan but it remains to be seen whether it can successfully be produced and profitably marketed from year to year. Cotton prices have risen well above normal expectations and the partners in the Scheme may find themselves at an early stage in a position to appropriate part of the surplus profits realised to a General Development Account. In the interests of self-help and economic stability it is advisable that, if the results permit, a substantial appropriation for General Development should be made before the division of profits between the partners takes place. Repayment of outstanding loans would be according to arrangements agreed with His Majesty's Government - vide para.

136. After these Joint Appropriations have been met there remains the net divisible profits of the Scheme for distribution. The proportions should be fully set out in the Decree on the following lines -

	<u>Live land</u>	<u>Dead land</u> (a)
To the landowner - States	25%	25%
or Private landlord	20%	15%
Ushur to the State	5%	10%
To the Tenant (for division in a manner laid down in the Decree).	50%	50%
To the Board (for application in a manner laid down in the Decree)	25%	25%

137. As regards the Board's share in the net divisible profits, provision will need to be made for special appropriations and if the following scheme meets the case it should be written in to the Decree. -

138. After meeting the costs of general supervision and administration, and the interest on temporary loans and all charges which are proper to be made to revenue the balance (to be known as the Board's net Share) to be appropriated on the following lines -

- (a) Extraordinary and non-recurrent expenditure
- (b) Minimum contribution of £6,000 to the two States jointly for Social Services.
- (c) A moderate amount to a Tenants' Welfare Fund.

Note: A similar contribution might be required from the account of the States and Landlords before distribution. This is not essential but they might like voluntarily to make it.

(d) A modest bonus to a staff provident fund (if established) at the discretion of the Board.

(e) Any balance remaining after appropriating (a), (b), (c), and (d) above, to the General Development Reserve of the Board.

139. The General Development Account would constitute one of the main buttresses to the financial structure of the scheme. When it had been built up to an adequate degree of strength any surplus to requirements could be paid over as an increased contribution to the States for Social Services (vide (b) in the scheme of appropriation of the Board's net share outlined above).

140. The working of this method of division may be exemplified as follows:-

Area under cotton:	6,000 acres	
Yield:	6,000 bales of 400 lbs. each	
Price:	50d per lb. for lint cotton f.o.b. Aden	
Expenses:	Say 3d a lb. net after crediting the value of the seed.	
		£
Gross Cotton Proceeds		500,000
<u>Less: Joint Collective Charges and expenses:-</u>		
(a) Ginning, marketing etc.	30,000	
(b) Bulk pest control	5,000	
(c) Agricultural Research	3,000	
(d) Depreciation and replacement of Assets	<u>15,000</u>	
		<u>53,000</u>
Gross Profits		447,000
<u>Less: Joint Appropriation:</u>		
(a) Price Equalisation	25,000	
(b) General Development	<u>62,000</u>	
		<u>87,000</u>
Net divisible profit		360,000
Tenants	180,000	
States & Landlords	90,000	
Board	<u>90,000</u>	
		<u>360,000</u>
141. Dealing with the collective account of each of the three partners in turn -		
<u>Tenants</u>		£
Share (50%) in net divisible profits		180,000
Less: Reserve for advances in ensuing season (say)		<u>30,000</u>
Balance		150,000
Less: Advances and book debits (say)	30,000	
Water Charge (say)	<u>8,000</u>	
Balance		38,000
		<u>£112,000</u>

(a) Dead land is considered to be alive when it has been cultivated for five years.

<u>States and Landlords</u>		£
Share (25%) in net divisible profits		90,000
Less: Water Charges from private landlords (say)		<u>2,000</u>
	Balance	<u>£88,000</u>

This share would be inclusive of Ushur in (tithe) which the State would collect in respect of cotton via the Board.

<u>Board</u>		£
Share (25%) in net divisible proceeds		90,000
Water Charges for other crops		<u>10,000</u>
		100,000
Less: Normal administrative and maintenance expenditure (say)		<u>50,000</u>
	Board's net share	50,000

<u>Appropriations</u>		(say)
		£
Extraordinary & non-recurrent expenditure		2,000
Contribution to Joint States Social Services:		
	£	
Minimum	6,000	
Additional Contribution	<u>4,000</u>	
		10,000
Tenants Welfare Fund		600
Staff Provident Fund		600
General Reserve Account		<u>36,800</u>
		<u>£50,000</u>

142. It is emphasised that these figures are purely illustrative. In a good year appropriations to reserves and for other special objects might be possible. On the other hand, with cotton down to 30d a lb. and with the level of production maintained, the Board might only just cover its normal administrative and maintenance expenses and have nothing available for appropriations. In the early years first priority should be given to the building up of the Reserve for General Development. The needs of the other accounts, e.g. Price Stabilisation may have to be satisfied at this stage by token appropriations.

143. There is one aspect to which the Mission wishes to draw special attention. It must be recognised that the maintenance of Tenants' Individual Accounts places a great strain upon the accounting and administrative staff. The present system involves an enormous amount of detail. Apart from the day to day detail and constant checking by the clerical and accounting staff to keep the records straight, much of the time of the British Agricultural Assistants in charge of the three main divisions of the scheme is monopolised in supervising and dealing with queries in connection with individual accounts. More and more as the scheme develops will arise the need for greater attention to the field duties of supervision and instruction of the cultivators and any step that can be taken which would result in a major easement to the office work should be taken if at all possible.

144. One alternative to individual accounting which should seriously be considered is the introduction of system whereby the cultivators receive flat rate advances at so much an acre at suitable times throughout the season and then, when the cotton is delivered to the collecting stations, a final payment is made for their cotton. Stability of income is secured so far as possible by the operation of the Price Equalisation Account. One important consequence to be anticipated from this system in working is clean picking. Acting under the impulse of immediate settlement cultivators may be expected to bring in all pickable cotton whereas under the present system where only a book credit is made when the cotton is brought in, the picking may not be one hundred per cent. Undoubtedly there will be difficulties in applying the system but it is advisable to weigh the advantages very carefully and give full consideration to the possibilities of its introduction. It would appear to open the door to the establishment of periodic markets as a local feature in rural life. From the aspect of local administration (and its finances) there is something

to be said in favour of developing the system on these lines. The Mission advise that consideration be given to the change over from individual accounts to a "final payment" or market system. If, as will be suggested, the financial year of the Board is altered to the 1st. October, the change could be made effective in the 1951/52 season.

Financing of Cultivators

145. The financing of cultivators and the distribution of crop proceeds are matters of very great importance. It is important now fully to recognise the underlying principles affecting the well-being of the cultivators. On new extensions where nothing can be expected from past crops special assistance in the first year may be required. The scheme of subsequent advances ought to pay regard to the psychological aspect of the cultivator. It would seem unwise in his own, and in the general interest, to put him in funds at a time when vital farming operations depending on his immediate exertions require accomplishment. Issues of money, whether in the form of advances or instalments of profit ought to follow as closely as possible to the completion of each operation including the operation of picking. The incidence of the Bairams ought to be observed and the cultivators put in funds if this can be done without serious repercussions. The possible effect of money issues on the price of labour should not be overlooked. One general aim should be to keep the cultivator in heart and to maintain a standard of living above the level of bare subsistence.

146. Acceptance of the general principle of ensuring by all possible means a steady standard of living for the cultivator demands a forecast of results based on trends. This means taking a view as to the level at which the returns to the cultivator can safely be fixed. If results are better than the forecast there would be a margin for reserve, while in the opposite conditions a draft on the reserve would be required.

147. The building up of a Price Equalisation Reserve primarily for the protection of the cultivators against violent changes in their standard of living and, through a scheme of advances, of striking at the root of agricultural indebtedness, should be regarded as important objects of policy.

148. The position of the average cultivator can be kept under review by a periodic estimation of the normal expenses of a tenant and of the profits earned by him on the basis of the price fixed for the season. An estimate on these lines prepared by the Board and supplied to the Mission has been included as Appendix No. 2. It will be observed that the ideal holding has been put at 25 acres. A final view cannot be taken upon this point. It may well be that in order to reduce the necessity to employ much outside labour the size of the average holding will have to be reduced. The matter should certainly be maintained under annual review.

FUTURE CAPITAL PROGRAMME

149. The first stage of the capital programme financed under the Colonial Development and Welfare Act covered the three years ending the 31st March, 1951, and reference has already been made to it in para. 104. The second stage envisaged by the present Mission includes no extensive or expensive control works in the Bana Gorge. These may be needed in future but a final view cannot be taken until considerably more technical data are available based on research and more experience gained as to the earning power and economic prospects of the agricultural scheme. The next few years therefore should be regarded as a period of consolidation of the progress already made, and of undertaking a moderate programme of improvement and expansion of the existing system within the works and financial capacity of the Board.

150. With these considerations in mind, the Mission advises that a detailed capital programme of the order of £350,000 be worked out and considered for execution by the Board in the years 1951/52 to 1953/54. A provisional estimate has been set out below. The details of its make-up will be found in Appendix No. 3.

	£	<u>Provisional Estimate</u>
		£
Irrigation Works		
Bana-Hassan Diversion Canal	10,000	
Ba Tais Canal	30,000	
Naza'-Fadhli (modification)	2,000	
Khor Canal Extension	40,000	
Upper Abyan Canal	75,000	
Lower Abyan Canal	<u>105,000</u>	
		262,000
Plant and Equipment		40,000
Houses and Buildings		15,000
Experimental Drainage System		3,000
Reserve for Additional Irrigation Field Works		5,000
Tube Well Experiments		<u>25,000</u>
	Total	<u>£350,000</u>

151. These figures must be taken as providing only a general indication of the works to be undertaken and it is essential that detailed estimates be worked out on the lines of the estimates for non-recurrent (capital) submitted and approved in respect of the first stage. The programme for each year within the three year period should be drawn up and approved by the Board. If the capital expenditure is included in the annual budget it should be shown as a separate section and not confused with the administrative and maintenance expenditure of the Board.

FINANCING REQUIREMENTS

152. The Board has estimated that its cash position in the year 1951/52 will be as follows:-

	April to June £	July to Sept. £	October to December £	January to March £	Total £
<u>Receipts</u>	210,000	150,000	150,000	60,000	570,000
<u>Outgoings</u>					
Normal Administrative & maintenance expenditure	18,000	15,000	15,000	15,000	63,000
Cotton Account	70,000	41,000	55,000	59,000	225,000
Capital	55,000	39,000	22,000	44,000	150,000
Financing	<u>10,000</u>	<u>60,000</u>	<u>10,000</u>	<u>-</u>	<u>80,000</u>
	<u>143,000</u>	<u>155,000</u>	<u>102,000</u>	<u>118,000</u>	<u>518,000</u>
Surplus (+) or Deficiency (-)	+ 67,000	- 5,000	+ 48,000	- 58,000	
Cumulative Surplus	+ 67,000	+ 62,000	+ 110,000	+ 52,000	

153. On the face of this presentation and assuming that the cotton crop is successfully harvested and shipped and payment received at the prices agreed under contract with the Raw Cotton Commission, it is evident that the Board will be in a position not only to meet its normal recurrent and crop financing outlay but also to cover the cost of the first instalment of the three year capital programme without recourse to outside help except the advances of the Raw Cotton Commission which it is reasonable to assume will be continued next season when the time comes. This is a fortunate position for the Board to be in at the close of the initial stage of development, but its achievement does not obviate the need for making arrangements in respect of temporary financial accommodation should the need for this facility arise during the course of the season owing to a lag in shipments.

154. The chief danger is a hold up in the ginning output due to the non-arrival of baling material and of hooping iron and studs. Every possible effort should be made to secure that the materials arrive in time for this season's needs and beyond this the aim should be to lay in stocks for the ensuing season. The danger might be obviated in future if advantage is taken of established import houses in Aden.

155. In the view of the mission it would be of great assistance to the Board if the Government of the Colony of Aden agreed to act as bankers for the Board and provided overdraft facilities up to an amount agreed by the Governor. The figure the mission has in mind is £100,000. Temporary help of this nature may not be required but the knowledge that the power to overdraw is there and can be exercised provides an assurance that a temporary lag of receipts behind expenditure will not lead to difficulties of finance in the course of the season.

156. It is advisable that the overdraft arrangement should be on a business basis and at a rate of interest settled at the outset. On the other hand, the Aden Government should arrange for the safe investment of the Board's funds surplus to immediate requirements. In the matter of financial provision, periodic forecasts and monthly revision of the cash estimates is essential, so that, should a tendency be observed for net receipts to decline, the cause can be ascertained at once and appropriate steps taken.

157. Although the Aden Government would hold or invest the main funds of the Board, it should not be involved in every payment large and small made by the Board or with every item of receipt entering its account. To avoid this position it is recommended that arrangements be made to provide the Board with a drawing account with the National Bank of India in Aden. All that is required is to maintain a working balance. Surpluses over and above the limit fixed should be transferred automatically to the Aden Treasurer for the account of the Abyan Board. Conversely when the account needed replenishing the Aden Treasurer at the request of the Manager, would make the necessary transfer.

FINANCIAL CONTROL

158. The present position is that the Manager of the Board is regarded as a Sub-Accountant of the Aden Treasury. The Board must therefore conform to the Aden accounting regulations. Routine returns must be submitted as if the Board were a Government department. Indents on the Crown Agents must be sent through the Aden Government. The Aden accounting staff, it would appear, are already over-burdened with the normal business of the Colony and it is clear that they cannot be concerned in detail with the day to day affairs of a quasi-commercial undertaking operating outside its own territory. On the other hand it would be folly for the Aden Government, even though recognising the need for the enjoyment of a greater measure of financial autonomy by the Board, to relax such control as it does possess without the introduction of satisfactory safeguards. That there is a danger of the present arrangements constituting a bottle neck and having an adverse effect on the business and planning of the Board will be apparent.

159. Two normal stages of devolution to bodies such as the Abyan Board may be distinguished. First, all Government regulations as regards Treasury (Cash and Banking), Accounting, Stores and Contracts, Personnel, Technical Sanction for engineering works, etc; are deemed to apply and no modification is permitted except with approval. This is not a one-sided arrangement for many benefits and safeguards are inherent in the working of established regulations. Secondly, the newly established concern, when it has found its feet and gauged its requirements, frames in consultation with the Government its own regulations under the main broad heads, eg. Banking, Accounting, Stores and Contracts, Powers of Financial Approval for Board, Managing Director, Manager, Engineer etc. and adopts them with the approval of the Government.

160. The aim doubtless is (and in the view of the Mission should be) to establish the Board on a separate accounting basis in order to permit an up to date view to be obtained from time to time of the undertaking as a whole and to enable it to plan ahead on sound business principles. Efficiency will indubitably be encouraged through the management and the personnel knowing what is happening. Moreover, actual losses due to a lag in the presentation of accounts under the ordinary non-trading accounting system may be avoided.

161. Trained staff both supervisory and subordinate are needed to run the accounts on business lines. Two trained accountants with reasonably efficient staff are now functioning. A system of accounting and of internal responsibility is in the making and should be written in to the Financial and Accounting Regulations. Separate accounts and balance sheets have been prepared reflecting the working of each of the past three years.

162. The Government of Aden is still in a position of special responsibility towards the people of Abyan and some degree of financial and administrative control will continue to be necessary, but the formalities need not be hampering and indeed should be welcomed by the Board as essential in the interests of the stability of the scheme.

Essential safeguards at the present stage would be -

- (a) the formal consent of the Governor to the annual estimates of revenue and expenditure.
- (b) the appointment of a financial representative to the Board.
- (c) reference to the Governor of -
 - (i) forecasts of any overdrafts required and the rate at which issues on overdraft will be necessary together with estimates of the date and rate of repayment;
 - (ii) proposed cotton and cotton seed sales contracts;
 - (iii) matters affecting the cash position of the Board;
 - (iv) payment of contributions to the two States;
 - (v) formation of reserve funds or reserve accounts;
 - (vi) capital programmes and annual instalments thereof;

- (d) Submission to the Governor of the Annual Accounts and the Annual Report of the Board, not later than a specified date in each year.
- (e) Approval of, and subject to such limitations as may be imposed by the Governor, the opening and operation of a drawing account with the National Bank of India in Aden.
- (f) Arrangements for monies surplus to requirements to be placed on deposit with or for investment by the Aden Government.
- (g) Audit to be by the Principal Auditor at a reasonable fee.
- (h) The Government to advise the Board on legal matters.

163. These items are intended to indicate the nature of control that may be still necessary. Provided the Aden Government is satisfied that adequate financial and accounting arrangements have been adopted and the means of conforming to them exist, there is no reason why greater financial responsibility should not be entrusted to the Board.

164. The Mission noted that Financial and Accounting Regulations for the Abyan Board had in fact been drafted and are available as a basis for consideration by the Board and the Government. The Mission recommend, that early consideration should be given to this draft with a view to its adoption and that it should be covered both with respect to its introduction and amendment in the new Abyan Decree.

FINANCIAL YEAR

165. The financial year of the Board at present marches with that of the Government from the 1st. April to 31st March. It straddles the main crop year with the result that profits on sales made subsequent to the close of the financial year are brought into the next accounts. When dealing with money crops such as cotton in which different partners are interested there are advantages in adhering to the crop year. Processing is immediate and quick sales are effected. The full position is reflected in the accounts for the year and is easily understandable. There is no point in presenting complex accounts to the Abyan Board at this early stage and to the extent that the accounts can be reduced to simple form the better will be the understanding.

166. From one other aspect a change in the financial year is desirable. The hot season is not a propitious time in which to present the budget for the new year and prepare the final accounts for the old one. If these duties could be effected in the time immediately following the leave period, the staff are more likely to tackle them in good heart and with fresh minds than otherwise.

167. On the whole there is a case for changing the financial year of the Board to the 1st. October - 30th. September and this the Mission recommend. The intervening six months (April to October) would provide a valuable breathing space of time for the preparation of the capital and recurrent estimates and for the settlement of the Financial and Accounting Regulations to be adopted by the Board. A supplementary budget would be needed for the interim period and the accounts for 1950/51 would cover a period of 18 months.

CHAPTER X

P E R S O N N E L

ADMINISTRATIVE REQUIREMENTS

168. Perhaps the most remarkable result arising out of the establishment of the Abyan Board is that in a district where until recently land was left uncultivated and conditions of life were insecure owing to the prosecution of blood feuds between people of the Lower Yafa' and Fadhli Sultanates and the absence of any orderly administration, a promising agricultural scheme has been established and the rulers of the two States while retaining their individuality and independence have been brought together in a spirit of mutual co-operation for the advancement of their respective countries.

169. Agricultural progress has been remarkable during the past few years but the pace has outstripped the growth of the administrative services. There is no intention that the Abyan Board should usurp the functions of government in the field of social services. The primary object of the Abyan Scheme is to raise the standard of living of the people of the delta through improved methods of water control and

agriculture and a good start has been made along the road of increased prosperity. But the Board cannot act alone. Its very existence and functioning raises problems in other fields and it is clear that unless social and administrative developments move in line with agricultural progress the scope of advance in many desirable directions will be limited.

170. Already, the increased wealth of the district has enabled the two States to finance social and public services and there is the expectation that their growing resources will be beneficially applied in this way. Unfortunately, owing to pressure of demands upon the British administrative staff whose services extend to the supervision and guidance of districts other than Abyan it may not be possible for them to deal adequately with the urgent duties arising out of the actual functioning of the Abyan Board and at the same time handle the many and varied problems arising in the administrative and social fields. These include the reorganisation of the judicial system of the two States, the improvement of public security, the reform of the penal system, and the orderly progress of Land Settlement in agreement and with the goodwill of the States and the passage of the enabling decrees. Beyond these things is the necessity for close liaison with the management of the Board.

171. The Mission feel that the success of the Abyan Scheme is being jeopardised by the present under-strength of the administrative service staff in Abyan. It is advisable that the staff should be increased by one experienced administrative officer; by one officer of Assistant Political Officer or Administrative Assistant status; and by two clerks. There is a pressing need for these increases to the establishment, and the maintenance of policy objectives through continuity of service of individuals in the district during the next five years is most desirable.

ABYAN BOARD STAFF

172. A list of Abyan Board staff has been included as Appendix No. 4 to this Report. The Manager - Major J. L. Congdon, T.D., is an Agricultural Officer, on the staff of the Director of Agriculture Aden Colony and Protectorate. He is paid by the Department of Agriculture and is on loan to the Board. He acts as Secretary to the Board but is not a member of it. His views are sought and carry weight. In a pioneering concern of this nature strenuous effort is inescapable and a heavy burden devolves on the Manager who functions in a co-ordinating capacity and provides the drive within the limits of the policy laid down. There is no margin for relief in the case of sickness or absence for other reasons, and the time required for planning ahead may be occupied by the details of day to day duties. It will be some years before the Scheme reaches full maturity but even at this stage of adolescence the need for more attention to routine matters is evident. Considering the functions of the Board, particularly in the field of development which demands unremitting attention, it is advisable that there should be appointed an Assistant Manager whose duty it would be to assist and relieve the Manager. The pay of this Assistant Manager should be met by the Board. The Mission recommend that this appointment should be made.

173. The Engineering establishment also requires strengthening and reorganising. As matters stand there is no member of the staff who could replace the Chief Engineer if he proceeded on leave or became a casualty, and with the exception of the Construction Engineer, who performs the functions of a resident engineer on civil engineering works, there is not a single engineer subordinate to the Chief Engineer. The Senior Surveyor, and the surveyors who work under him combine the functions of a drawing office staff with those of assistant engineers responsible for surveys and small projects. This arrangement doubtless lends itself to early stages of development, but does not provide the chain of responsibility which can withstand the removal of a link.

174. The Chief Engineer should be assisted by an Executive Engineer who should act as his deputy and relieve him of a great part of his ordinary routine duties in the general supervision of the drawing office and the work in the field. The Executive Engineer should in his turn be assisted by at least three Assistant Engineers of whom one would be engaged on project and research work at headquarters under the direction of the Executive Engineer, and his pay met against the capital programme, and the other two should be assigned definite areas, such as the Upper and Lower Abyan in which they should reside, and for the irrigation of which they should be directly responsible to the Executive Engineer.

175. The Executive Engineer, and the headquarters Assistant Engineer, would require the creation of two new posts. The remaining two Assistant Engineers would ultimately be recruited in replacement of two of the posts of Surveyors and their cost met against the ordinary budget. It should also be possible to relieve Assistant Engineers on leave by competent Surveyors, or Construction Foremen, whose practical experience would offset to a great extent their lack of more scientific training.

176. The Construction Engineer, as at present, should be responsible directly to the Chief Engineer for all project works entrusted to him. The weakness of the present establishment is that it lacks cohesion, and a study of the list of staff conveys very little of the actual duties of each member of the staff and in particular the chain of responsibility which is essential to good engineering administration.

CHAPTER XI

GENERAL OBSERVATIONS AND CONCLUSION

178. The Mission endorse the form of organisation adopted for the Abyan Scheme which is in the shape of a partnership between the Landowner (who is the State in the majority of cases), the Tenant and the Board, based on a share-farming system. An admirable start has been made in developing the agricultural possibilities of the area and the time is opportune to take stock of the position with a view to assisting the next stage of progress.

179. A fundamental principle of the scheme is the sharing of benefits and of obligations. It follows inevitably, and rightly, that there should be a clear definition of the collective charges and expenses to be borne by the three partners in proportion to their respective shares. The charges and expenses as well as the appropriations of gross profit that should in the view of the Mission be borne collectively have been set out in the Report (paras. 122 and 133). The financial system should provide first, for a General Cotton Account with an appropriation section to handle the gross cotton proceeds, the Joint Collective Charges and Expenses, and the Joint Appropriations; and, secondly, for the establishment of a Collective Account for each of the partners as a body. The additional requirements are the creation of Price Equalisation and General Development Reserves. Through the machinery of the Collective Accounts of each party the means is provided of making debits incident on a particular party, e.g. a contribution by the Landlords and the States to a Tenants' Welfare Fund, or issuing the tenants share in accordance with a definite scheme of financing. For example, in the interests of the tenants as a body it may be advisable to defer the issue of additional profits in order to finance later agricultural operations. In other words it may be possible for the tenants to finance themselves from their own money and the system should provide for this desirable development.

180. The Report has indicated that the scheme is inherently sound and that, given prudent direction, the financial problem is manageable. The immediate need is to consolidate the progress made to date and to expand the system on the present lines and in a way that should be productive of additional revenue other things being equal. While recommendations are made with respect to investigations, no costly constructional schemes are envisaged. Careful study and surveys of the gorge area and Liqmat Al Bana reveal possibilities for some measure of water control but there is no ground for impulsive action and decisions can be taken some years hence when the data are available and the existing scheme has gained in experience through regular working. The construction programme to cover the next stage has been estimated to cost £350,000 spread over a period of three years. Assuming the successful establishment of cotton as a money crop and its continued production without heavy losses from pests or other causes, the scheme should be able to generate its own finance both for capital and for recurrent expenditure during the next stage subject to help in seasonal finance from the Raw Cotton Commission (para. 105) and to the power in reserve to borrow temporarily on overdraft from the Aden Treasury up to a limit of £100,000. The question of large scale finance for major irrigation works does not arise at the present stage. The need is certainly not imminent and the matter can be considered at the next review three years hence. Additional capital may then be needed for a pilot tube well project (para. 186).

181. The Colonial Development and Welfare Loans amounting to £270,375 are free of interest until the 1st April, 1952 when the terms are to be reviewed. While the Mission do not wish to anticipate the future decision, it may be helpful for them now to express the hope that the relief from interest be extended to a period of five years and that even then no interest as such be charged but that the Board should undertake to repay the loans by annual instalments of not less than £15,000. This provision would enable the Board to increase the annual instalment in any year that it found it possible to do.

182. It should be remembered that the long term cotton sales contract with the Raw Cotton Commission contains an escape clause in event of a revaluation of the dollar/sterling rate. In that contingency prices for unsold stocks would have to be renegotiated. Should this season's crop produce the anticipated margin of profit and the net divisible proceeds be pegged at a reasonable level the financial position of the partnership will be one of reasonable strength and

there should be no great difficulty in adjusting the position of the Board to the circumstances arising out of revaluation.

183. The principal factors determining the agricultural possibilities of the Abyan Scheme are water, soil, plant breeding and the control of plant diseases and pests. Each aspect is associated with its own special problems and if the resources of the area are to be developed and the stability of the scheme ensured so far as is humanly possible, provision must be made for investigation and research. The senior staff required to deal with the problems are -

(a) An Assistant Engineer to work under the Chief Engineer but water research problems would have first call on his time. He would be chiefly concerned with investigations in connection with the supply, control and economical use of water. His cost in whole or in part should be met against projects.

(b) A Soil Chemist.

(c) An entomologist with a knowledge of plant pathology.

(d) An Agronomist - plant breeder.

184. The three scientists ((b), (c) and (d)) form a research unit. It is recommended that they should work under the Director of Agriculture, Aden Colony and Protectorate but in contact with the appropriate research unit in the United Kingdom or in Africa, and that their cost should be met by a grant for a period of five years from Colonial Development and Welfare Funds (vide para. 78). The linking of these research officers, for example, the soil chemist via Dr. Greene with the Rothamsted Experimental Station, and the constitution of a small Committee in London to advise in connection with research programmes is an important feature of the recommendations of the Mission. Organisation on this basis coupled with close collaboration with the management of the Board should ensure that the work done is on the right lines and kept in the mainstream of scientific and technical advance.

185. The Mission attach importance to safeguarding the development of underground water supplies. These, if developed by tube wells, would constitute an entirely new resource. Uncontrolled irrigation by this means would be extremely harmful to the district and it is most essential that the raising of water through tube wells for irrigation should be carried out only under licence and subject to specified conditions.

186. In connection with tube wells much investigation is necessary. Two stages are envisaged, first, a systematic hydrological reconnaissance by means of a drilling at selected points throughout the area, and secondly, a tube well pilot scheme. As a preliminary step the Mission recommend that the Chief Engineer should be sent on a short visit to India to see tube well irrigation in operation and to study this kind of development in its technical aspects with a view to starting on sound lines if the results of the subsoil water survey prove to be favourable. A figure of £25,000 has been included for tube wells in the provisional capital estimates. Additional finance would be needed for the pilot projects in due course. But this can be considered when the stage beyond 1954 is being planned. As regards the division of net crop proceeds on the tube well areas so many varied systems are current in South West Arabia that no great difficulty is foreseen in arriving at a satisfactory arrangement acceptable to all parties and at the same time carrying the sanction of local custom. In due course the question of rent or crop shares in tube well areas should be examined by the Board and the two States.

187. Machinery exists under the 1st April Agreement for the eviction of the bad tenant. But this ultimate sanction is a very serious one to apply and the Mission feel that there is need for the establishment of Agricultural Courts with powers to inflict fines in the cases of agricultural offences. Such fines should be paid into the Tenant's Collective Account. The Agricultural Courts might be composed of agricultural sheikhs each responsible for a small area of the Scheme and chosen by the tenants. These sheikhs would be the connecting link between the tenants and the Board's Agricultural Assistants. The difficulties of introducing arrangements on these lines are appreciated but the objective should be kept in mind. Security of tenure for the cultivator is of very great importance and while on the other hand there must be some penalties for inefficiency and neglect, conversely, there should be rewards for good husbandry. The normal tenancy contemplated is for a single crop year but the good cultivator should expect, in effect, all the rights of permanent occupancy. Possibly the letting

in such cases might be for a longer period such as the period of a rotation in the first place. Some of the cultural operations in connection with cotton production are very heavy and opportunity should be taken whenever possible to lighten the task of the cultivator. For example hand root pulling instruments for the removal of the old cotton roots before burning might be introduced with advantage. The desirability of establishing a Tenants' Welfare Fund has been mentioned. Its use would be for activities in advance of the Government's social programme, for example, child welfare. The cultivators make an important contribution to the scheme and their contentment and welfare should be a joint agricultural and social objective. In due course the question of Tenancy Representation on the Board should be considered.

188. The position of the private landlord in the Scheme will need skilful handling to achieve the best results. Some may wish to run their estates on a tenancy basis, in which case the application of standard conditions of tenancy in the interest of the cultivators should be considered. Others may favour direct management and diversification of production. The system followed depends to some extent upon the crops grown and the other activities carried on and landlords are a potential source of new capital. But in any case it is necessary that rules of good husbandry and fair remuneration and conditions for tenants or paid labour should be applied. Funds and price permitting, the States should be open to purchase land in the Scheme for allotment on a tenancy basis in the ordinary way.

189. The need for windbreaks in the irrigation area has been mentioned. It would be advantageous if these were associated with a forest policy adopted by the States and for the Board in its working to provide not only for windbreaks, but also for fuel plots throughout the area. Shade trees in villages and at market sites would be a desirable amenity.

190. Much has already been done in the field of staff welfare, but there is still scope for action in this direction. Local leave facilities are desirable for the Board's expatriate staff. The introduction of a staff provident fund is recommended.

191. In very many ways especially through careful planning and efficient working, through the adoption of improved methods of agriculture and of water utilisation, through the provision and full use of vocational training in the field and in the workshops of the Board, the Abyan Scheme undoubtedly can be a strong point of influence in Southern Arabia and in neighbouring territories. The Scheme is being developed on sound foundations. Each partner - the Tenants, the States and the Landlords, and the Board, has a vital contribution to make to the future. There are no grounds for over-optimism and the need for the exercise of caution is emphasised. But there is no reason to suppose that the spirit of goodwill and of mutual co-operation will not continue. On this basis the undertaking can with much confidence look forward to a bright future.

192. It remains for the Mission to express their grateful thanks for the assistance received at every stage from the officials of the Government and the staff of the Board. In particular it is desired to thank Mr. B. J. Hartley, C.M.G., O.B.E., the Managing Director, Major J. L. Congdon, T.D., the Manager, and Mr. D. Hall, the Chief Engineer of the Board who accompanied the Mission during its tour of the Abyan delta, together with Mr. M. N. H. Milne, the senior Political Officer whose help was indispensable.

The Mission cannot adequately acknowledge the hospitality received from His Excellency the Acting Governor and Mrs. Goode and other official residents of the Protectorate, and from Major and Mrs. Congdon at Abyan but they wish to express their sincere appreciation and thanks.

Finally the thanks of the Mission are due to Mrs. Milne, our Secretary, who has been indefatigable in dealing with the heavy work involved.

Aden.

14th February, 1951.



PLATE 1

Tilted tertiary limestone forming west side of the Ligmat Bana gorge. The dry season flow of the Bana occupies a small part of the sand and boulder bed. The flow is from right to left in this view.



PLATE 2

View from tilted limestone of El Kaur looking west towards the similar outcrop forming Khaufar Rock. Tamarisk and shrubs mark the bed of the Wadi Hasan.



PLATE 3

Stabilized bed of Ba Tais Canal immediately upstream of a "drop" or fall.



PLATE 4

Typical fall in the Ba Tais Canal. Note the silted bed of the channel upstream.



PLATE 5

View of the same fall (as in Plate 4) taken further downstream. Heavy action is taking place at the toe. The gradient of the bed is too severe and more falls are required.



PLATE 6

Typical example of uncontrolled erosion Naz'a Canal.



PLATE 7

Approximately stable reach of Ba Tais Canal in a re-aligned section. The bed is formed from deposited sand.



PLATE 8

This stone and brushwood weir near El Kaur firmly anchored to the rocky east bank of the Wadi Hasan deflects part of the main flow.

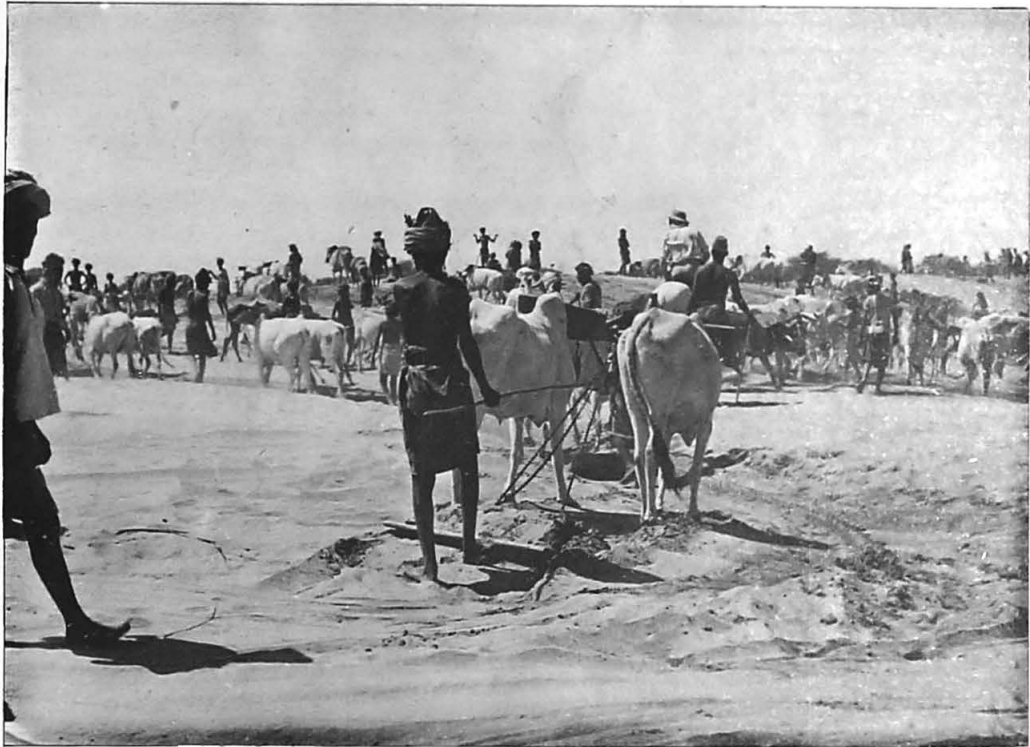


PLATE 9

Two hundred yoke of oxen with scraper boards forming a diversion bank (Oqma) across the sandy bed of the Bana. Traditional skill, efficiency, economy of effort and ingenious use of available material are displayed in this work which demands a high degree of co-operation.



PLATE 10

Residual hummocks of silt in a wind eroded landscape a few miles north east of Zingebur.



PLATE 11

"Dead" land east of the Wadi Hassan on the Zingebar - Asala road. Sand dunes encroach on this deep alluvial deposit. The hummocks of silt are remnants of a land surface laid down by former inundations.

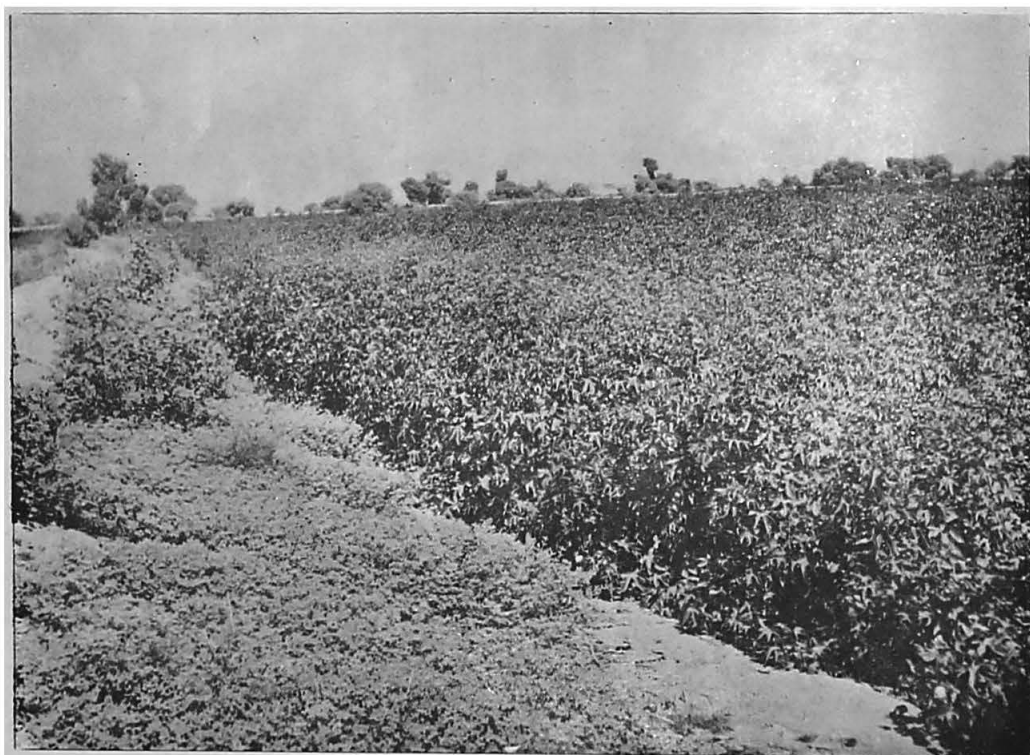


PLATE 12

Egyptian type cotton grows to maturity after a single watering. This cotton is mostly dark green but a belt of smaller more mature plants is seen where surface soil was scraped up to make the embankment on the left. The smaller more mature plants were perhaps less well supplied with available nitrogen.



PLATE 13

After a single watering these widely spaced plants of Egyptian type cotton free from pests and disease will bring to maturity more than 100 bolls per tree. A fair proportion of the cotton in Abyan is as luxuriant as this.



PLATE 14

Salt accumulation in surface soil caused by high level of ground water has prevented growth of cotton in this field near Well No. 6 Um Boreis.

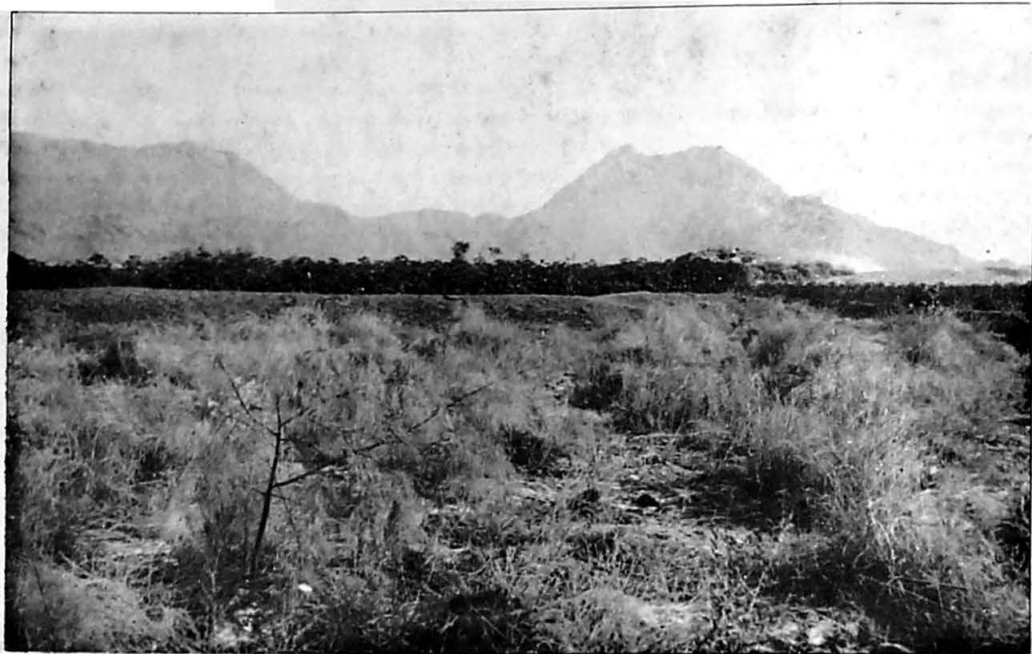


PLATE 15

Salt efflorescence caused by rise of subsoil water near Kubelia. The vigorous cotton in the background has not yet been affected. Seepage waters are moving towards the Wadi Hasan. It may be possible to increase this natural drainage by some inexpensive cuts.

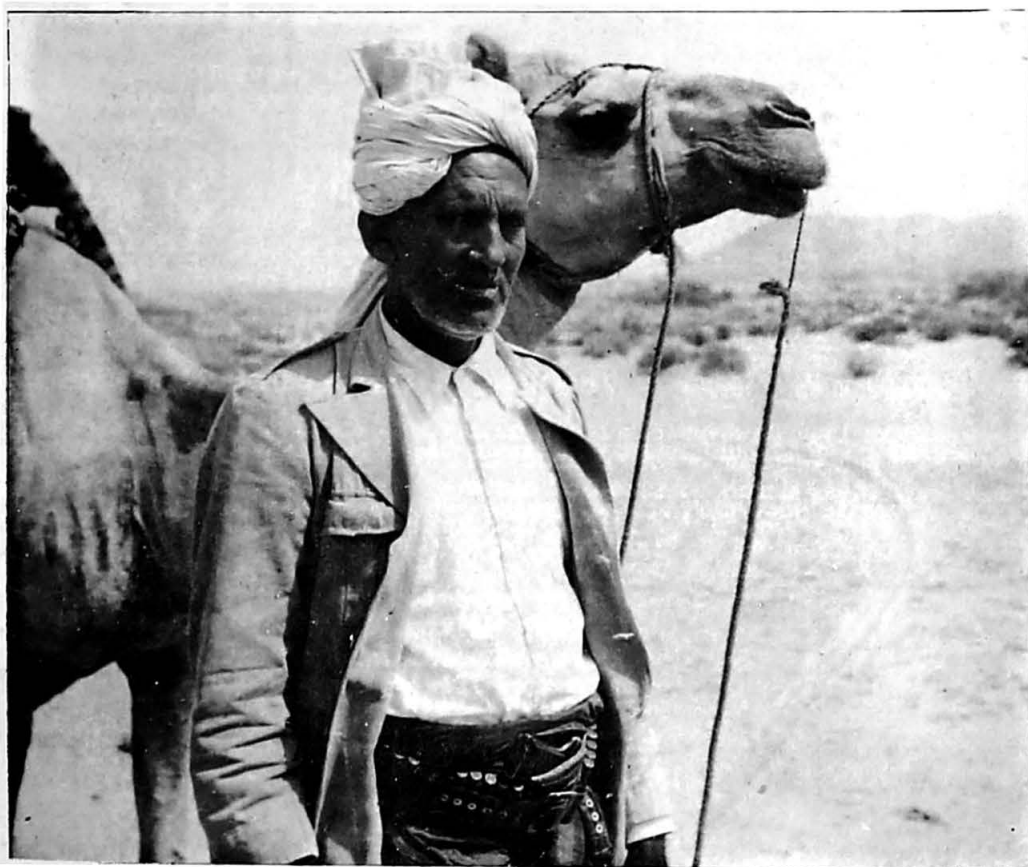


PLATE 16

Syed Aidroos Bin Zain an Agricultural Inspector employed by the Abyan Board.

DS 18646/1/5494 K3 6/52 R

ABYAN DEVELOPMENT SCHEMEAGREEMENT REACHED ABOUT ABYAN BOARD AFFAIRS
AND CONNECTED MATTERS, APRIL 1st, 1950

It is calculated that if all land in Abyan is irrigated by canals instead of oqmas it will be possible to irrigate all land that is at present alive with greater regularity than in the past and at the same time it will be possible to bring under cultivation much land that is now dead. To convert the irrigation from the old method to the new is one of the purposes of the Abyan Board.

2. This conversion will take some time. It is necessary first to obtain the staff, to survey the ground and to plan and build the canals in the best possible position. The following outline is intended to explain the Board's plan up to the end of the year 1954/55: but it must be remembered that many factors outside our control may speed up or delay the programme.
3. The first main canal has been begun. It will run from Ba Teis southwards but will water no land until it reaches the vicinity of Zingibar. At first it will bring in a tract of Fadhli dead land. This is not because the Board wishes to favour dead over live land, but because the shape of the land makes this course inevitable. When this canal reaches Zingibar it will be possible for it to water most of the present live land in the vicinity and it is hoped that these lands will then receive more regular water; but this cannot be for some time. In the intervening period the Board will take over and continue to run as economically as possible the present "Oqma" system. This means that the farmers in these areas will not reap much benefit for some time from the Board's activities. Few will lose by them but the irrigation system will not yet be altered. As soon as the canal reaches live lands, these lands will be given preference over previously dead lands; but it is hoped that there will be found to be sufficient water to irrigate a much larger total area than in the past.
4. At the same time it is proposed to introduce a proper system of crop rotation so that the land does not ever become too dirty or exhausted. It is hoped that this rotation will be one year cotton; one year grain or "simsim" and one year fallow on all land. It is of course possible that in a year of poor floods some land will be left unwatered for a second season; but the programme will be so designed that this is reduced to a minimum, and, before too much land is brought under cultivation, records will have shown how much water can normally be expected.
5. A system of regular fallowing is essential if good crops are to be reaped regularly year after year, but it is clear that such a system must be by complete areas and not be dotted about. This will be hard on some small landowners, who, for at least one year in three, will find themselves cut off from water altogether. It has therefore been decided that such farmers shall, in the fallow year, have priority as tenants on state land if they wish it.
6. It is also essential for good farming that each section of land should grow the same type of crops in the same year. It will therefore be necessary for the farmer to agree to plant such crops as the Board may indicate in each year.
7. A few bad or lazy farmers cannot be allowed to spoil the system for the majority. Bad tenants on state land will therefore be evicted by the Land Settlement Committee, which consists of one representative of the State, one of the Abyan Board, and the P.O. Bad tenants on private land will be evicted by the same committee and the owner of the land will be required to nominate a new tenant. Owner occupiers who farm badly will have their cases examined by a special committee consisting of the Land Settlement Committee strengthened by the addition of two good farmers of the neighbourhood. If this committee so decides the owner will be required to nominate a tenant to work his land.
8. In order to pay for these services the following crop shares have been decided and will apply to all land on which the Board operates on all crops planted after 1.4.50. These shares will not be altered before 31.3.55 before which the position will be reviewed.

	<u>On live land</u>	<u>On dead land</u>
The farmer who works the land	50	50
The Abyan Board	25	25
The Land owner	20	15
The State (Ushur)	5	10

9. Dead land will be considered to have been made alive when it has been cultivated for five years.

10. The method of share collection will be wholly altered as from 1.4.50.
11. It will be assumed that each farmer will reap 24 keilas Sirkali of grain per dhumd and 10 Keilas of Simsim, unless he appeals before a date which will be announced from time to time and prove that for reasons outside his control he has been unable to reap so large a crop. A fee for appeal will be Rs.5/- per dhumd and will be payable to the State if the appeal is unsuccessful. The land of a farmer who appeals will be inspected by representatives of himself, the State and the Board and he will be required to pay on the crop as assessed by them but the farmers who grow more than these amounts and who do not appeal will not be taxed by State or Board on the excess.
12. The farmer will then be given the choice of how he pays. He may, if he wishes, bring the State's, the Board's and the landlord's shares to the Board in cash or kind; or he may ask for the amount to be debited against his cotton account.
13. His cotton will be bought by the Board at a fixed price, which will during the coming 5 years be not less than As.4 per lb. for clean cotton, As.2 per lb. for dirty cotton and As.1 for ground sweepings and pickings. Grading will be done by a European Inspector appointed for the purpose.

From the price of the cotton will be deducted all debts and dues to Board, State and Landlord and to it will be added harvesting charges on the Board's share at An. $\frac{1}{2}$ per lb. The balance will be paid to the farmer. The State will then distribute the landlord's shares.

Fodder crop in "Saif" Season: The farmer will deliver 50 bundles per dhumd to the local stack-yard of the Abyan Board or the equivalent in cash. "Usher" on fodder will be paid in cash, i.e. 5% on live land and 10% on dead land. Habhab: To the Board Rs.26/- per crop per dhumd with the same right of appeal as in para 11; Ushur as in para 8 above i.e. 5% on live land and 10% on dead land.

"Aqab" will not be taxed in any form.

The functions of the various parties are as follows:-

The Board will:-

- (a) build and maintain the Capital works, main canals and field channels;
- (b) make up dead land ready for watering;
- (c) deliver water to each section possible;
- (d) indicate in advance the crop to be grown in the coming season in each section;
- (e) to receive the cotton and other shares described above and to distribute the money received;
- (f) to provide stack-yards for fodder and weighing stations for cotton at convenient places;
- (g) to make advances to farmers when necessary.

A fixed schedule of usual advances will be drawn up and no advances not listed on this schedule will be made to tenants without the sanction of the landlord.

The State will give no further agricultural advances to Abyan farmers.

The farmer will:-

- (a) make up the banks and field channels on the land that he is himself farming;
- (b) cultivate such crops in such manner as the Board may direct. This will include payment for machinery when working on his land;
- (c) to bring in cotton, fodder and cash to the approved places.

If any farmer neglects his duties the Board may do the work for him and double the cost will be deducted from his cotton account.

The Landlord will be responsible either for cultivating his own land or for appointing tenants to do so for him. He will be responsible to the Board and the State for debts to be incurred by his tenants.

<u>Glossary</u>	<u>Agab</u>	Ratoon crop.
	<u>Dhumd</u>	Unit of area. About 4/5ths of an acre.
	<u>Hubhub</u>	Water melon.
	<u>Keila</u>	A measure of capacity. About two bushels.
	<u>Keila Sirkali</u>	New (or Aden) Keila. Equivalent to one bag of grain.
	<u>Oqma</u>	Large earth-work diversion erected across the Wadi bed and inclined at an angle to the direction of flow.
	<u>Saif season</u>	Late March to early April.
	<u>Soames</u>	Field earth banks.
	<u>Ushur</u>	An Islamic land-tax amounting to one-tenth of the total yield of crops.

ESTIMATE OF THE POSITION OF AN AVERAGE TENANT FARMER
ASSUMING THAT HE IS CULTIVATING A HOLDING OF
25 ACRES

Estimated Cultivation Costs per acre for the season 1950/51.

<u>Cultivating operation</u>	Cotton Rs. As.	Millet Rs. As.	Simsim Rs. As.
(1) Preparation prior to irrigation	8. 0	8. 0	8. 0
(2) Ploughing after irrigation	10. 0	5. 0	5. 0
(3) Sowing	3. 0	6. 0	6. 0
(4) Weeding and thinning	15. 0	- -	- -
(5) Harvesting or picking	30. 0	20. 0	10. 0
(6) Cost of Seed	- -	3. 0	8. 0
(7) Maintenance of banks (say)	6. 0	6. 0	6. 0
(8) Tractor ploughing (once in 6 years)	10. 0	- -	- -
	82. 0	48. 0	43. 0
Estimated value of Receipts	210. 0	72. 0	64. 0
Margin of profit	128. 0	24. 0	21. 0

Note

It is considered than an ideal holding for a tenant farmer will be 25 acres gross 24 Net with a 3 course rotation. One year cotton, one year millet or simsim one year fallow, each tenant would cultivate 16 acres say, each year. If divided as follows 8 cotton 6 millet 2 simsim his gross earning would be:-

8 acres cotton @ Rs. 210 per acres	= Rs. 1680
6 " millet @ Rs. 72 " "	= Rs. 432
2 " simsim @ Rs. 64 " "	= Rs. 128
Total gross earning	Rs. 2240

On the basis of the above costs if he did no work he would have to pay:-

for cultivating and harvesting 8 acres cotton @ Rs. 82 per acre	Rs. 656
for cultivating and harvesting 6 acres millet @ Rs. 48 per acre	Rs. 288
for cultivating and harvesting 2 acres simsim @ Rs. 43 per acre	Rs. 86
Total Cost	Rs. 1030
Estimated Receipts for holding (16 acres)	Rs. 2240
Estimated Expenditure for holding "	Rs. 1030
Balance Profit	Rs. 1210

or Rs. 75.10 As. per acre of cultivation = over £5/-/- per acre.

If his farming operations were conducted entirely by family labour his receipts would be Rs. 2240 gross or Rs. 140 per acre or £10. 10. per acre.

ABYAN SCHEME - CAPITAL PROGRAMME
PROVISIONAL ESTIMATE (THREE YEARS) 1951/52 - 1953/54

<u>Item No.</u>	<u>Description</u>		
1.	<u>Irrigation Works.</u>		
(1)	Bana-Hassan Diversion Canal approx. length 1,200 M.L. Capacity 20 M ³ per second. Complete with headworks.		10,000
(2)	Ba-Tais Canal (remodelling)	£	
	masonry falls 18 Nos	12,000	
	Banks & earthwork 45,000 M ³	2,250	
	Secondary Canals & Structures	8,000	
	Irrigation Field Works	6,000	
	Contingent	<u>1,750</u>	30,000
(3)	Naza-Fadhli (modification) 2 Falls and Earthwork		2,000
(4)	Khor Canal Extension 6 Kilo extension. Capacity 10 M ³ per second. Widen off-take through rock. Central Gates. Strengthen existing banks. Excavation for Extension. Falls & Off-takes 6 Nos. approx. Secondary Canals. Irrigation Field Works.		40,000
(5)	Upper Abyan Canal. Length 15 Kilo. Capacity at head 20 M ³ second 20 Falls at £1,000 each 360,000 M ³ Excavator at 8d Secondary Canals 30 kilo Irrigation Field Work Contingent	20,000 9,000 10,000 30,000 <u>6,000</u>	75,000
(6)	Lower Abyan Canal. Length 15 Kilo. Capacity 20 M ³ second. Headworks & River Diversion 20 Falls in Masonry Excavators 40 Kilo Secondary Canals Irrigation Field Works Contingent	15,000 20,000 10,000 15,000 35,000 <u>10,000</u>	105,000
			262,000
2.	<u>Houses and Buildings</u>		
	Extra Office accommodation		
	Extra dwelling houses		15,000
3.	<u>Plant and Equipment.</u>		
	(Drilling equipment. Excavator. Provision for heavy tractors etc.)		40,000
4.	<u>Experimental Drainage System.</u>		3,000
5.	<u>Tube Well Experiments</u>		
6.	<u>Reserve for Additional Irrigation Field Works</u>		25,000
	TOTAL		<u>£350,000</u>

It is emphasised that the foregoing is a very rough estimate. The programme, however, follows the general pattern of the work contemplated and is based on current prices. Quantities are estimated from maps and will require to be verified by survey prior to the preparation of the final estimates. The proposed change in the financial year to the 1st. October will provide a space of time for planning.

ABYAN BOARD STAFF AS AT JANUARY, 1951

<u>POSITION</u>	<u>NAME</u>	<u>SALARY PER YEAR</u>
		<u>£</u>
<u>HEAD OFFICE AND GENERAL OFFICE:-</u>		
Manager	Major J. L. Congdon	Paid by Dept. of Agriculture
Chief Clerk	Mr. Khalid O. Abdillah	216
Junior Clerk	Mr. Ahmed Bin Ahmed Khan	72
Office boy	Abdulla Mansoor	22 10
Agricultural Inspector	Syed Aidroos Bin Zain	252
Chowkidar	Ahmed Mokbil	52 4
Sweeper	Ayyash Ismail	45
M.T. Driver	Abde Mohd. England	112 10
Temporary staff	Abde Thabit	36
<u>ACCOUNTS SECTION:-</u>		
Head Accountant	Mr. B. F. May	910
Deputy Head Accountant	Mr. W. J. D. Platt	750
Assistant Accountant	Mr. C. P. Fernandez	297
Assistant Accountant	Mr. A. D. Samuel	360
Head Cashier	Mr. Ibrahim Awad Shamsan	270
Head Book Keeper	Mr. Abdul Gani	207
Book Keeper	Mr. Abdo Noman	180
Assistant Book Keeper	Mr. Fuad Zaid Ali	153
Assistant Cashier	Mr. Ali Awadth Bazughalfan	153
Office boy	Kassim Yehia Muflahi	25
M.T. Driver	Mohamed Hazem	91 16
<u>ENGINEERING SECTION:-</u>		
Chief Engineer	Mr. D. M. Hall	1,500
Construction Engineer	Mr. T. Cangos	720
Senior Surveyor	Mr. Costantini	690
Surveyor	Mr. Polisco	600
Surveyor	Mr. Cigonetti	600
Surveyor	Mr. Privitera	600
Surveyor	Mr. Elio	600
Construction Foreman	Mr. K. Schlatholt	600
Construction Foreman	Mr. M. Borsato	600
Construction Foreman	Mr. A. Borsato	300
Assistant Surveyor	Mr. Mohd. Ali Sobahi	82 16
Master Clerk	Mr. Ahmed Mubarak	90
Office boy	Mohsin Mohamed	22 10
M.T. Driver	Kassim Ali Yafee	91 16
M.T. Driver	Naser Abdul Kawi	104 8
M.T. Driver	Ali Saif Damashi	91 16
M.T. Driver	Ahmed Abdulla	90
<u>MAIN STORE:-</u>		
Head Storeman	Mr. Mahmood Rahamtullah	321
Senior Storeman	Mr. Shafiq Ali	201
Storeman	Mr. Khalid Lukman	162
Storeman	Mr. Angelo Nitu	91 16
Storeman	Abdulla Zain	82 16
Chowkidar	Mohsin Saleh Ahmed	42 2

POSITIONNAMESALARY PER YEAR£HALIMA DEPARTMENT:-

Agricultural Assistant	Mr. M. Guthrie	710	
Chief Clerk	Mr. Ahmed Ali Zokari	144	
Senior Clerk	Mr. Mohamed Ali Mokbil	81	
Agricultural Inspector	Mr. Obeid Fadhle	180	
Asst. Agricultural Inspector	Mulazim Ali Alwai Aulaqi	108	
Asst. Agricultural Inspector	Ali Fareed	73	16
Asst. Agricultural Inspector	Abdul Haq Salem	82	16
Asst. Agricultural Inspector	Salem Holeiman	59	8
Asst. Agricultural Inspector	Saleh Tbhais	53	2
Water Guard	Saleh Mohsin	53	2
M.T. Driver	Mohamed Ali Omer	90	
Syoe	Saleh Dheifullah	51	6
Syoe	Ali Shammakh	51	6

GIAR DEPARTMENT:-

Agricultural Assistant	Mr. H. A. B. Clements	680	
Chief Clerk	Mr. Ahmed Hason Chowderi	198	
Senior Clerk	Mr. Ahmed Omer Said	108	
Storeman	Ibrahim Samman	84	12
Asst. Agricultural Inspector	Gaabel Abdullah	86	8
Asst. Agricultural Inspector	Mehdi Bin Naser	82	16
Asst. Agricultural Inspector	Ahmed Abdul Rabboh	81	
Asst. Agricultural Inspector	Syed Abdulla Fadhli	52	4
Asst. Agricultural Inspector	Abdul Kader Hassani	52	4
Water Guard	Kassim Ahmed Sha'ari	51	6
Chowkidar	Sayed Kassim Ali	52	4
Chowkidar	Saleh Ali Aulaqi	52	4
Syoe	Salem Naser Aulaqi	51	6

ZINGIBAR DEPARTMENT:-

Agricultural Assistant	Mr. R. McKay	680	
Chief Clerk	Mr. Said Ahmed Haddad	198	
Senior Clerk	Mr. Mohd. Ali Masri	156	
Junior Clerk	Mr. Ahmed Abdo Hobaiishi	126	
Storeman	Mr. Salih Mahdi	54	
Agricultural Inspector	Haj. Saeed Bin Ali	243	
Agricultural Inspector	Sultan Naser	183	
Asst. Agricultural Inspector	Sayed Ali Muhammed	108	
Asst. Agricultural Inspector	Sayed Abdullah Jaffar	108	
Asst. Agricultural Inspector	Sultan Fadhle Mohsin	108	
Asst. Agricultural Inspector	Awad Farag	90	
Asst. Agricultural Inspector	Saleh Yehia Muflahi	86	8
Asst. Agricultural Inspector	Nasir Bin Mohsin	67	10
Water Guard	Hussein Al Huati	54	
Water Guard	Hussein Al Kaila	54	
Water Guard	Naser Bin Salem	54	
Water Guard	Al Yod A Somali	54	
Water Guard	Ahmed Ali Mokbil	54	
Water Guard	Hussein Saeed Yafie	45	
Chowkidar	Ali Fadhi Sallami	52	4
Syoe	Abdo Hason Zabidi	51	6

POSITIONNAMESALARY PER YEAR£WORKSHOP DEPARTMENT:-

Works Foreman	Mr. Balsarili	480	
Head Mechanic	Mr. Abdo Ebrahim	252	
Mechanic	Mr. Abdulla Hussein	189	
Fitter	Mr. Sayed Khalid	90	
Wireman	Abdul Bari	180	
Assistant Wireman	Mohamed Abdo England	40	10
Garage boy	Mohamed Ali Wahti	52	4
Blacksmith	Mohamed Hussein	108	
M.T. Driver	Abdulla Mohamed Saeed	112	10
M.T. Driver	Saeed Abdulla Faeash	90	

TRACTOR UNIT:-

Tractor Driver	Saeed Omer Maizari	130	10
Tractor Driver	Saeed Ali Abubaker	121	10
Tractor Driver	Ahmed Haidra	121	10
Tractor Driver	Ahmed Abdo	108	
Tractor Driver	Ali Mohamed Dalie	72	
Tractor Driver	Ali Said	72	
Tractor Driver	Saeed Garnai	72	
Tractor Driver	Awad Daamal	72	
Tractor Driver	Mohamed Ahmed	73	16
Tractor Driver	Goman Abdulla	73	16
Tractor Driver	Abdulla Hassan Dalie	73	16
Tractor Driver	Ali Abdo Ras	73	16
Tractor Driver	Ahmed Somali	72	
Tractor Driver	Salem Yafie	72	
Tractor Driver	Yousuf Abdul Kader	72	
Tractor Driver	Omer Ahmed Labani	91	16
Assistant Tractor Driver	Abdulla Tamhan	54	
Assistant Tractor Driver	Abdulla Hason Qutaibi	54	
Assistant Tractor Driver	Saeed Omer	54	
Assistant Tractor Driver	Salih Khurat	54	
Assistant Tractor Driver	Abdul Rehman Mohamed	54	
Assistant Tractor Driver	Alawi Abdulla	54	
Assistant Tractor Driver	Al Hammadi	54	
Assistant Tractor Driver	Nasir Lahman	54	
Assistant Tractor Driver	Abdi Othman	54	
Assistant Tractor Driver	Saleh Ba Habeeb	54	
Assistant Tractor Driver	Mohamed Naser	54	

AL KOD GINNERY AND GLAR GINNERY:-

Gin Carpenter	Mr. Othman Oleim	243	
Gin Carpenter	Mr. Ahmed Hussein	270	
Engine Driver	Kumbar Hameed	126	

WATER SUPPLIES IN ABYAN

by

Dr. Herbert Greene

If wisely managed the Abyan delta may reach and maintain a high level of agricultural productivity. It is therefore important to obtain the basic information on which wise management will depend. The first requirement is a topographical survey and the setting up of permanent beacons say at 1 Km. intervals. Secondly, in order to study the movement of water within the soil it is urgently desirable to establish in the Abyan delta a good scatter of permanent observation points by sinking lined wells with cemented curbs. Perhaps 50 such wells will be required. In the interest of public health arrangements should be made to avoid pollution of the well water. From both points of view the matter demands urgent attention. In the third place it will be necessary to obtain regular and reliable records of water levels in these wells. With these records should be linked such other observations of water levels in rivers, canals, pools or in temporary wells as may be obtainable. The collection and continuing analysis of these records would be a main duty of the soil scientist working in consultation with the irrigation engineers. It is hoped that Mr. E. H. Jaques the government geologist will take an active interest in this work in so far as his other duties permit. From these and from other observations the soil scientist would seek answers to such questions as: How much water does this soil contain before watering? After watering? After maturing a crop? In which direction does drainage occur? How rapid is the flow of subsoil water?

2. During the visit of the mission some fifty tests were made on accessible water supplies in the Abyan delta and some additional tests were made at Lahej and at Sheikh Othman.
3. The points visited in Abyan do not give adequate coverage of the area; the precise location and elevation of the wells is not known; many of the wells may collapse or be abandoned within a few years. However, for lack of anything better these observations are now placed on record.
4. Observations on surface or subsurface waters have no certain or predictable relation to deep lying waters that may be tapped by tube wells. To ascertain the quantity and quality of these deep lying waters it is necessary to make direct tests by experimental borings. In this seemingly rather uniform and readily permeable alluvial deposit one would expect somewhat general continuity between subsurface and deep lying waters; nevertheless, it is quite likely that the latter are more quickly fed by lateral movement along aquifers than by vertical percolation. In other words, one would expect to find within the deposit ribbons of more permeable material serving as the main channels for movement of water although other less rapid but more pervasive movements are no doubt of importance also.
5. It will accordingly be understood that the few observations now recorded do not permit the drawing of far reaching inferences. The contour readings are approximate only. The depth in feet is meant to represent the depth at which water lies below the general land surface in the vicinity of the well. Thus wells e and f appeared to lie in a former river bed some 12 or 13 feet below the adjacent land surface. On the other hand well k appeared to lie in a former riverbed some 5 feet above the adjacent land surface. In general the land surface is so irregular that there may be an error of some feet in the readings recorded. Nevertheless they provide a rough indication of the present position.
6. A large and recent rise of water level is recorded for wells M, R and BB. The same process may have taken place in wells G and H, N, P and Q, in the date plantation S, in wells V and Y. Probably these observed and conjectured rises of water level do not have a single source or constitute a single system. For example in wells G, H, M and N the change may be due to seepage from the adjacent Ba Tois canal. Similarly the Kubelia group, wells P, Q and R lie in a tract where the Wadi Hasan is being recharged by seepage from the west. Whether observations S and V are isolated or connected can easily be ascertained by digging and inspecting intervening pits or by observing whether moist and salty patches are appearing

on the soil surface between and around these points. Whether rises of subsoil water in wells BB and Y are isolated events is not now known. Thus, these observations are not themselves of much value except in that they convincingly demonstrate the need for obtaining more data at the earliest possible moment so that there will be a sound basis for evaluating the course of later changes in water level.

7. It is desirable to ascertain the salt content of water tapped by tube wells because a high salt content hinders or stops plant growth and also because metallic corrosion of tube well linings may then be a heavy expense. Total salt content can be estimated quickly and with moderate accuracy by measuring the electrical conductivity of the water. On the present occasion the electrical conductivity of the waters was measured with a Dionic Water Tester (Evershed and Vignoles catalogue number 16047 price about £61) which gave a reading of 1100 when calibrated with N/100 NaCl solution. This solution, containing 10 milligram equivalents per litre (in this case 585 part per million of common salt), is normally taken as the limit between good and doubtful irrigation water. Similarly a conductivity reading of 3300 would normally be taken as the limit between doubtful and bad irrigation water. The total salt content as thus estimated is not however the sole criterion. The chemical composition of the dissolved salts has to be considered in the sense that a high proportion of sodium to calcium is undesirable especially if the total salt content is high. Mr. Simansky obtained analyses of two subsoil waters from Abyan. Their main soluble constituent was sodium chloride together with some sulphates. The amount of water sent for analysis was small and the data are possibly neither reliable nor representative. In default of more adequate information we may assume that the proportion of sodium is not so high as to make the water unsuitable for irrigation.

8. A third factor to be considered is the permeability of the soil. If the soil is almost impermeable application of irrigation water containing salts will lead to a progressive accumulation of salts in the soil for the water is used by plants or is removed by evaporation whereas the salts remain behind in the soil. It is thought the solution remaining in the soil may thus become ten times as concentrated as that originally applied. Plant growth is hindered and eventually made impossible by this increase in salt content. On the other hand, if the soil is permeable so that in successive waterings there is a net downward movement of water through the upper layers and away into a drainage system no accumulation of salt will occur and it is safe to use a moderately saline water. Just how far the limits with the readily permeable soil of the Abyan delta may be relaxed is difficult to say. Perhaps 2200 and 6600 may be taken as limits between good, doubtful and unsuitable water. We must be guided by local experience. For garden wells near Zingibar the following readings were obtained:

Well JJ	850	
Well uu	1300	
Well xx	1500	Sultan Hussein's garden with fruit trees.
Well yy	1800	
Well zz	1950	5 year old garden with fruit trees.
Well aaa	2700	

The few observations made at Lahej confirm the local opinion that the water is uniform and good in quality: the two town wells gave readings of 1800 conductivity units and the three garden wells were in the range 1600 - 1700.

9. Just north of Sheikh Othman tomatoes are being grown in a small garden watered by manpower lift from a well of which the conductivity reading was 3700. The owner said he was too poor to own animals. Had he been able to lift more water from the well he considered he could have grown a variety of crops.

10. The water at present being used for irrigation in the garden at Sheikh Othman gave a reading of 4600 conductivity units. Recent analyses of this water (Bore No. 5) are available in a P.W.D. file from which it appears (a) that the total salt content of the water increased between 1939 and 1948 (b) Magnesium Chloride is the main constituent. Thus even if the Sheikh Othman deposit closely resembles those in Abyan it may be difficult to compare behaviour of tube well waters from the two areas. However, it may turn out that the Abyan waters are considerably lower in total salt content and do not contain a high proportion of

sodium in which case they would be considered more suitable for irrigation than the Sheikh Othman water. Field tests would be needed to show what method of irrigation is best and which crops are most profitable. The soil chemist, whose appointment is recommended, would find it of interest to keep an eye on Sheikh Othman garden.

11. Considered in relation to total salt content the Abyan waters seem to fall into a few groups. Waters of low salt content are found near the W. Bana (Observations a, b, gg, jj, kk, ll, pp, uu). If observation d is discounted because this is a newly dug well not yet in use, well waters north of Rumela are seen to be of moderate salt content. The well waters near Dirgag and Kubelia are in the 2500 - 3400 range. Salt contents are appreciable higher near Khanfar and in wells U, Y and Z. As seepage into the W. Hasan is taking place near Kubelia the moderately high salt content of observations aa and cc and the moderately high salt contents near Kubelia may reasonably be associated with this circumstance. The same conjecture cannot confidently be advanced for the still greater salt concentrations of wells U, Y and Z. These may depend on events that took place hundreds of years ago.
12. It will be noticed that well water is moderately saline in the neighbourhood of Zingibar. Additional observations might make it possible to draw a fairly clear boundary between these waters and the much less salty water used for gardens west Zingibar.
13. The isolated observations at Khamila (well hh) and at El Asala (well oo) are not discouraging in that neither of these places has been flooded for some years. El Asala is an abandoned village and the well is not much used: accordingly its salt content is probably higher now than will be the case when the area is watered again and re-occupied.

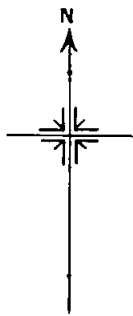
ABYAN DELTA

ELECTRICAL CONDUCTIVITY OF WELL AND SURFACE WATERS FEB. 1951.

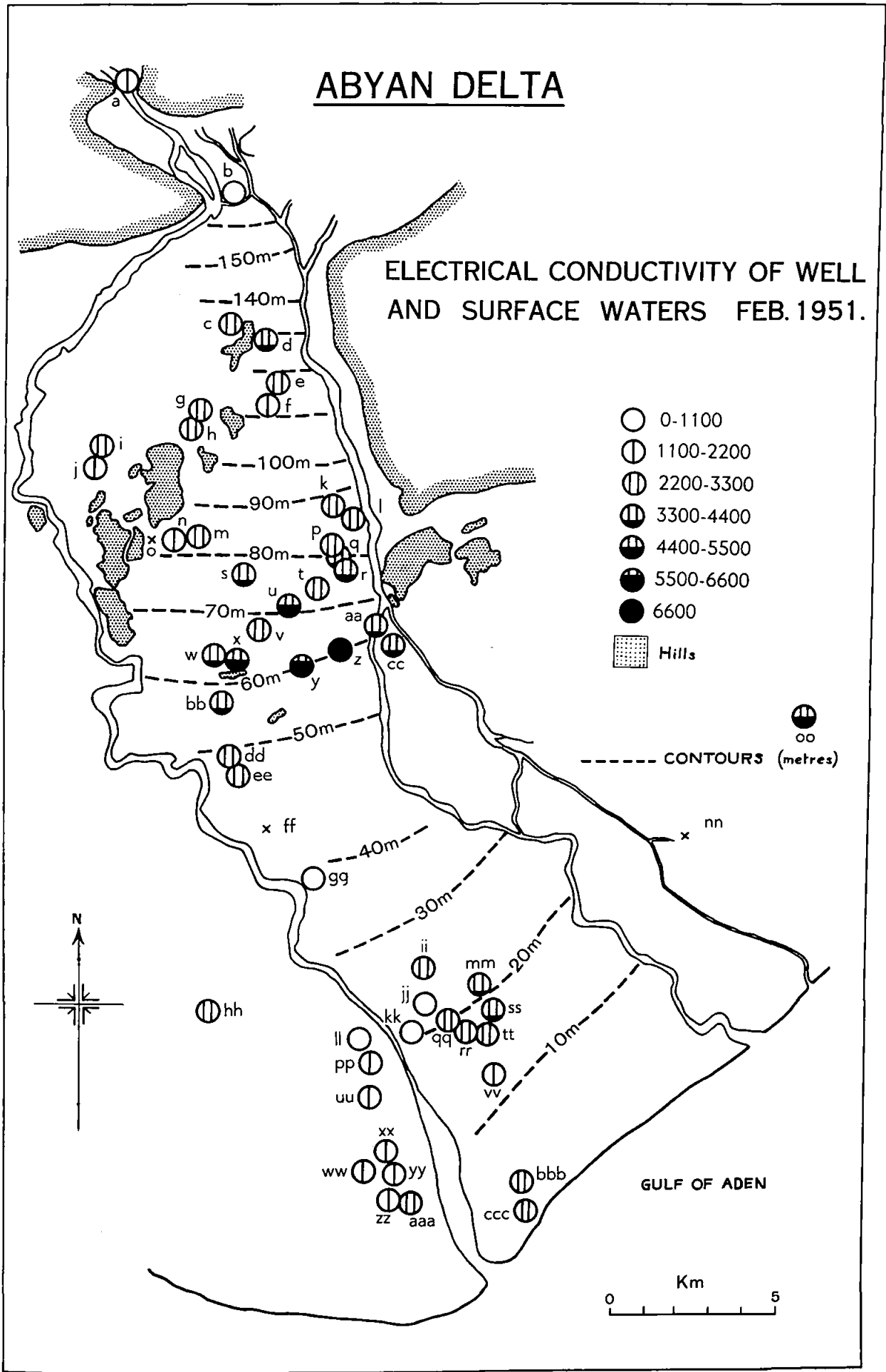
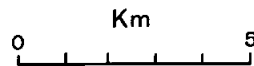
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- ◓ 4400-5500
- ◔ 5500-6600
- 6600

 Hills

 oo
 --- CONTOURS (metres)

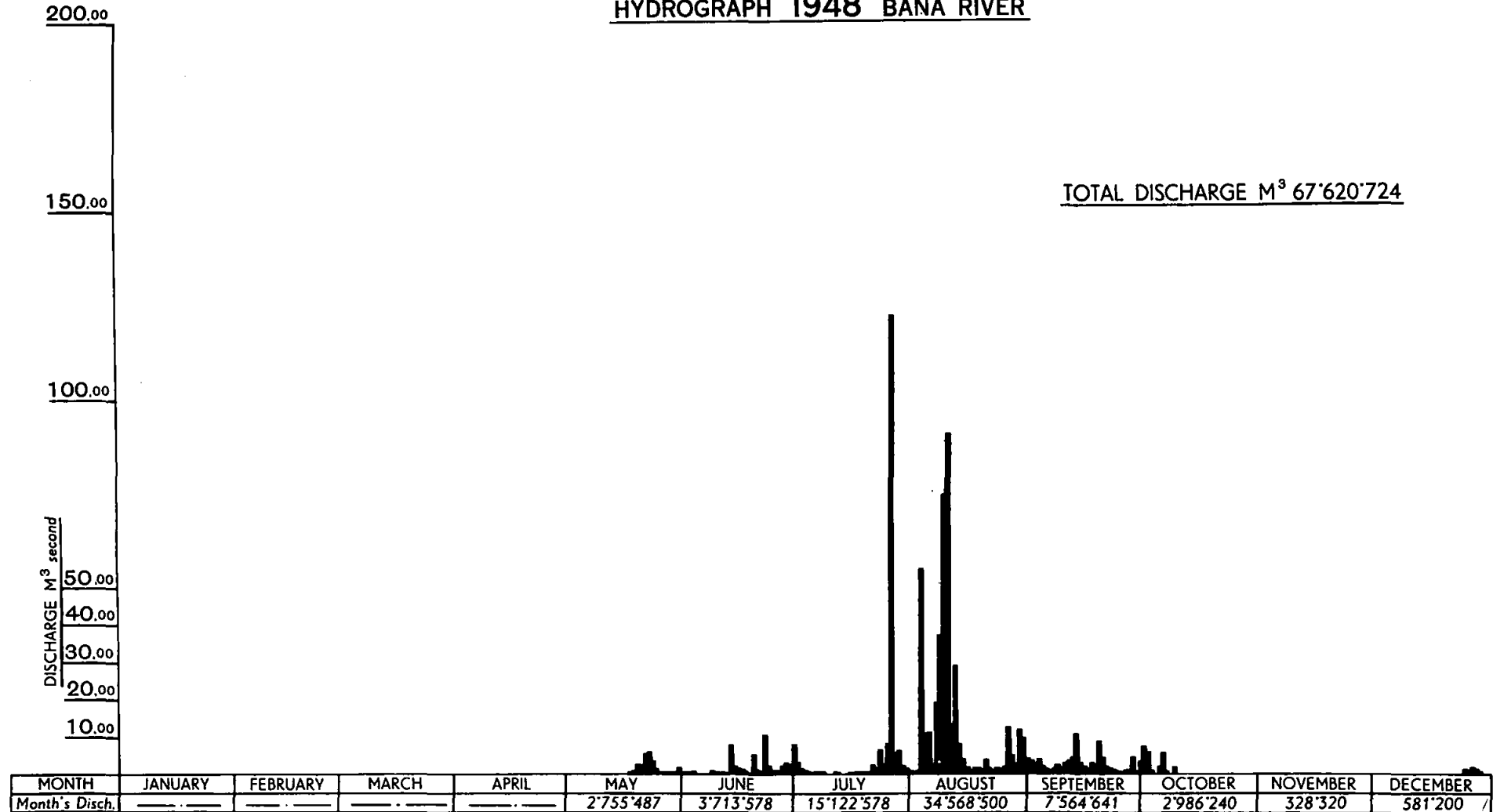


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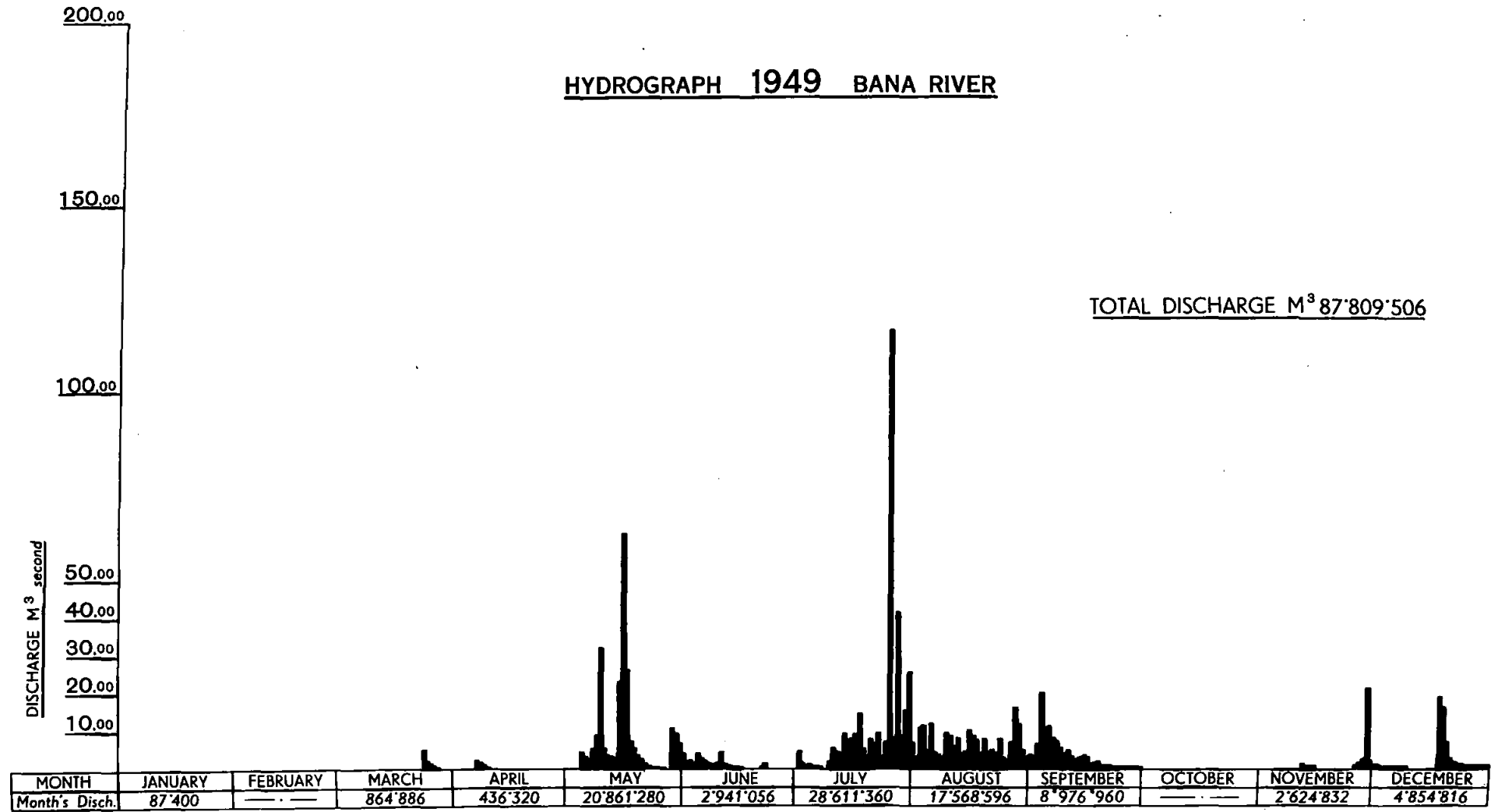
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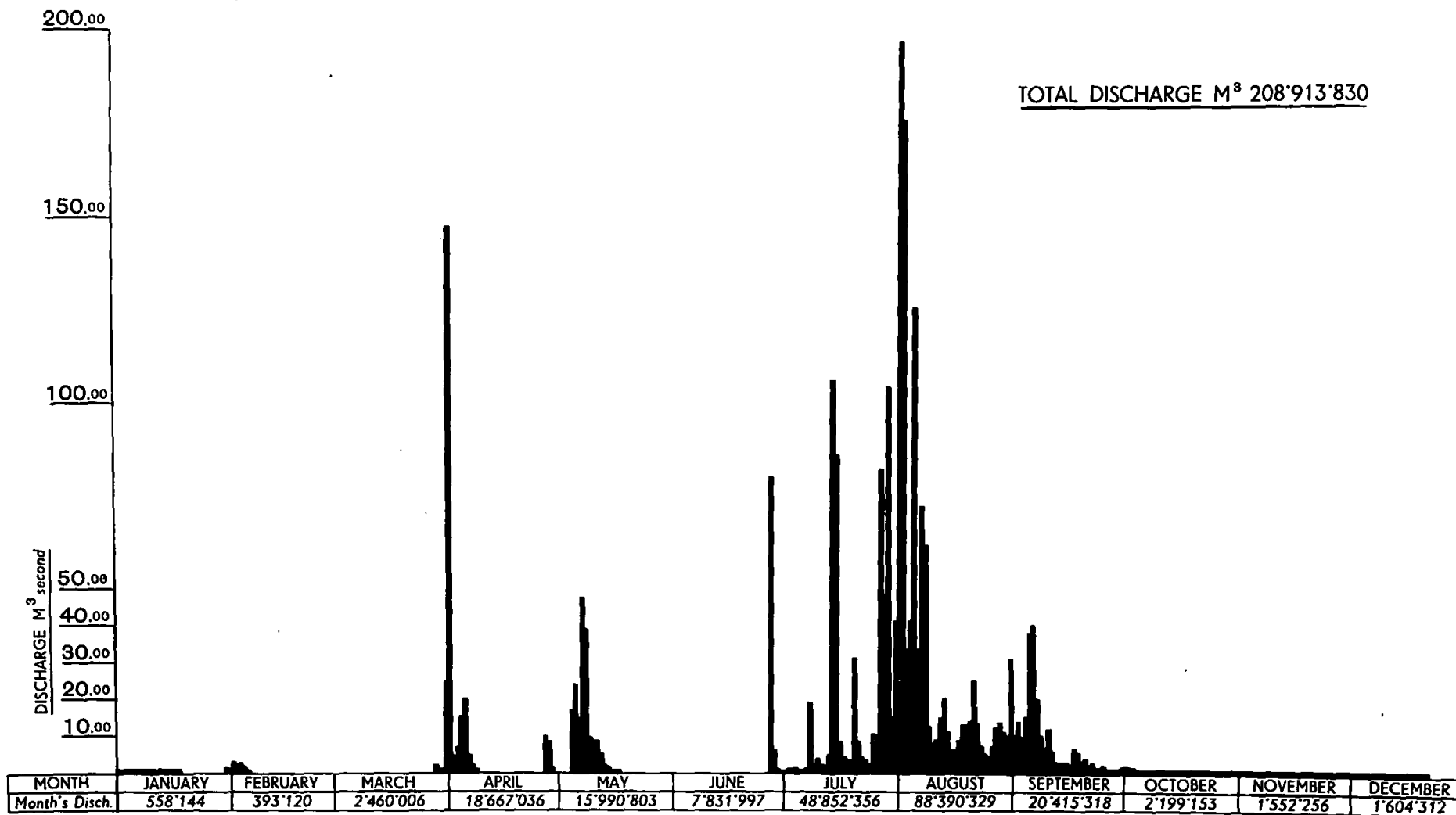


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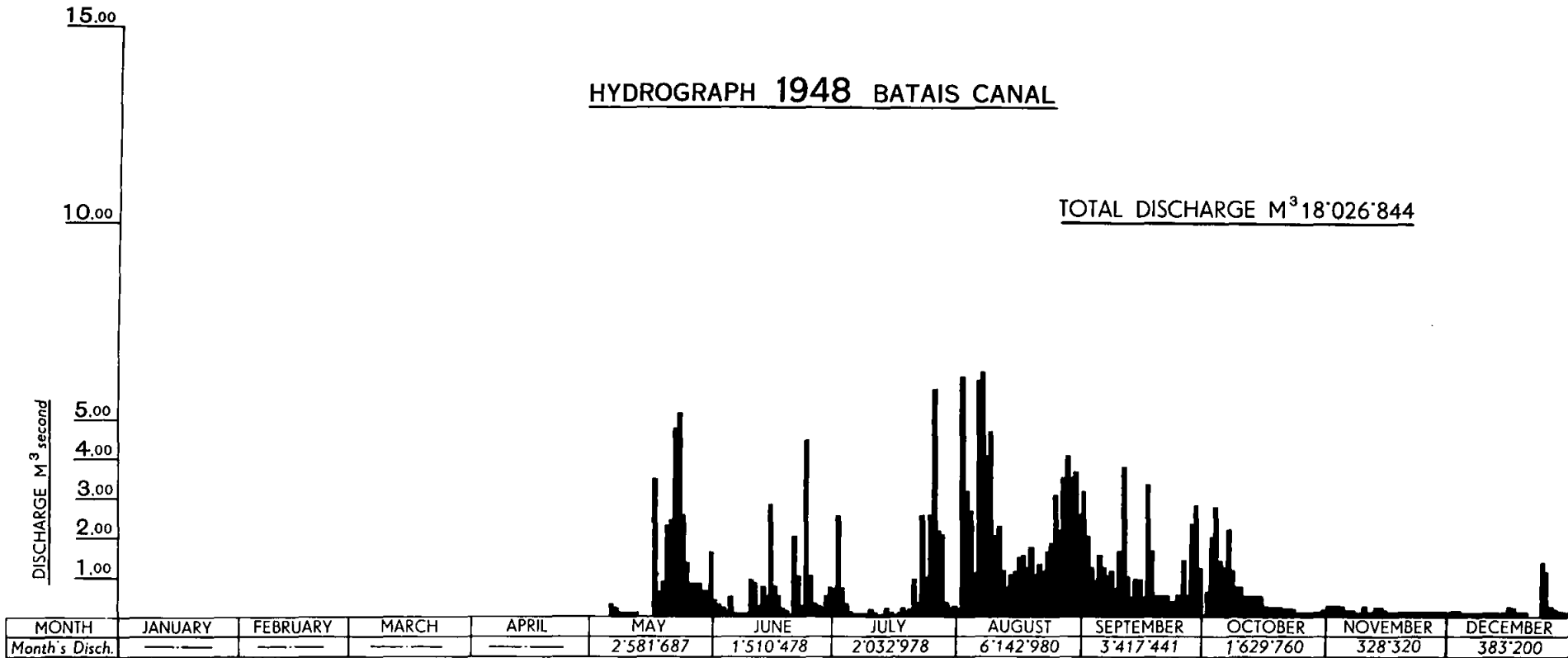


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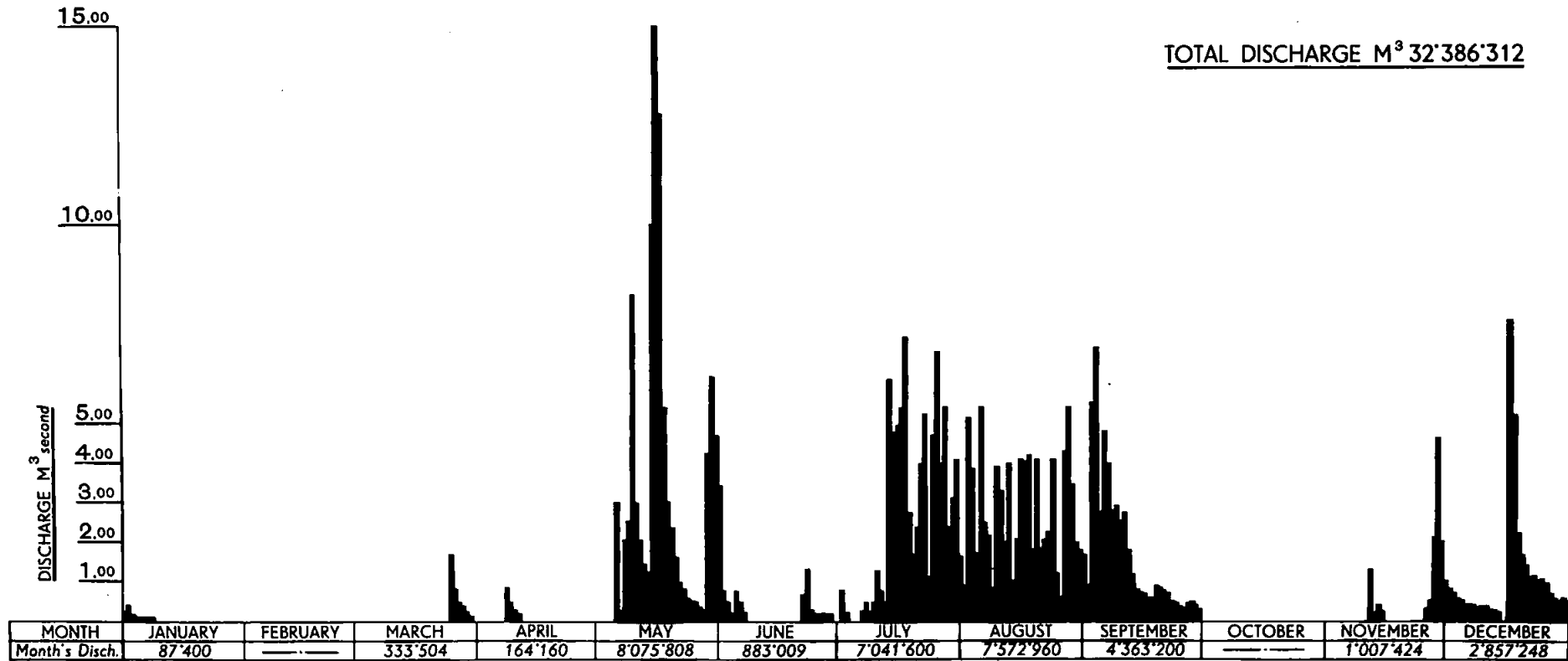


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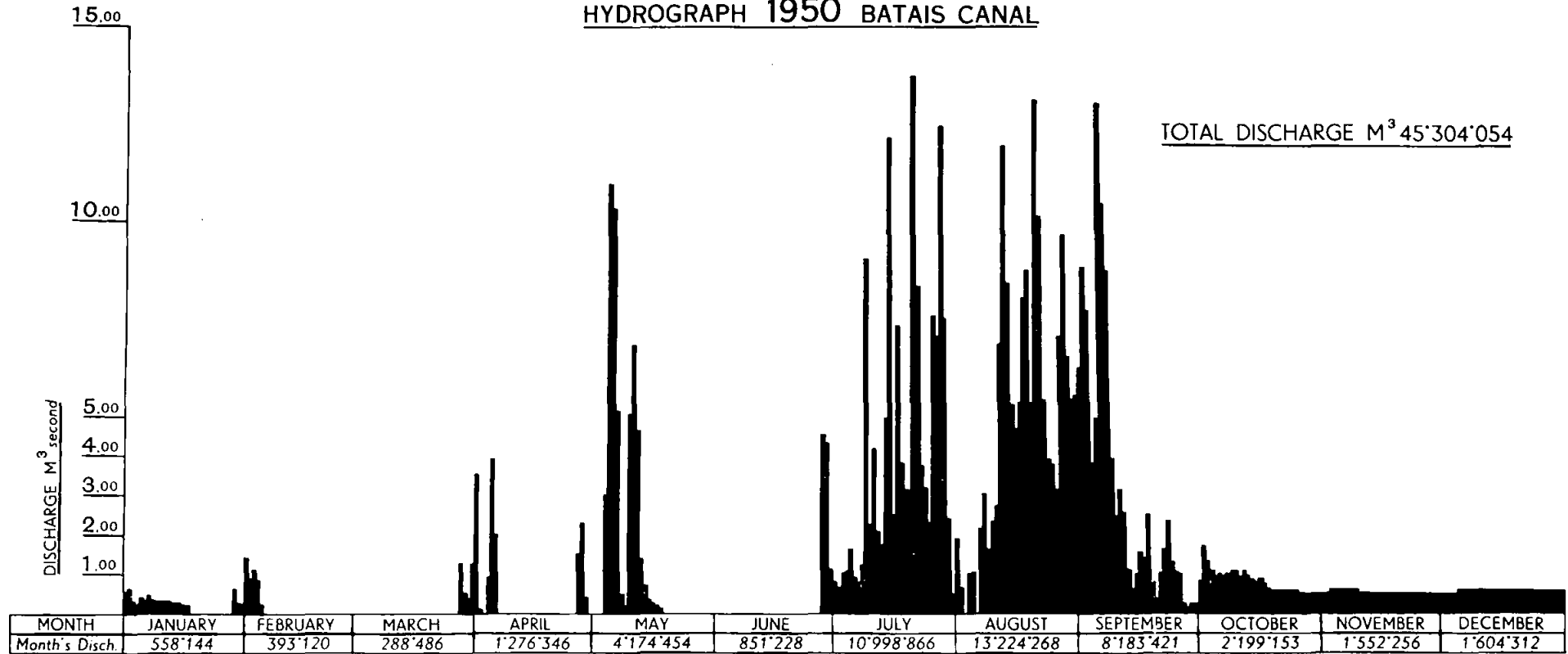
TOTAL DISCHARGE M³18'026'844



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