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Sind and the Lloyd Barrage

SECOND EDITION

(As revised up to December 31st, 1929)

SIND AND THE LLOYD BARRAGE.

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MAP OF SIND.

SIND AND THE LLOYD BARRAGE.

INTRODUCTION.

The Province of Sind is situated beyond the reach of the south-west and the north-east monsoons, and in consequence its rainfall is slight and at all times fitful. Unlike the greater part of India, therefore, the area of cultivation in Sind that depends upon the rainfall is insignificant. The river Indus, however, flows through the entire length of Sind, and for many generations water has been brought by a system of artificial canals and by branches of the river on to the land, and cultivation of a certain area thereby rendered possible. The supply of water, being dependent upon the rise and fall of the Indus, therefore fluctuates, and whilst most of the large canals are regulated and the supply of water is reasonably assured, there can be no guarantee that water will be available at the season when the cultivator requires it.

(2) The British occupation of Sind took place in 1843. Twelve years later Lieutenant Fife submitted a report on the irrigation of Sind with proposals for a complete revision of the existing canal systems and the construction of new canals to supply almost the whole cultivable area. His right and left bank areas practically correspond to the right and left bank areas of the present project.

(3) With his proposals for the complete scheme Lieutenant Fife submitted a rough estimate of only one area—the Rohri-Hyderabad area—as he was best acquainted with it. The authorities in England returned these in 1857 because they were not based on accurate surveys, and authorized a minute survey of the whole of Sind. The Rohri-Hyderabad canal was surveyed and the project resubmitted in 1859, but remained in abeyance till 1867, when it was taken up again by Colonel Strachey, Inspector General of Irrigation.

(4) The scheme for a Rohri-Hyderabad canal then underwent various vicissitudes, but no real progress was made till a committee was appointed in 1892. This committee considered that the perennial canals should be abandoned, but recommended the improvement of the existing canals and the early construction of the Jamrao weir and Jamrao canal. They did not take the right bank of the river into consideration. The committee's recommendations were accepted by the Bombay Government, but the latter were not prepared to abandon the principle of high level perennial canals entirely. As a result of the committee's report large sums were expended on improving the existing canals.

(5) The next body to study the case of Sind irrigation was the Irrigation Commission of 1901-03, but no practical proposals were put forward. Shortly afterwards however Dr. Summers, the Superintending Engineer, Indus left bank division, applied for permission to survey a feeder to the Dad canal from Rohri. Dr. Summers recognized that eventually a weir would be needed at Sukkur to supply his feeders as well as a similar canal on the right bank. He, however, considered that his own scheme would meet all requirements for many years to come. Permission was granted, and it was subsequently extended so as to cover the whole of the present Rohri-Hyderabad canal area. In due course Dr. Summers submitted his preliminary plans and estimate, and in forwarding them to the Government of India the Bombay Government asked for sanction to prepare a scheme to comprise:—

1. A barrage at Sukkur.
2. A right bank canal.
3. A Rohri-Hyderabad canal.
4. An Eastern Nara canal.

This proposal was generally approved by the Government of India and orders were issued accordingly in 1907. The complete scheme for a barrage and canals was forwarded to the Government of India by the Bombay Government, who recommended to the Secretary of State that only the Barrage and Rohri canal should be constructed, the proposal for the Eastern Nara and the right

bank canals being held back for further consideration. The Secretary of State placed the proposals before a committee of engineers in London in 1912 consisting of Colonel Sir J. Ottley and Messrs. Lionel Jacob, W. L. Cameron and A. L. Webb.

This committee was of opinion that such a project was not justified as a protective work for Sind and that it was not shown to be a productive work. Acting on the committee's advice the Secretary of State declined to sanction the execution of the scheme. The Government of Bombay did not however let the matter drop. Fresh investigations were undertaken and the conclusion was reached that, although it was difficult to prove any direct effect of the Punjab withdrawals on the river at Sukkur, there was reason to believe that these might have a prejudicial effect at the beginning and end of the kharif irrigation season, and that there was good ground for holding that Sind ought to be protected from such a contingency by the construction of a Barrage. The Bombay Government was convinced of the fact that the existing conditions of cultivation and irrigation were not suited to the special circumstances of the country, and was aware that Sind was crying out for improvements and benefits of the kind which the Punjab and the United Provinces had long enjoyed. It therefore put forward a rough outline of a revised scheme with the following changes from the one previously submitted, *viz.* :—

1. The inclusion of the right bank canal.
2. A new site for the Barrage below the gorge.
3. Possibly a new head to the Eastern Nara supply channel from the Barrage.

It submitted a rough forecast of the cost of the scheme as Rs. 1,120 lakhs and revenue as Rs. 63.5 lakhs with a net return of approximately 5.7 per cent. on the capital cost, and asked for the sanction of the Government of India to the preparation of detailed plans and estimates for a scheme on these lines. This sanction was accorded.

(6) In October 1915 an Executive Engineer was placed on special duty to revise the project, and in May 1916 he submitted a report and outline for the whole scheme. These proposals were approved, but owing to the war nothing could be done between May 1916 and June 1918 when the preparation of the present project was taken in hand.

(7) In 1918 Mr. C. M. Baker, I.C.S., Collector, and Mr. C. M. Lane, Executive Engineer, were placed on special duty to investigate the nature of the lands commanded and to make recommendations as to the intensive cultivation, the nature of crops and the duties to be adopted in designing the canals. Their report was submitted to Government in March 1919. Another Executive Engineer was simultaneously placed on special duty to design and estimate the cost of a complete scheme for a barrage and canals. He submitted his scheme to Government through the Commissioner in Sind in July 1920. This project provided for a Barrage at a new site below the gorge at Sukkur (instead of above it, as in the original project) and for a system of perennial canals on both banks of the river. The estimate of the total cost was approximately 18½ crores of rupees. The Government of Bombay submitted the scheme to the Government of India in July 1920 strongly recommending it for the sanction of the Secretary of State. The Government of India submitted it to the Secretary of State in December 1920, and the latter intimated his sanction to the technical and administrative sides of the project and the estimates for works in the House of Commons on the 2nd and 3rd August and in the House of Lords on 9th August 1921. The approval of the Secretary of State to the proposals of the Government of Bombay for financing the work was given in 1922, and approval to the project and permission to start construction were given by the Bombay Legislative Council in June 1923. The figures of borrowings for the purpose of financing the project are presented in Appendix A on page 46.

(8) It is unnecessary at this point to describe the project in detail. The Barrage is being constructed three miles below the gorge at Sukkur with three canals on the right and four on the left bank taking off from the river each with a separate head regulator. The head regulators of all the canals are

immediately' above the Barrage which can completely control the river-level and keep the approach channels to the canals clear of silt. The canals are divided into two systems. The right bank system comprises the North-Western, Rice and Dadu canals. The left bank comprises the Perennial Rohri canal; a perennial supply channel to feed the Eastern Nara river and the canals dependent thereon and two feeder canals for irrigating land in the Khairpur State. The bulk of the work is expected to be completed in the spring of 1932, and irrigation to commence in June 1932.

(9) The Government of India agreed to lend the necessary funds year by year to the Bombay Government for the purpose of financing the project, the total cost of which was, as already stated, estimated to be Rs. 18½ crores. They did not, however, undertake to bear any part of the cost of the scheme. But it is evident that the success or failure of so large a project must be of great importance not merely to Sind and the entire Presidency, but indeed to the whole of India. More particularly its full success will have a considerable effect upon the central revenues. The supply of perennial irrigation to three and a half millions of acres of land, which were previously unirrigated and mostly uncultivated, must very greatly increase the export and import trade of the area. And, while the direct realizations from land sales and land revenue will, it is estimated, set off the cost of the project, it is unfortunate that the large indirect return which it will produce in the form of income-tax and customs revenue will not at present be available for use either in repayment of its debt or to defray any of the cost of development of the area which is necessary for the production of that revenue. It has been estimated that the project will earn about 6 per cent. in the thirteenth year rising steadily to 10·4 per cent. in the twenty-first year. In this connection Sir M. Visvesvaraya and Nawab Ali Nawaz Jung Bahadur in their report which is dealt with in more detail in part A, paragraph (iv), of Chapter I on Irrigation below have written:—

“The cost of the project compared to the yearly revenues of the Bombay Government is abnormally high and the finances of this Government have been none too prosperous since the close of the War. This work is without question an all-India responsibility and its burden should be borne by the broader shoulders of the Central Government. To construct one of the world's greatest schemes in a detached sub-province containing a population of a little more than 1 per cent. and to make a Presidency with 6 per cent. of that total population, the bulk of which does not share in its benefits, responsible for the whole cost seems hard on the latter. The Government of India recommended the scheme at a time of transition when the hardships it would entail were not fully realised, and it is but fair that they should now come to the rescue.”

(10) The progress of the work of construction has been closely followed by the Government of Bombay; and His Excellency the Governor, the Members of Council and the Ministers have paid regular visits to Sind to inspect it. In January 1929 the Bombay Government arranged for the members of the Legislative Council to visit Sukkur, and 42 members availed themselves of the invitation. The last of these visits up to date was paid by His Excellency Sir Frederick Sykes in November 1929. In March 1929 His Excellency convened a conference of officials to consider every aspect of the development of Sind, and more especially its agricultural development, which was inevitable when the Barrage and the canals were completed and perennial irrigation was thus made available for the whole country. In July 1929 this Government published a memorandum which sought to take stock of the situation as it stood then and to indicate the lines, which were suggested either at this conference or from other sources, upon which the Government was dealing with it, and the outstanding points for decision and furtherance. The present memorandum has brought the case up to date to December 31st, 1929, and, as in the former memorandum, the following aspects are discussed:—

- I.—Irrigation.
- II.—Communications.
- III.—Land Policy and Revenue.
- IV.—Agriculture.
- V.—Forests.
- VI.—Administration.
- VII.—Finance.

I.—Irrigation.

From the point of view of irrigation Sind may be conveniently divided into three parts:—

- (A) The area which falls under command of the Lloyd Barrage and Canals.
- (B) Upper Sind.
- (C) Lower Sind.

(A) THE LLOYD BARRAGE AND CANALS.

(i) This vast project is designed to secure irrigation to the area comprising parts of the Shikarpur Canals and Begari Canals, the Ghar Canals and the Western Nara Canals Divisions on the right bank of the Indus, to the Khairpur State, the Nasrat Canals, Hyderabad Canals, Jamrao Canals, the Eastern Nara Canals and a small part of the Fuleli Canals Divisions on the left bank of the Indus. The whole area under command excluding Khairpur State will amount to about 7,406,000 acres, of which the canals are designed to irrigate 5,394,000 acres annually on attainment of final development. The present irrigation in this area extends to 2,035,000 acres, and the new irrigation provided for will therefore amount to 3,359,000 acres or, including Khairpur State, 3,557,000 acres.

(ii) *The Barrage.*—The Lloyd Barrage, which is situated about 3 miles downstream of the Sukkur gorge, will consist of 66 spans of 60 feet each, separated by 58 ordinary piers, each 10 feet wide, and 7 abutment piers, each 25 feet wide. The total width of waterway provided will be 3,960 feet and the over-all length of the Barrage between abutments will be 4,725 feet. The structure has been designed to pass a maximum river flood of $1\frac{1}{2}$ million cusecs, or about 50 per cent. more than the highest flood hitherto recorded. Each span of the Barrage will be fitted with electrically operated single steel gates, designed to maintain a level $18\frac{1}{2}$ feet above the Barrage sill. A road bridge is provided on the downstream side as an integral part of the Barrage, and this will be at a lower level than the upstream arches carrying the operating gear of the regulating gates.

(iii) *The Canals.*—Three canals will take off on the right bank and four canals on the left bank of the river immediately above the Barrage. The principal features of these are tabulated below:—

Canal.	No. of spans of 25 ft. each.	Designed Discharge Cusecs.	Length in Canal Miles.	Bed width. Ft.	F. S. Depth. Ft.
<i>Right Bank.</i>					
North Western ...	6	5,099	86	165	10.2
Rice ...	18	10,215	82	243	11.75
Dadu ...	4	2,887	181	92.5	9.6
<i>Left Bank.</i>					
Eastern Nara ...	16	18,889	581	380	11.5
Khairpur Feeder, East ...	2	2,094	13	82	8.5
Rohri ...	12	10,191	309	250	12.0
Khairpur Feeder, West... ..	2	1,936	1	79	8.8
Total ...		45,761	1,008		

The total length of the main canals, branches and distributaries will be 6,234* miles. The total quantity of earthwork in the excavation of these is estimated as 5,647,000,000 cubic feet. This work is being done partly by manual labour and partly by the use of dragline excavators. Of the latter

46 machines are in operation, their daily outturn varying between 100,000 cft. for the largest and 13,000 cft. for the smallest. Their total capacity approximates to 74 tons of earthwork per minute on the basis of $5\frac{1}{2}$ days of

24 hours work per week. It is calculated that this would be equivalent to the labour of nearly 32,000 men working for the full 12 months of the year, or of about 75,000 men employed for the normal working season of five months of the year in Sind.

In case manual labour had been relied on for all earthwork of the canals, the cost would certainly have been 50 per cent. higher than actual cost by use of mechanical excavators. Even at an increase of 25 per cent. the extra cost would have amounted to Rs. 1·65 crores. It may also be stated that it would have been quite impracticable to obtain 75,000 labourers even if the greater part of the agricultural labour of Sind had been drawn on, and such a step would have resulted in serious difficulty, if not disaster, to the zamindars whose agricultural operations would have been brought to a standstill in consequence.

(iv) *Cost of project and progress of work.*—The actual project itself is estimated to cost Rs. 20·03 crores, or £15,022,500 sterling. Work was commenced in July 1923. On the actual Barrage work is now at an advanced stage in 16½ spans on the right bank and in 22½ spans on the left bank, leaving 27 spans which are being taken up during the present working season. Construction is expected to be completed by the year 1932. The seven canal head regulators on either bank and the guide banks are now approaching completion. Of the total estimated quantity of 564·7 crores cft. of earthwork in the main canals, branches and distributaries, the approximate quantity completed on 31st December 1929 amounted to 320 crores cft., leaving a balance of 244·7 crores cft. to be completed. The total length of main canals, branches and distributaries to be constructed is 6,234 miles, of which about 2,000 miles, comprising chiefly the largest sections of the main canals and principal branches, were completed by 31st December 1929. Progress has also been made with the construction of canal masonry structures, regulators, falls and bridges. Arising out of criticisms advanced in debates in the Legislative Council and in order to obtain an outside technical opinion on the work, Sir M. Visvesvaraya and Nawab Ali Nawaz Jung Bahadur were appointed to conduct an independent investigation into the engineering aspects, both technical and administrative, of the construction work on the Barrage and Canals and to report thereon to Government. This report was submitted on the 18th September 1929 and appendix C details the conclusions which Government have been able to form on its principal recommendations up to date.

(v) *Rectangulation survey and provision of water-courses.*—The original project, as sanctioned by the Secretary of State, did not provide for the rectangulation or square survey of the area, but in May 1926 Government decided, as the result of a conference of irrigation and revenue officials held by the Commissioner in Sind, that in order to secure the proper distribution of water and facilitate the alignment of water courses, it was necessary to have the area rectangulated as far as possible, and arrangements were made for the rectangulation work to be commenced by the Survey of India Department in the ensuing cold weather. It was intended that the whole area should be rectangulated down to 64 acre blocks by the Survey of India, the cost being roughly estimated at Rs. 18·75 lakhs spread over a four years' programme. At the same time the cost of further sub-division of the 64 acre blocks, which was proposed to be done by the Barrage administration, was roughly estimated at Rs. 4·44 lakhs. Both these items, it was considered, might legitimately be regarded as a necessary part of the cost of construction of water-courses, which should be recovered from the occupants of land. A further expenditure for levelling and level charts, amounting to Rs. 8·88 lakhs, was contemplated in connection with this survey, and this was considered to be debitable to the project and not recoverable from the occupants of land.

In May 1927 the Revenue Officer submitted proposals, which were approved by Government, for restricting the work of the Survey of India to rectangulation down to rectangles of half a square mile instead of to blocks of 64 acres. A reduction in the cost of the Survey of India's rectangulation operations from Rs. 18·75 lakhs to Rs. 9·5 lakhs was thus secured. At the same time the programme for levelling and for the preparation of level charts was much reduced and the cost brought down from Rs. 8·88 lakhs to Rs. 1·92

lakhs. The sub-division below 320 acre blocks was to be done under the control of the Revenue Officer, and a programme for the sub-rectangulation of 1,500,000 acres during the next six years at a total cost of Rs. 7.5 lakhs, or 8 annas per acre, was approved. It has been found possible to work up fully to this programme, and a considerable saving over the estimated expenditure has been made, the average cost per survey party being only Rs. 18,000 as against Rs. 26,900 provided in the estimates. This result has been largely due to the greater output of the staff, rigid economy and careful organisation.

There has been no attempt to proceed with the sub-rectangulation of land by compulsory process. The carrying out of rectangulation operations in an area already surveyed under an unscientific system and already extensively cultivated is fraught with very great difficulties, but Government are confident that, where such operations are possible, they are very much in the interest of the zamindars. Government are therefore carrying out the sub-rectangulation of occupied lands by persuasion; already some of the more enlightened and progressive zamindars have applied and are applying to have their holdings rectangulated, and in the last working season the Revenue Officer was able, with the help of the Co-operative Department and local revenue officials, to get some 25,000 acres of occupied land sub-rectangulated. It is now recognised that the work must be spread over many years and that the whole area cannot be rectangulated. The whole of the area covered by the Barrage has now been classified by villages into three categories—(a) those in which sub-rectangulation can be carried out without difficulty, (b) those in which owing to natural difficulties or the prevalence of very small holdings sub-rectangulation within a reasonable period of time and at a reasonable cost is rendered impossible, and (c) those villages which are intermediate between these two classes in point of difficulty. For the present attention is being concentrated on class (a). It is estimated that the occupied area in this class is approximately 800,000 acres. It was decided to attempt operations in an area where the Barrage irrigation schemes were most advanced and where the Executive Engineer of the present (non-Barrage) division was prepared to supply water according to the new system of survey. Several villages in taluka Sanghar, district Thar Parkar, were accordingly selected and have been successfully rectangulated.

In order to persuade the zamindars to have their lands rectangulated it was decided to make certain concessions. The rectangulation could not be carried out without slight variations being made not only in the position but also in the size of holdings, and as no one would agree to receiving back a less area than he surrendered, this meant in practice that certain additions had to be made to holdings in order to bring them into the rectangulation scheme. These additions were given free of malkano and in all amounted to 966 acres for an area of 23,555 acres comprised in 139 holdings rectangulated, or in other words, 4.1 acres of Government land had to be parted with for every 100 acres rectangulated. It was, however, stipulated that no compensation would be given in these cases for land which would subsequently have to be taken up for water-courses, and this, it is estimated, would be about 2 per cent. of the area rectangulated. The loss in Government land has therefore been about 2.1 per cent. of the area rectangulated, and it may be taken that the whole of this land is land which would otherwise have had to be given out as "mohag" land (*i.e.*, land adjacent to an occupied holding) at Rs. 15 per acre under the concessions sanctioned by Government. It has also been agreed that the actual cost of survey for this land would not be recovered by Government.

These concessions were found to be justified because of the necessity of ascertaining, by actual experiment, how far the rectangulation of these lands was possible. For the future Government have sanctioned the Revenue Officer's proposal that no undertaking should be given that rectangulation costs will not be recovered: all that will be promised will be that these will not be recovered at a higher acreage rate than is charged on all occupied lands in the Barrage area. The Revenue Officer has also been authorised to announce that in (a) class villages—that is, in those villages in which sub-rectangulation can be carried out without difficulty—no land will be given out on "mohag" claims until the village is sub-rectangulated, and to allow the Survey Officer to grant

up to 6 per cent. of the occupied area in making adjustments during rectangulation, any excess area over the original holding being paid for at the concession rate of Rs. 15 per acre. This will absorb some 48,000 acres. These terms should be sufficiently liberal to enable the rectangulation of occupied lands to proceed at a fair rate.

The cost of these rectangulation operations is in addition to the amount provided in the sanctioned project estimate for water-courses. This was Rs. 1,37,00,000, but it may be possible to retain in use a part of the existing system of water-courses in highly irrigated and developed areas. The cost of rectangulation and provision of water-courses will amount to about Rs. 2-8-0 per acre, and it is suggested that this expenditure shall be recovered from the zamindars.

As stated above, no provision for this rectangulation was made in the original project, but after examination of the scheme in detail it was realized that it would be to the advantage of all concerned and it would greatly facilitate the efficient distribution of water and ensure the zamindar receiving his water supply simply and directly. Further, under the existing Irrigation Act the zamindar has to pay irrigation assessment on the whole area of a survey number, even though only partially cultivated, while under the rectangulation system, when his fields are rectangulated down to a unit, which will eventually be about one acre, he will only be assessed on the number of units of the survey number actually irrigated. The system of rectangulation will therefore be advantageous to the zamindar who will in consequence more than recoup the charge proposed in a few years. There will be no difficulty in effecting such recovery in the case of new lands as part of the purchase price, but approximately three-quarters of the Barrage area comprises land already occupied. The Revenue Officer has accordingly proposed the enactment of a new section of the Bombay Irrigation Act, 1879, empowering Government to recover the cost of provision of water-courses, including rectangulation charges, where necessary, from the zamindars, there being no existing law under which such a charge is authorised. The form which such legislation should take is now under consideration.

(vi) *Application of the Bombay Irrigation Act, 1879.*—It has been recognised for a long time that the existing Bombay Irrigation Act is defective and unsuitable in its application to the general administration and control of irrigation in Sind. The approaching transformation of the greater part of Sind from the old conditions of haphazard irrigation to modernized methods of distribution and use of water, which must inevitably take effect with the advent of the Barrage, emphasizes the urgent necessity for provision by the earliest possible date of suitable machinery to deal with the new conditions. The Commissioner in Sind appointed a committee of revenue and irrigation officials in 1926 to consider and report on the question of revision of the Sind canal rules and to prepare a draft of amendments considered necessary to adapt the Bombay Irrigation Act to the requirements of Sind. The report and draft amendments were submitted to Government by the Commissioner in Sind in August 1927, together with his comments and the opinions of the Chief Engineer in Sind, the Chief Engineer of the Barrage, and several experienced revenue officials. A further report in this connection was submitted to Government by the Commissioner in Sind in February 1928, and the draft amendments to the Act, as proposed by the Sind committee, are under the consideration of Government.

(B) UPPER SIND.

Projects are under preparation for the remodelling of the three large canal systems in the Begari Canals division, the Desert canal, the Unharwah and the Begari canal, on the right bank of the Indus. The probable approximate costs have been reported as :—

					Rs.
Desert canal	...	...	...	...	5 lakhs.
Unharwah	...	...	...	...	14 "
Begari canal	...	...	...	...	49. "
					—
			Total	...	68 "
					—

As regards the Begari canal, a branch from the Rice canal was originally proposed to take over the "Dhoro" or concentrated rice area of the Begari below its 52nd mile, for which provision of Rs. 48.7 lakhs was made. This proposal was abandoned, as it was found that by remodelling the Begari canal this rice area could be provided for adequately at less cost. The estimate of Rs. 49 lakhs for remodelling the whole Begari canal system covers provision of some Rs. 12 lakhs for the area originally intended to be served by the branch from the Rice canal. These projects, which provide for the complete remodelling of the three canal systems, would fully command irrigable lands under each. On the left bank of the Indus the area north of Sukkur, bounded on the east by the Jessalmir desert and on the north by Bahawalpur State, depends for its irrigation on the Mahi Canal system and on a series of small canals with direct heads from the river. A preliminary project report, comprising proposals roughly estimated to cost Rs. 56 lakhs, providing for the improvement of distribution of supplies and the extension of irrigation to parts of the area not at present under command, has been received and is under the consideration of Government. If this project, known as the Ghotki Canal project, is to be proceeded with, it will involve a preliminary expenditure of Rs. 40,000 on detailed surveys and preparation of the project. As has been stated, Upper Sind will remain unaffected by the operation of the Barrage, and any projects for the improvement or extension of irrigational facilities in this area will require to be considered on their individual merits and in no way as arising out of or resulting from the Barrage Scheme. The total cost of improvements to existing inundation canals and extension of irrigation to areas which at present have no such facility would amount, according to present information, approximately to Rs. 124½ lakhs for that part of Upper Sind which lies north of the sphere of the Lloyd Barrage and Canals. It is not possible at this stage to lay down any programme for the progress of these works, nor to forecast expenditure on them year by year.

(C) LOWER SIND.

(i) It is the third section of Sind, comprising the larger part of the Fuleli Canals division and the whole of the Karachi Canals division, situated to the south of the limit of command of the Barrage which stands in danger of being adversely affected at the critical periods of the kharif season under future conditions. In recognition of this danger Government in 1923 gave assurances to the zamindars of Lower Sind that systematic improvements to canals in this area would be undertaken, and in pursuance of these assurances projects have been prepared and are in process of preparation for the complete remodelling of the canals irrigating Lower Sind. The projects will provide for straightening the old tortuous inundation canals, for taking out new branches and distributaries, where required, and for control of draw-off to equalise distribution of available supplies at a higher level of command. As the result of the adoption of these measures not only would Lower Sind be safeguarded from possible lowering of the river levels at critical periods, due to withdrawals of the Barrage Canals, but the more equitable distribution of supplies would benefit considerable areas now precariously commanded.

The principle of the proper control and distribution of water is involved in this scheme. It is of paramount importance in dealing with any large volume of irrigation water and the land affected thereby to ensure the most equitable distribution of water possible. On this depends the prosperity of all the irrigators on the system and the value of their holdings. If water is not equitably distributed, no individual cultivator can have any security as regards the value of his land. If the unsystematic distribution of water hitherto obtaining is allowed to continue, the zamindar with a fortuitously good supply will have the value of his land greatly enhanced, whereas a zamindar not so fortunately situated will find his landed estate of little or no value.

This principle is of fundamental importance to the Lloyd Barrage scheme and its financial stability. A good deal of the land under the Fuleli canal will be transferred to the Rohri canal setting free water which will be used for extensions of cultivation on the Fuleli,

In view of the fact that the success of the Barrage scheme is entirely bound up with the equitable distribution of water it will be fatal to the Barrage itself to allow of any extension of the haphazard methods at present prevailing in the Fuleli area and indeed through the whole of Sind. Sales of land under the Barrage are an integral part of the financial scheme, and it will be impossible to persuade buyers that water will be equitably distributed on the Barrage canals if they see Government, from year to year, not only allowing the present inequitable system to continue but extending it.

(ii) *Fuleli Canals Division*.—A project has been prepared for the complete remodelling of the Fuleli Canal system. This is now under revision, this being necessitated by the decision to increase by 1,500 cusecs the full supply discharge to be provided. The project is divided into five sections in each of which the necessary widening, regrading, provision of new distributaries and control of draw-off to secure equitable distribution is provided for at an estimated cost of Rs. 49,98,043 as under:—

	Estimated cost.
	Rs.
Section 1.—From head to mile 27, where a new cross regulator will be provided ...	2,20,776
Section 2.—From mile 27 to mile 43 (existing Alipur regulator) ...	6,70,249
Section 3.—From mile 43 to mile 62, where a new cross regulator will be provided...	13,57,079
Section 4.—From mile 62 to mile 70/8, where a new cross regulator will be provided.	4,22,599
Section 5.—From mile 70/8 to tail (mile 81/8) ...	23,27,240
Total ...	49,98,043

Work has been commenced during the current season on section No. 5, the widening of the main canal above the Alipur regulator being simultaneously taken up. The completed project is expected to return 5·05 per cent. on capital expenditure. The work is expected to be finally completed in 1934-35, with an expenditure of Rs. 5·4 lakhs during the current year and of approximately Rs. 10 lakhs in each succeeding year until completion.

(iii) *Other Canals in the Fuleli Canals Division*.—A project is under preparation for affording assured irrigational command to the area situated to the west of the Fuleli and bordered by the Indus and by the Karachi Canals division. This area now depends for irrigation on the Hasanaliwah, Khairwah and Mulchandwah. The approximate estimated cost of the project is reported as Rs. 9·3 lakhs.

(iv) *Cost of immediately necessary improvements in the Fuleli Canals Division*.—The probable cost of remodelling the existing irrigation system in the Fuleli Canals Division to safeguard this area from possible adverse effects at critical periods of withdrawals of the Barrage canals and to afford improved distribution of available supplies will therefore amount to approximately Rs. 59½ lakhs.

(v) *Mehrani Canal Project*.—This project cannot be said to come within the scope of the assurances of Government as communicated to the Lower Sind zamindars at the time of the inauguration of the Barrage scheme. It provides largely for extension of irrigation to new areas and will accordingly be considered on its merits after the immediate commitments of Government have been given effect to. The project contemplates the extension of irrigation to 61,607 acres of good culturable land to the south of Guni Taluka which at present lie uncommanded. The total culturable area to be brought under command will be 156,043 acres for which 1,510 cusecs full supply discharge is provided at the head of the canal. The project is estimated to cost Rs. 26,10,105 and the estimated return on capital expenditure is 10·68 per cent.

(vi) *Karachi Canals Division*.—The principal canal system in this division is the Pinyari Canal system on the left bank of the river. Detailed plans and estimates have been received for this work, but these have been returned to the Chief Engineer in Sind for revision as extending beyond the scope of Government's assurances in 1925 to safeguard existing irrigation in this area. The project as submitted provided for extension of irrigation to areas outside of existing command and a small return on capital expenditure was forecasted. By limitation of the scope of the project to the existing

(ii) The Finance Committee (appointed to discuss the draft financial statement of the Government of Bombay for the year 1919-20) recommended, among other proposals, that in the event of savings becoming available for expenditure, the provincialization of seven roads in Sind mentioned in their report should be taken into consideration as a first instalment. The Chief Engineer in Sind was accordingly requested to submit, through the Commissioner in Sind, the particulars required in connection with the provincialization of these roads. He was also requested to furnish particulars with regard to other roads which he considered should be provincialized in the near future. The Chief Engineer thereupon suggested 24 roads for provincialisation. In passing on the Chief Engineer's report, the Commissioner in Sind selected only 16 roads in order of urgency for provincialisation. Government accepted this proposal and ordered these 16 roads to be provincialized.

1. Sukkur-Shikarpur Road.	} Right Bank Circle.	(iii) In April 1924 the Chief Engineer in Sind was requested to submit a report briefly describing the nature and condition of the roads provincialized in 1920 and 1921, indicating which of them stood in urgent need of improvements and were of sufficient importance to be taken in hand immediately. The Superintending Engineers of the Indus Right and Left Bank Circles reported that the six roads noted in the margin were in urgent need of improvement.
2. Shikarpur Jacobabad Road.		
3. Naushahro-Padidan Road.	} Left Bank Circle.	
4. Mirpurkhas-Umarkot Road (first six miles).		
5. Katcha portion of Hyderabad-Mirpurkhas Road.		
6. Hyderabad-Badin Road.		

Government however directed that improvements to the following roads should be taken in hand as early as possible, and the stage which each has now reached is as shown below :—

Indus Right Bank Circle.—

- (1) Sukkur-Shikarpur (21 miles) ; plans and estimates sanctioned for Rs. 6,19,457. Work in progress.
- (2) Radhan-Mehar (9 miles) ; preliminary improvements sanctioned for Rs. 31,073. Work not yet begun.
- (3) Shikarpur-Jacobabad (24½ miles) ; preliminary improvements sanctioned for Rs. 14,476. Road surfacing experiments in progress.

Indus Left Bank Circle.—

- (1) Hyderabad-Hala via Matiari (33 miles) ; plans and estimates sanctioned for Rs. 1,53,177. Work not yet begun.
- (2) Naushahro-Padidan (11 miles) ; plans and estimates sanctioned for Rs. 33,127. Work completed.
- (3) Mirpurkhas-Umarkot (47 miles) ; plans and estimates for the first 6 miles sanctioned for Rs. 49,100. Work not yet begun.

(iv) In 1925 the Chief Engineer in Sind was asked to report whether there were any other roads besides the six mentioned above which were in need of improvement, and he reported that three roads required to be metalled. These are shown below, the present stage of progress on each being noted :—

Indus Left Bank Circle.—

- (1) Shahdadpur-Hala (13½ miles) ; brick-paving sanctioned for Rs. 44,339. Work completed in 4 miles.
- (2) Tando Adam-Uderolal (7½ miles) ; plans and estimate sanctioned for Rs. 1,25,808 for metalling.* Revised estimate for brick-paving called for. Work not yet begun.
- (3) Chhor-Umarkot (12 miles) ; brick-paving sanctioned for Rs. 1,07,270. Work not yet begun.

An estimate, amounting to Rs. 96,607, has also been sanctioned for improvements to the Bاده-Nasirabad road (7½ miles) in the Indus Right Bank Circle, and this work is almost completed.

(v) In 1925 the necessity of providing better communications in the zone of the Barrage was brought to notice. The Commissioner was then asked to report on the matter in consultation with the Chief Engineer of the Barrage and the Chief Engineer in Sind. He forwarded reports from the Revenue Officer and the

Chief Engineers, and stated that the question of improvements of communications had been discussed at a conference which unanimously agreed that:—

(1) the question should be investigated by a thoroughly competent Road Engineer;

(2) it would probably be advisable to create two Road Engineers' Districts in Sind so as to relieve the Irrigation Engineers of this work; and

(3) money must be made available for expenditure on roads.

The Commissioner suggested that in the first instance a competent officer should be placed on special duty to investigate the whole matter. This proposal was approved, and Government appointed Mr. H. B. Parikh as Executive Engineer on Special Duty, to investigate and report on the question of improving communications in Sind and particularly in the Barrage Canals area. Mr. Parikh submitted his report in 1928 and gave preliminary estimates for the construction of the following mileage of Provincial and Local Board roads for the present:—

	Rs.
581 miles of trunk roads at Rs. 26,000 per mile	... 1,51,06,000
808 miles of feeder roads at Rs. 21,000 per mile	... 1,69,68,000
	3,20,74,000

and also the following further mileage of roads when funds become available:—

	Rs.
73 miles of trunk roads at Rs. 26,000 per mile	... 18,98,000
531 miles of feeder roads at Rs. 21,000 per mile	... 1,11,51,000
	Total ... 1,30,49,000
	Grand Total ... 4,51,23,000

The report is under reference to the barrage standing committee, but meanwhile the following points may be noted. Such bridges, so far as crossings on existing road alignments over canals and irrigation channels are concerned, are being or will be provided as part of the work of construction of the irrigation systems concerned. With regard to the construction of roads themselves these will generally be on or close to the alignments of the existing unmetalled roads and tracks, and it appears that in many parts of the country, for some time to come at least, the immediate needs will best be met by providing improved and raised unmetalled roads, which can be done most economically by employing modern grader and tractor outfits such as are being successfully used in America, the Punjab and elsewhere. These earthen roads can later, when the growth of traffic renders such action necessary, be provided with metalled or other suitable surfacing. It is recognized that the provision of surfaced roads proposed in Mr. Parik's report represents the probable final requirements when the whole country is fully developed.

(vi) The figures of Government expenditure on roads in Sind (on original works and repairs) from the years 1921-22 to 1927-28 are as follows:—

Year.	Works.		Repairs.	Total.
	Rs.	Rs.	Rs.	Rs.
1921-22	42,740	1,26,920		1,71,660
1922-23	1,00,248	1,44,992		2,45,240
1923-24	73,472	1,44,764		2,18,236
1924-25	1,65,700	1,45,054		3,10,754
1925-26	42,918	1,56,720		1,99,638
1926-27	1,11,981	1,68,858		2,80,839
1927-28	2,69,088	2,09,520		4,78,608
1928-29	2,82,952	1,92,597		4,75,549

(B) RAILWAYS.

(i) The Railways proposed to be constructed in Sind may be grouped under two systems, *viz.*, (1) the Sind Left Bank and (2) the Sind Right Bank Feeder Railways. It cannot be said that these feeder railways are necessitated solely by the advent of the Barrage scheme, since there has already been a local demand for these railways independent of considerations connected with the execution of the Barrage project. The impending completion of the Barrage project has, however, made the improvement of communications in this area a matter of urgency and necessitates the construction of feeder railways and new roads and the improvement of existing roads.

(ii) *Sind Left Bank Feeder Railways*.—This system consists of the following broad-gauge lines, totalling about 162 miles in length:—

- (1) a loop line from Mehrabpur to Pad-Idan, *via* Tharushah;
- (2) a loop line from Nawabshah to Tando Adam, *via* Sakrand and Hala; and
- (3) a chord line between Tharushah and Sakrand.

The North-Western Railway administration forecasts an annual loss of Rs. 6,43,685 on the working of these three sections of line, and towards meeting this loss Government have been asked to make an annual contribution of Rs. 4 lakhs for the first five years. During the second five year period the annual loss on working is estimated at Rs. 2,63,170. A guarantee of payment by the Bombay Government of the actual loss on working, limited to a maximum annual liability of Rs. 2 lakhs, has also been asked for by the Railway administration for the period subsequent to five years from the date of opening the lines to traffic. This guarantee was agreed to by the Legislative Council in March 1928.

The construction of these lines was sanctioned by the Railway Board in June 1928. The construction of the Mehrabpur-Padidan loop is in progress, and this section of the line is expected to be opened in the spring of 1930. The survey of the remaining sections has been completed, and detailed estimates are under preparation. It is hoped that the Nawabshah-Tando Adam loop will be ready and opened for traffic in the hot weather of 1931 and the Chord line in 1932.

(iii) *Sind Right Bank Feeder Railways*.—These are complementary to the Sind Left Bank Feeder lines. This system consists of two lines, *viz.*, from Sita Road to Jacobabad and Larkana to Dost Ali, of an aggregate length of about 135 miles. On the recommendation of the Sind Communications Board it is proposed to construct the loop, Larkana-Dostali Jacobabad, immediately and to take up the Sita Road-Dost Ali section when canal construction is well advanced.

The Railway administration's estimates show that these lines are expected to give a return of more than $4\frac{1}{2}$ per cent. and it is therefore probable that the Bombay Government will not be required to furnish any guarantee. The Railway Board has since intimated that it has decided to postpone the consideration of these Railways for the present, pending completion of lines already commenced.

(iv) Besides the two systems mentioned above, there are certain other lines dealt with by the Special Officer, Sind Roads, in his reports on communications. These lines are dealt with briefly below:—

(1) *Khadro-Nawabshah Railway (Jodhpur Railway)*.—The final location survey of this railway has been completed and the estimate has been forwarded to the Railway Board. No action has yet been taken regarding the acquisition of land, as this project, in common with all other Metre-gauge projects in Sind, is held up pending a decision on the conversion to Broad-gauge of the Hyderabad-Chhor Section of the Jodhpur-Hyderabad Railway and of the two branch lines from Mirpurkhas.

(2) *Jhol-Hiral (Jodhpur Railway)*.—The survey of this project has been completed and the project estimate submitted to the Railway Board.

(3) *Jhudo-Hiral (Jodhpur Railway)*.—The survey of this loop has been held in abeyance pending a decision on the conversion to Broad-gauge of the Hyderabad-Chhor Section of the Jodhpur-Hyderabad Railway.

(4) *Tando Adam-Palsh line (N. W. Railway).*—The Railway Board has recently intimated that it is not proposed to investigate this further at present, as this project is considered unlikely to yield a remunerative return.

(5) *Tando Mahomedkhan-Sujawal line (N. W. Railway).*—The reconnaissance survey of this line has been completed and the report will be submitted to the Railway Board shortly.

(6) *Shikarpur-Ratodero line (N. W. Railway).*—It has been decided that the consideration of this line should be postponed for five years.

(7) *Mirpurkhas-Nagar Parkar line.*—The Railway Board has decided to drop this line in favour of the Viramgam-Radhanpur-Badin project for the Bombay-Karachi connection.

(8) *A project for the conversion to Broad Gauge of the Narrow Gauge lines from Hyderabad to Chhor with two branches from Mirpurkhas to Khadro and from Mirpurkhas to Jhudo* is under investigation by the North-Western Railway.

(v) So far as the Sind Left and Right Bank Feeder Railways are concerned, the construction of which has become necessary owing to the advent of the Barrage scheme [*vide* paragraphs (ii) and (iii) above] it will be seen that liability on the part of the Bombay Government is confined to the Sind Left Bank Feeder Railways, and this is again limited to an annual guarantee against loss in working up to a maximum of Rs. 4 lakhs a year for the first five years after the opening of the line for traffic and thereafter to the actual loss, subject to a maximum of Rs. 2 lakhs, until the lines prove remunerative, when the amounts of the guarantees will be paid to this Government with interest.

As in the case of roads the question of railway communications is one of the subjects engaging the attention of the standing committee in Sind.

III.—Land Policy and Revenue.

(A) *Problem of disposal of land.*—The essential difference between the resettlement of Sind and the colonization of the canal areas in the Punjab is that in Sind the new canals are to irrigate an already settled country, whereas in the Punjab for the most part the irrigable area was at the outset a desert. The zamindars of Sind have their established position in the country, and it is essential that their legitimate claims should be considered. On the other hand the success of the project cannot be jeopardized by yielding to a number of interests that may be incompatible with the general and financial stability of the Barrage scheme. Moreover demands of all kinds have been put forward for grants of land on concessionary terms which, if acceded to, would involve grave financial risks. The policy that the Bombay Government has set before itself is that in the first place the legitimate claims of the present zamindars should be satisfied, secondly adequate provision must be made for special classes, such as peasant cultivators, and thirdly land must be sold in the open market in order that the capital cost of the project may be met by the receipts from the land sales. The cardinal feature of the situation is the marked absence of the large areas of hitherto uncultivated waste which form a familiar feature of the Punjab irrigation scheme. Out of the gross area of 7½ million acres commanded by the scheme the greater part is not Government land, but is already in the occupation of private persons, and its value is being enhanced out of all proportion by bringing water to it. Some 1½ million acres, after uncultivable land and land to be reserved for public purposes have been deducted, are available for the purpose of distribution, and this vacant land is very much fragmented. The policy adopted is that the indigenous population should have first claim to the newly irrigated tracts at the disposal of Government.

The Barrage is not expected to be completed before the spring of 1932, so that water will not be available for the new canals until the inundation season of that year.

These facts lead to certain conclusions. New colonists cannot be settled on the land long in advance of the date when water will be available. There is much preliminary work to be done in the larger unoccupied areas before these lands can be disposed of profitably to Government and to the purchasers. Since most of the area contains a considerable nucleus of zamindars and

cultivating owners already depending on agriculture for their livelihood, it is necessary to aim at the orderly development, so far as possible, of the whole tract at one and the same time. It is not possible to deal with the Barrage area piecemeal, deferring the development of certain sections until that of others is practically complete. Government have however already published their conclusions as to the policy which it is desirable to adopt in the disposal of waste lands, while reserving to themselves full liberty to change that policy in any directions which experience or changing circumstances may indicate. The various classes of grants to be made may be considered under the following heads:—

(i) *Fallow-forfeited and Mohag Grants.*—Government have already made clear their opinion that the indigenous population has the first claim to consideration in the development of the area, and the Royal Commission on Agriculture has expressed the same view. They have therefore set apart 350,000 acres to be granted to existing landholders at the nominal rate of Rs. 15 per acre. Since Government are undertaking a capital expenditure of over Rs. 30 per acre on this land and on every other acre already occupied, the magnitude of the financial concession being made to the existing landholders in the tract will be readily understood. Government consider that the resources of these landholders can best be employed, and will be fully employed, for many years to come in bringing their lands under the more intensive cultivation which will be possible under Barrage irrigation.

In order to enable Government to ascertain their total liabilities on account of these concessionary grants, it has been considered necessary to prescribe a definite date by which all claims to fallow-forfeited land within the Barrage area must be received. September 30th, 1930, has accordingly been fixed as the date for this purpose. It is sufficiently distant to obviate any hardship to individuals, the order having been issued in November 1929, and it has been given the widest publicity. Any claims received after this date will ordinarily not be considered.

(ii) *Peasant Grants.*—Although it is not possible to settle peasants on the land before cultivation operations can be undertaken, the terms on which Government are prepared to grant land to peasants are described below. When the Jamrao was colonized thirty years ago, grants for both Sindhi and Punjabi peasants were given free of malkano. In the Punjab to-day fairly heavy recoveries are made from peasants. The Punjab peasant is required to pay Rs. 3 per annum per allotted acre for the first ten years, and thereafter has the option of paying Rs. 5 per acre in perpetuity, without acquiring proprietary rights, or of paying heavier annual payments over a period, which may extend to forty years for the purpose of acquiring proprietary rights, according to the prescribed scale.

Government clearly cannot afford, nor do they consider it necessary, to give land to peasants free. The Hari, whose status is raised to that of a peasant proprietor, has his income largely increased, and there is no reason why he should not pay a reasonable share of that increase to Government by way of instalments for the purchase of his land. But in the present conditions of Sind agriculture Government do not think it desirable to attempt to levy the prices which the Punjabi peasant willingly pays, and they have therefore empowered the Revenue Officer to make grants to Sindhi peasants on the following conditions. The peasants will be tenants-at-will for the first five years, during which they will pay Rs. 3 per annum per allotted acre and will be required to comply with certain conditions framed with a view to ensuring that they actually live on or near their land and bring it under cultivation. Thereafter they will be required to pay malkano equivalent to half the amount paid by peasants in the Punjab according to the following scale:—

Number of years.						Annual payment per acre.		
						Rs.	a.	p.
15	...	...	...	...	...	5	0	0
or 20	...	...	...	...	...	4	8	0
or 25	...	...	...	...	...	4	0	0
or 30	...	...	...	...	...	3	8	0
or 40	...	...	...	...	...	3	0	0

The ordinary land revenue will be recovered in addition to these payments of malkano. The peasants will thus be able to complete payments for their holdings within a period ranging at their option from 20 to 45 years. It is not desirable to permit payment within a shorter period, since the object is to get the peasants settled on the land and not to encourage them in the speculative sellings of their holdings. The present value of these payments is about Rs. 50 per acre. Government consider that peasants should be settled only on land of good quality and that a grant should ordinarily be about 16 acres and never more than 24 acres. For the present, Government have authorized the Revenue Officer to set aside 50,000 acres for the purpose of peasant grants. This is enough for 3,000 peasants. Government however trust that, as time goes on, it may be possible to set aside a larger area for this purpose. It is impossible to settle these peasants on the land before water is available, but much of the preliminary work can be done before that time, and it should be possible to settle about 25,000 acres of this land in 1932-33 and the remainder in the following year.

It is not proposed at present to give peasant grants at concession rates to other than Sindhis (including Tharis). The Punjabi peasant is sufficiently alive to the value of perennial irrigation and will be able to buy land in the ordinary way at full rates provided that he is given reasonable opportunities to purchase small holdings and pay for them by instalments. An exception will be made in the case of Punjabi *abadgars* already settled in Sind in respect of areas mainly colonized by Punjabis. It is improbable that any other class would be suitable for or be attracted by the conditions obtaining in Sind, but Government will consider sympathetically claims that may be advanced on behalf of any such classes. The Revenue Officer has also been authorized to consider applications from co-operative societies or other organized groups for grants on terms not more generous than those outlined above.

(iii) *Military Grants*.—After very careful consideration Government have come to the conclusion that no concessions of a financial kind can be made at their expense on the grounds of military service. Subject to the fulfilment of a few definite commitments made before the Barrage scheme was sanctioned, the Revenue Officer is authorized to make grants to military personnel, either retired or serving, on terms of full payment for the land either by themselves or by the Government of India in the Army Department on their behalf.

(iv) *Sales at full rates*.—Having regard to the heavy capital cost of the Barrage, it is necessary to obtain for the bulk of the unoccupied land the best prices that will be procurable from time to time. Government are of opinion that good prices cannot be expected if land is sold long before water is available in the canals, and they do not therefore contemplate resort to sales on any considerable scale more than about a year before the canals are open and flowing. Sales by open auction will be the rule, and these will be open to all bidders, whether from this or other provinces. Payment by instalments will be permitted, the general rule being 10 per cent. down and the balance in five equated annual instalments of principal with interest at 6½ per cent. The Revenue Officer will, however, be permitted to reduce or increase the number of instalments in cases where for special reasons he considers it desirable to do so.

(v) *Limited auctions and sales at fixed prices*.—While, however, Government consider that sales by auction should be the rule, there is, in the aggregate, a very large area of land for which sales by auction would not be advisable or even practicable. In these cases the Revenue Officer is authorized to sell lands at a fair price fixed by him, or to hold auctions confined to a limited class of bidders. Examples of the sort of cases referred to are lands which are equally in the *mohag* of several people and of which the sale to a stranger would consequently be inadvisable and lands in small scattered parcels to which no particular person has a valid claim, but which could not be expected to attract any considerable number of bidders at an auction. In such cases a standing offer to sell at a fixed price may be the better method. The same scheme of payment by instalments will apply here as to sales by auction.

(vi) *Short-term leases.*—Over one hundred thousand acres in the Barrage area are at present held on temporary leases for five years and a considerable area is held on leases for one year which are regularly renewed. In some cases definite promises were made that such lands would be permanently granted when the Barrage came into operation and in some cases lands were granted on the express understanding that no such claim would be considered valid. The circumstances of each lease will have to be examined when application is made for its conversion into a permanent grant. There will doubtless be some cases in which financial concessions will have to be made. Generally, however, it will be equitable to fix a price approximating to the full value of the land and to recover it by a more extended system of instalments. This conclusion is justified by the fact that few of these leases date back to the period anterior to 1910, when the Commissioner in Sind issued orders, in pursuance of a decision of Government, that no land commanded by the right and the left bank canals or by the remodelled Eastern Nara should be given out except on lease, the lessees to be subsequently given first claim to permanent occupancy on payment of suitable malkano *fixed with regard to the enhanced value of the land due to an assured supply of water.* This land is already in occupation and under cultivation on existing canals, so that these terms can be offered to the holders as soon as the circumstances of each case are investigated. Undoubtedly a large number of these lessees hope to get their grants confirmed on payment of a light malkano and the decision to fix a price approximating to the full value of the land may in certain cases be considered harsh. This expectation is not, however, justified. These lands are often very valuable, since they have a water-supply already available, and Government do not think that the fact that tenants have had a free lease for several years can be admitted as a valid claim to further concessions in the matter of price. The leases are now being renewed only on the condition that the holders will agree to take the lands up permanently at the price fixed by the Revenue Officer when they are called on to do so. Many lessees will take up the whole of the land now held by them on these conditions and the land not so taken up will be available for disposal to others in the ordinary way.

The Revenue Officer has been authorized to lease for a period of years lands which are not yet ripe for sale. These leases may be for varying periods and may be sold either by auction or by tender or at rates fixed by the Revenue Officer. It is expected that the sale of these leases, which are now a regular feature of colonization work in other provinces, will bring in considerable sums and will materially assist the general development of the area by admitting of the temporary cultivation of lands for which water will be available, but which in other respects are not ready for final disposal.

(vii) *Long-term leases.*—It is anticipated that the Revenue Officer will receive a certain number of applications for large grants for special purposes such as cotton-growing, cattle-breeding, fruit-farming, etc., generally involving some concession in the matter of price. The history of such grants in other provinces suggests that careful scrutiny of such proposals is necessary, if the public revenues are to be adequately safeguarded. Government have therefore passed orders that the Revenue Officer should not sanction any application which involves either the grant of more than 500 acres or any special concession in the matter of price without their consent.

It is vital to the success of the whole Barrage scheme that the general standard of agricultural production should be raised. This can best be achieved by a demonstration of what can be done by private individuals or companies working for their own profit land for cotton-growing, cattle-breeding, fruit-farming, seed farms, etc. A few large grants ranging from 2,000 to 20,000 acres on terminable leases to persons who will adopt progressive methods and contribute to the social advancement of their small neighbours will be of very great value. Government are now engaged in working out the details of such leases. They have fixed 2,000 acres as the minimum area for each lease and have set on foot enquiries as to the amount of land that can be made available, and they are drawing up a form of lease, which, after scrutiny by the Barrage standing and advisory committees, will be published. They invite applications from persons and syndicates of persons for taking up such leases, the terms of which will be modified or adjusted to suit the requirements of individual applicants.

(viii) *Grants to other departments.*—The Agricultural Department have intimated that they will require about 3,000 acres for seed farms. The grant of leases for special purposes mentioned in the preceding paragraph may, however, obviate the necessity of setting apart so large an area for a Government seed farm. The question of the land that will be required by the Forest Department has been discussed in Chapter V below.

There remains the area remaining for disposal at full rates. It would be premature to estimate what this area will be. Leases for long periods, which will be a new feature in Sind, will, for instance, have to be taken into consideration, and it is difficult to foresee with any accuracy the extent to which these leases will be taken up. The total area for disposal will be very large, and the sales are likely to be spread over a period of not less than twenty years, during the course of which some of the proposals may undergo modification in the light of the changing financial situation and actual experience. The proposals must therefore be regarded rather as a general indication of the lines along which development can for the present proceed than as an irrevocable commitment to a particular policy.

(B) The following is a summary of the work upon which the Revenue Officer is engaged and of the progress achieved up to date.

(i) *Settlement work.*—It has been decided that revision settlements in the talukas commanded by the Barrage are to be introduced in time for the revised rates to be levied in the revenue year 1932-33, since the new canals are expected to be in working order by the kharif season of 1932. The talukas concerned are—

District.	Talukas.
Hyderabad	... Dero Mohbat (except a few dehs). Tando Bago (about half). Tando Allahyar. Hala. Hyderabad (except a few dehs).
Sukkur	... Sukkur (a few dehs only). Garhi Yasin (except a few dehs). Shikarpur (a few dehs only). Rohri do.
Larkana	... Dadu, Johi, Sehwan, Kakar, Mehar, Warah, Labdaria, Larkana, Kambar, Ratodero and Mirokhan.
Thar Parkar	... Mirpurkhas (Jamrao and non-Jamrao areas). Digri. Jamesabad. Sanghar (non-Jamrao and Jamrao areas). Khipro. Umarkot. Samaro (Hiral tract and non-Hiral tract). Diplo (a few dehs only). Mithi do.
Nawabshah	... Kandiaro, Naushahro, Moro, Sakrand, Shahdadpur, Nawabshah, Sinjhor (Jamrao and non-Jamrao areas).
Upper Sind Frontier	... Shahdadkot and Jacobabad (about half).

The work is in the hands of two officers working under the general supervision of the Revenue Officer, and is being spread over four years. None of the reports has yet reached Government. Since the Barrage project contemplates an even distribution of water throughout the area commanded, the settlement reports will be of a homogeneous character, and it will be possible to deal with them simultaneously. It may be pointed out that the existing practice of restricting the enhancement of the assessment at a revision settlement to 33 per cent. is not being followed in the case of these settlements.

The guarantee of perennial irrigation will so enhance the value of the lands and increase the margin of profit that a more substantial addition to the rates of assessment is legitimate. Further, a suggestion has been put forward

for the levy of a betterment tax on the lands commanded by the Barrage, the object being to recover from existing holders of these lands some payment in return for the greatly increased value which will be given to their lands owing to the security afforded by the Barrage and the substitution of perennial for seasonal irrigation. In the Punjab a betterment levy is made when occupied land is brought under irrigation. In Bikaner, khatedars whose lands come under the Sutlej Valley Project have been required to surrender part of their holdings in return for getting irrigation for the remainder, and in addition have had to pay a heavy acreage rate as a contribution towards the capital cost of the canal. In the Thal area of the Punjab the zamindars have been compelled, in view of the possibility of the Thal Irrigation project being sanctioned, to surrender to Government no less than three quarters of their holding in order to obtain perennial irrigation for the remaining quarter. In view of these precedents the question whether a betterment levy should be made an integral part of the Barrage scheme is being considered by Government.

(ii) *Land sales*.—The policy of Government was defined in their Resolutions Nos. L. C. 1348 of 14th November 1927 and 3462/24 of 30th August 1928 and 24th January 1929. The Revenue Officer is at present engaged in disposing of the concessionary area of 350,000 acres of *mohag* and fallow-forfeited lands. Every effort is being made to get this area disposed of as quickly as possible, but there are many impediments in the way. Since water for this land will in most cases not be available till the Barrage canals flow, many applicants do not apply for their land when a *kacheri* is held; others do not take up the land because of the rice restriction in perennial areas. It is apparent that *mohag* lands cannot be given out freely until a clearer idea of the actual location of the new water courses is obtained. In many cases it is inadvisable to give out the land before the rectangulation operations are completed. The total area of land in the Barrage area fallow-forfeited after 1910-11 was 247,000 acres, and although it is not easy to estimate with any precision how much of this will be restored, it is known that there will be a large saving. Out of this total area, the restoration of 62,579 acres was dealt with and 22,190 acres were restored in the year 1928-29. Practically all the land which was applied for on valid grounds was given out. It will be seen that approximately one-quarter of the total fallow area was dealt with and about one-third of this was taken up. Much of the remaining area will doubtless be applied for later on, but it is certain that in respect of a large area of the fallow-forfeited land there is no one remaining who has a valid claim to its restoration, and also that in the areas where rice cultivation was once common but which are now excluded from the rice area, much being bad *kalar* land will not be taken up because of the rice restriction. There is no general demand for the restoration of lands fallow-forfeited before 1910-11, and their restoration has now been prohibited, as most of the khatedars from whom such old forfeitures were made are now dead. The savings on the area of fallow-forfeited land will go to swell the balance available for ordinary *mohag* grants, and the present indications are that the total area of 350,000 acres will be sufficient for meeting fully the claims, to satisfy which they were sanctioned. Payment for these grants is being made in two equal instalments, 6½ per cent. interest being charged for the second instalment.

In February 1929 the Revenue Officer made an experiment of putting up to auction 1,452 acres of Government land for which water from the existing canals is available. The total sum realized was Rs. 1,59,801-12-0. The prices obtained for blocks of land classified as A, *i.e.*, good land, varied from Rs. 100 to Rs. 175 per acre, and those for purely B land, *i.e.*, poor but cultivable, from Rs. 50 to Rs. 110 per acre. Whilst these prices are satisfactory in view of Mr. Baker's original estimate that A land would fetch on an average Rs. 150 per acre and B land Rs. 50, it is felt that there is no hope of high prices being obtained in auction until the Barrage water is available or is in immediate prospect. At the same time it is clear from the experience which has now been gained that for estimating purposes the distinction between A and B land is no longer necessary. The most that can be said about this classification is that generally speaking the A land is better than the B land. Mr. Baker, who was

himself mainly responsible for the classification, has himself put on record his mistrust of its accuracy, and in the last two years a great deal of A class land was found which should have been classified as B class and *vice versa*. Sind zamindars of great experience will seldom give a considered opinion of the crop-growing qualities of land, unless they are allowed to dig pits in the land at frequent intervals and to examine closely the depth and the texture of the soil. More important still is the fact that the purchaser of land looks to many other factors besides the actual quality of the soil. The levels of the land, its distance from villages and markets, and communications are matters which to him are hardly less vital than the actual quality of the soil, and they are matters of much greater relative importance in a settled country like Sind than they are in new waste areas like those dealt with in most of the Punjab Canal schemes. The A and B lands are also so inter-mixed that no adequate disposal schemes could ever be framed for them. For these reasons Government have sanctioned the Revenue Officer's proposal to abandon the distinction between A and B land.

(iii) *Land Acquisition*.—The total area of land to be acquired for the purposes of the project is approximately 106,000 acres. Up to December 31st, 1929, 37,367 acres have been acquired at the cost of Rs. 55,65,489.

(iv) *Rectangulation*.—Details have been given on pages 5 to 7 *ante*.

(C.) SUMMARY.

1. The policy outlined above for regulating the disposal of land makes no pretensions to be final, and proposals for its extension and improvement will have to be considered with accruing experience.

2. The area to be set apart for long term leases and the conditions regulating their grant are now under consideration, and should be settled at an early date.

3. The re-settlement of the talukas commanded by the Barrage will require consideration on receipt of the settlement reports.

IV.—Agriculture.

A—Agricultural Development, 1923-1929—

(i) *Organization of the Department of Agriculture in Sind in 1923*.—In the year 1923 when the Barrage project was sanctioned the gazetted staff of the Agricultural department in Sind consisted of the following officers:—

1 Deputy Director of Agriculture in the Indian Agricultural Service (Rs. 350—50—1,250—50—1,500).

1 Cotton Breeder in the Bombay Agricultural Service (Rs. 250—20—750).

1 Divisional Superintendent of Agriculture in the Bombay Agricultural Service (Rs. 250—20—750).

The Deputy Director was in charge of all the work under the general supervision of the Director of Agriculture, Poona. Though he was mainly engaged on cotton, the cotton-breeder was also in charge of rice and wheat breeding. The Divisional Superintendent of Agriculture was in charge of propaganda work. In addition to these officers, the services of the Presidency specialist officers, *e.g.*, the live stock expert, the agricultural chemist, the economic botanist, the plant pathologist, etc., were always available. The non-gazetted staff consisted of thirteen graduate assistants, who were employed as farm superintendents, managers, etc., and several non-graduate assistants (including Lyallpur certificate holders), clerks, mechanical assistants, etc., etc. There were farms at Mirpurkhas, Sukkur, Larkana, and Jacobabad, and the Willingdon cattle farm at Malir near Karachi.

(ii) *Appointment of Advisory Committee, 1923*.—As soon as the Barrage project was sanctioned, it became apparent that the enormous increase in the irrigated area in Sind which would result from its completion would create a series of new agricultural problems, and accordingly a committee composed of both official and non-official gentlemen was appointed in 1923, with the Commissioner in Sind as chairman, to consider the question of the development of

the agricultural department to enable it to deal with these problems. The committee submitted its report in the following year. It stated its conclusion that the establishment of the Barrage canals system would necessarily result in fundamental changes in the theory and practice of agriculture of the country, for which timely provision must be made, if full success were to be assured. The turning of a very large amount of perennial water into a country which had hitherto been watered only during a small part of the year was certain to bring to the front a host of new problems, if the water was to be used to the best advantage, if the largest crop outturn was to be attained, and if the biggest profit was to be obtained both by the cultivators and by Government. The committee therefore considered it essential that the experimental work connected with the agricultural problems should be undertaken *before* the advent of the Barrage. The chief problem was how to give perennial irrigation without damaging the land, without producing alkali in it, and at the same time how to utilize the water to the best advantage. The data so far available were chiefly obtained from the Punjab and Egypt, but were inadequate for application to Sind conditions. The committee was convinced that considerable expenditure on experimental work would be necessary to secure as large a return as possible. It therefore urged that very careful experiments should be made to obtain sufficient data on the following points:—

(1) the best rotation of water to give the maximum duty without damaging the land either by the production of kalar or otherwise;

(2) the best rotation of crops which would enable the maximum returns to be got from the land without damaging it, while at the same time maintaining its fertility;

(3) the production of the types of crops which would give the best results under Barrage conditions;

(4) the best way by which the land should be tilled under the new conditions, whether by cattle or otherwise;

(5) the best methods of preventing the development of salt in the land and utilizing the land containing a limited amount of salt and the reclamation of salt land.

(iii) *Recommendations of the Committee.*—To obtain these data the committee recommended that experimental work should be initiated immediately, as much of the data required would take a number of years to obtain; that such work should be placed under the best and most scientific direction obtainable; and that it should be financed on a liberal scale so as to ensure that the maximum results should be obtained. The committee recommended the establishment of three experimental stations—

(1) at Larkana for the area to be irrigated on the right bank of the Indus;

(2) at Sakrand for that under the Rohri and other canals on the left bank;

(3) at or near Shadipali for the area to be fed from the various canals dependent on the Eastern Nara.

These three stations were to be the centres where the main experimental work was to be carried on, but the intention of the committee was that there should be additional operational stations to try out on a large scale and under different conditions the results obtained at the central stations.

The committee also considered three other developments to be necessary. They were (1) the organization of agricultural propaganda, (2) the establishment of an Agricultural College at Nawabshah and pending the initiation of such a scheme a more liberal provision of scholarships for Sind students at the Poona Agricultural College and (3) the appointment of a separate Director of Agriculture in Sind.

(iv) *Government's action on the recommendations of the Committee.*—Government accepted the recommendations of the committee with certain reservations. The establishment of two main stations on the two banks of the Indus was admitted to be necessary, but as it was not certain whether the problems of the Eastern Nara tract were so different in character from those in the rest of the left bank as to require an independent station, the matter was held over for further investigation. In regard to subsidiary stations it was considered possible that, when definite results had been achieved at the principal stations, the experiments would be repeated on private farms without

the necessity of having subsidiary stations. This point was also held over for further investigation. Government however decided to establish forthwith one experimental station at Sakrand on the left bank of the Indus, as the problems of this tract demanded immediate investigation and land was available for it, while the facilities for irrigation water were considered to be adequate. Government also accepted the committee's proposals regarding scholarships at the Poona Agricultural College. They decided to hold over the questions of opening a separate college and appointing a separate Director of Agriculture for Sind. The scheme of starting an experimental station at Sakrand was intended to be brought into operation from 1st September 1925. The total estimated cost on this account during the year 1925-26 amounted to Rs. 3,02,432, and the scheme being an important one was laid both before the finance committee and the Legislative Council.

(v) *Action of the Legislative Council in 1925.*—The scheme was dealt with by the Honourable Minister in charge of Agriculture, i.e., on the transferred side of Government, and before moving the grant in the Council, the then Honourable Minister (Mr. A. M. K. Dehlavi) informally consulted the Sind members and a few members from the Presidency who were interested in the subject. They expressed their willingness to accept the scheme on the following conditions:—

(1) that the Sakrand scheme should not be treated as a part of the full scheme recommended by the advisory committee, but a scheme full and entire in itself, and not likely to be developed further as suggested by the committee. Further developments, if found necessary, should be taken in hand only after consultation with a fresh committee of the Sind zamindars and others interested;

(2) that Dr. H. H. Mann, the then Director of Agriculture, should be placed in charge of the scheme and the investigations under it for a sufficiently long period to enable him to study the various problems and to make it successful. For this purpose they proposed that Dr. Mann's services should be lent to Sind for five years, at the end of which time the success of the scheme was to be examined and not at the end of ten years as proposed by the advisory committee;

(3) that the cost of the scheme, viz., Rs. 3,02,432, should be reduced as far as possible.

In the debate in the Legislative Council the Honourable Minister stated that he agreed to the first condition, but as regards the second he explained that there were difficulties in the way of removing Dr. Mann from the Presidency and sending him to Sind, and he explained that the proposed undertaking could not be given as this involved the question of the extension of his service. An assurance was however given that Government had no objection to Dr. Mann's services being made available for the scheme. The demand was passed by the Legislative Council on 6th August 1925.

(vi) *Sakrand Research Station established under Dr. Mann.*—Government entrusted Dr. Mann with the immediate direction and control of the station in addition to his duties as Director of Agriculture. To assist him in the discharge of the latter duties, a post of Joint Director of Agriculture was created for a period of two years. Dr. Mann was, however, unwilling to take up the work unless in the normal course the experiments which he initiated were carried on by himself for five years without any question by Government. He also asked that if his connection with the rest of the Presidency ceased at the date of his retirement in October 1927, all agricultural work in Sind thereafter should be placed solely in his charge. Government accepted this proposal. Thus the initial task of organising the work at Sakrand fell on Dr. Mann from October 1925. He continued to be in charge of the station from that time onwards till the date of his retirement in October 1927.

(vii) *Dr. Mann's retirement and subsequent arrangements.*—Before that date the arrangements to be made in view of Dr. Mann's impending retirement were taken into consideration. In January 1927 Government proposed to permit him to retire from the Indian Agricultural Service on attaining the age of 55 on 16th October 1927, and at the same time to create for him an appointment as Director of Agriculture for Sind for a period of 3 years with jurisdiction over the whole of that area including that commanded by the Barrage. Dr. Mann was also asked to submit a programme whereby the services of certain officers whose duties extended over the Presidency including

Sind would be made available for both in such a manner as not to entail in the future any difficulty with regard to superior control in view of the existence of two Directors of Agriculture. Dr. Mann however found himself unable to accept these proposals, and accordingly he retired from the service on October 16th, 1927. A stop-gap arrangement was then made whereby the senior officer on the station, Mr. V. A. Tamhane, the soil physicist and chemist, was placed in charge, while the general supervision of the work rested with the Director of Agriculture in Poona. This arrangement, although admittedly temporary, has continued up to date.

(viii) *Direction and co-ordination of agricultural activities in Sind.*—The advisory committee had laid stress on the point that each experimental station established by Government should have a separate Director who should be the best scientific agriculturist available. For this reason they recommended a pay of Rs. 1,500—50—1,750 for the Director of the Sakrand station. Government accepted this view and obtained the sanction of the Secretary of State for the creation of a post on this rate of pay. So long as Dr. Mann was in charge of the station, the question of filling this post did not arise. The state of affairs on the farm was however found to be not entirely satisfactory at the time that Dr. Mann left it. The development, e.g., clearing, levelling, etc., had only been half done, and no plan of exploitation had been thought out for the utilisation of the land to the best advantage when ready. Such agricultural work as had been undertaken had in several respects been inefficient. Thus cultural operations such as sowing had not been carried out on approved professional lines. For various reasons a good deal of time had been lost, and more than half the area of the farm had not been utilised at all. In the opinion of the Commissioner in Sind, who visited Sakrand in December 1927, if the farm was to attempt to fulfil its functions, it required a very experienced and well paid agriculturist who would direct and co-ordinate the activities of all the branches. The new Director of Agriculture (Mr. Main) immediately on joining his appointment in October 1927 also pressed for the immediate appointment of a Director for the Station. The question was considered by Government, and the name of Mr. G. S. Henderson of the Indian Agricultural Service, Imperial Agriculturist at Pusa, who had been a member of the original committee appointed in 1923, was put forward. During the budget session of March 1928, the then Honourable Minister (Mr. G. B. Pradhan) held a meeting to which five members of the Legislative Council from Sind were invited together with the Secretary, Revenue Department, and the Director of Agriculture. The Sind members did not want a separate Director for Sind because there was not in their opinion sufficient work. They recommended the appointment of Mr. V. A. Tamhane, soil physicist, to be in charge of the farm permanently and to be mainly responsible for the scientific section. They also favoured the appointment as Deputy Director for Sind of an officer of the Indian Agricultural Service, who should be an agriculturist with headquarters at Karachi but who should spend a large portion of his time at Sakrand advising the agricultural section. The Honourable Minister proposed that Mr. W. J. Jenkins of the Indian Agricultural Service (at present Deputy Secretary, Indian Central Cotton Committee) should be appointed Deputy Director for Sind with Mr. Tamhane as Joint Director at Sakrand primarily responsible for the experimental section and generally for the success of the scheme. Mr. Jenkins who was on leave in Europe was approached in the matter, but declined to accept the post on the terms offered. A conference was then held at Poona on 2nd August 1928 by the new Minister (the Honourable Moulvi Rafiuddin Ahmed) at which some Sind members of the Legislative Council, the Secretary, Revenue Department, and the Director of Agriculture were present. It was decided to make enquiries about likely officers at Simla during the forthcoming conference on the report of the Agricultural Commission. Nothing however resulted from this. It was at the same time decided to appoint for a period of two years an officer of the Indian Agricultural Service to be Director of the farm on Rs. 1,500—50—1,750 and to be in addition Deputy Director of Agriculture in Sind for which he would draw in addition a reasonable amount not exceeding one-half of the pay of the second post. Dr. Clouston, Agricultural Adviser to the Government of India, was asked to suggest the names of one or more officers from other

provinces willing to accept the post, and advantage was taken of his presence in Bombay in December 1928 to discuss the matter with him. He strongly recommended the appointment of Mr. Henderson whom he considered to have better qualifications for the post than any one else in the department.

The Honourable Minister (Mr. B. V. Jadhav) deferred taking any action on this suggestion until he visited Sakrand, which he did in January 1929.

About the same time Sind was visited by other members of the Government, and also by a party of members of the Legislative Council to whom allusion has already been made. The members of the Legislative Council included Sakrand in their itinerary. It consequently appeared to His Excellency the Governor that advantage should be taken of the amount of first-hand knowledge of conditions in Sind which had been so recently obtained, and accordingly in March 1929 he convened a conference of members of Government and officials to consider the question of the Barrage in all its aspects, but more particularly in its agricultural aspect. In regard to this it was generally agreed that with a view to preparing Sind for the new era which the Barrage would open, the agricultural department had a part to play which was equally important with those played by the public works and the revenue departments. For the construction of the Barrage and the canals the ablest officers of the public works department were being employed. The staff of the revenue department had also been chosen with equal care, whereas the agricultural work had for the first two years been in charge of the Presidency Director of Agriculture who had been unable to devote himself sufficiently to it, whilst for the last eighteen months a stop-gap arrangement was in force. The agricultural department was thus some way behind the others in its preparations for the advent of perennial irrigation. The conference decided that the whole administrative machinery of the department required overhauling. Moreover it was undesirable to accentuate the difference between the Barrage and the non-Barrage area. It was therefore felt that the first and most important step for Government to take was to place an officer in charge of all the agricultural work of Sind including the Sakrand farm with his headquarters at Karachi, where in the recess he would be in close proximity to the Commissioner in Sind and the heads of other Departments. He would thus absorb the present post of Deputy Director of Agriculture in Sind and the sanctioned post of Director of the Sakrand farm. His pay, for which budget provision existed, would be a consolidated one of Rs. 2,000 rising by Rs. 50 to Rs. 2,250 with the usual Karachi allowances, and though technically subordinate to the Director of Agriculture at Poona, he would be practically independent. It was noted that the sanction of the Secretary of State to the Sakrand scheme expired in October 1930 and that permanent arrangements were urgently required.

The proposals of the conference were considered by Government in April 1929 and were approved. It may be pointed out that the lines on which Government proposed to proceed had already been approved by the Royal Commission on Agriculture. In view of the importance of the project, the Commission took the view that the chief revenue and irrigational officers should have ready access to the best agricultural advice at the headquarters of the Province. In paragraph 290 of their Report it is stated that—

“The agricultural problems of Sind will, in our opinion, assume such importance as a result of the construction of the Barrage that we consider the Province should have its own Director of Agriculture with headquarters at Karachi. The work at the Sakrand farm and its sub-stations will fully occupy the time of a Deputy Director of Agriculture.

“We recognize that Sind under Barrage irrigation will contain as important and comprehensive a system of agriculture as Egypt has to-day and we consider that the welfare of the people demands a chain of experimental stations subsidiary to Sakrand, and a full staff of competent officers. We are convinced that the financial returns to the State from expenditure on a farsighted policy will be on the most generous scale.”

Further, the Karachi Chamber of Commerce, as a result of a conference held in Bombay by the Honourable the General Member in March 1929, had interested itself in the matter and addressed a letter to Government in which it expressed its apprehension that the subject of agricultural research

in Sind was not receiving as much attention as its importance demanded. It drew attention to the fact that, though funds had been provided for the Director and the Agricultural Engineer and the staff, no appointments had yet been made. The Chamber considered the appointment of a competent Director to be a matter of vital importance in view of the impending revolution in the agricultural conditions with the advent of the Barrage.

It was decided that the proposals of the conference held in March 1929 which were approved by Government should be laid before the Legislative Council at the July session. This was done by putting to the vote of the Council a token grant for the establishment of the officer proposed to be appointed in charge of all the agricultural work in Sind both within and outside the Barrage area. The discussion in the Council centered round the following two issues:—

(a) Whether an expansion of the agricultural staff and propaganda in the province was necessary.

(b) Which officer should be appointed to direct and conduct research and propaganda.

As regards the first issue, the majority agreed that in the interests of the Barrage scheme it was necessary to employ a larger staff and to carry on research and propaganda. As regards the second issue, there was a consensus of opinion that the best man ought to be obtained and that the post should therefore be advertised. These recommendations were accepted by Government and the token grant passed by the Council. It has accordingly been decided to appoint a Chief Agricultural Officer for Sind, with headquarters at Karachi, on Rs. 2,000—50—2,250 per mensem with the local compensatory allowances, to control and direct the research, propaganda and development work of the Agricultural Department both within and outside the Barrage area under the general direction of the Director of Agriculture, and the formal sanction of the Secretary of State has been obtained. The post has been widely advertised both in India and abroad, and applications for it are being received up to January 31st, 1930. It is expected that an appointment will be made shortly after that date.

B—Public Interest in the Agricultural Development of Sind—

The Karachi Chamber of Commerce has set up a sub-committee to deal with Agriculture, and has made several suggestions to which reference is made in this Chapter.

The Bombay Chamber of Commerce has also established a Standing Agricultural Sub-Committee, and in September 1929 addressed a long communication to Government submitting its conclusions as a result of a study of the materials available up to date. The Chamber is insistent that the Chief Agricultural Officer in Sind should be the best man obtainable irrespective of race or nationality. The Karachi Indian Merchants' Association and the Buyers and Shippers Chamber, Karachi, have both indicated their interest in the agricultural development of Sind by requests for representation on the Sind Divisional Board of Agriculture and the Sind Cotton Committee. Some of the points raised by these bodies and suggestions made in the public press and elsewhere are dealt with below.

C—Crops—

(i) The most important criticism that has been offered on the problems and possibilities of irrigation in Sind has emanated from the Royal Commission on Agriculture which has remarked that—

“there can be no doubt that this vast project provides a unique opportunity for putting into practice the lessons to be drawn from irrigation experience elsewhere in India. There is every reason to believe that the greatness of the opportunity thus presented is fully realized, but there are a few points we wish to emphasize. We have carefully examined the project from the point of view of its effect on cultivation and on the welfare of the rural population. There is at present considerable difference in the agricultural conditions on the right and left banks of the Indus. The area on the left bank is mainly a cotton area, the agricultural organization of which is

based on one irrigated crop in three years. Wheat and rice are the principal crops on the right bank and a crop is taken every year. The first question for special investigation is the kind of crops the cultivation of which can confidently be recommended to the cultivator in all the tracts to be brought under perennial irrigation. It should be ascertained whether the distinction between the crops which are grown on the right and left banks is based on a real difference in conditions of soil, water supply or climate, in fact, on anything more definite than a preference on the part of the cultivator."

The answer to this question is that the distinction in the cropping practised on the two banks of the Indus is real. It is due to the topography of the country. The land surface on the right bank is lower than that on the left bank. This has facilitated "flow" irrigation on the former bank and rice has become the established crop. The high sub-soil water-table on the right bank, which has been accentuated by the large volume of water poured on to the country in irrigating the rice crops, has resulted in the accumulation of alkaline salts on the land surface on a large scale, and in many areas renders it difficult under existing conditions to grow any other crop but rice with success.

(ii) *Wheat*.—The importance of wheat as a crop to be grown in the Barrage area has for a long time been recognized both by Government and by responsible bodies in Sind. The Karachi Chamber of Commerce has recently addressed a communication to Government on the subject which may be taken as representative of the various suggestions that have been made from time to time. They are briefly dealt with below.

(1) It is recommended that for the time being the growing of the ordinary local wheats of Sind should be continued, but that careful experiments should be carried out as rapidly as possible with the superior types of white wheat, such as Pusa 12, Punjab 11 and Punjab 8-A, which have proved successful in other parts of India, in order to discover whether the soil in the Barrage area is suitable to their production, and to ascertain the best type that can be grown and produce the greatest amount per acre.

It may be stated in reply that effect has been given to this suggestion during the past 14 years so far as facilities have permitted. These three wheats have all been grown at the Mirpurkhas Government farm and the seed of the two former has been distributed on a considerable scale on the Jamrao canal. In Upper Sind Pusa 12 is the most popular and a large seed farm was opened at Jacobabad in 1919 to propagate seed of this variety. The operations at this farm have been of much value.

(2) It has been suggested that in view of the changes in milling and baking practice in Europe which have taken place in the past ten years steps should be taken to ascertain which particular types of wheat have the highest commercial value under modern conditions, and the particular characteristics of such wheat.

The Director of Agriculture has recently been in consultation with the authorities at Pusa, and it has been arranged that the baking and milling tests conducted some years ago upon Pusa 12 and other Pusa wheats shall be repeated. For this purpose pure samples will be grown both at Pusa and in Sind, and these will be sent to England for baking and milling tests. These tests are to be arranged with the co-operation of the High Commissioner for India in London who, through the Trade Commissioner, is in touch with representative bodies.

(3) The Karachi Chamber of Commerce suggests that it is for the Agricultural Department to ascertain to what extent the characteristics of a good milling wheat such as No. 1 Manitoba can be reproduced in an Indian wheat. The objective should be to reproduce in Indian wheats as many characteristics as possible of the world's best wheats. Pusa 12 is understood to possess such characteristics. The Department of Agriculture in Sind is at present investigating this problem.

(4) One important point to which attention has been drawn is, that whatever wheats are evolved from early experiments should during the experimental stage be subjected to milling and baking tests. In other words, the practical

value of the wheats and not merely their productivity should be kept prominently in view. Government are alive to this necessity and are carrying out such experiments so far as the resources at present at their disposal permit.

(5) On the subject of legislation the Karachi Chamber of Commerce writes as follows: "Any suggestion on the part of Government to prevent through legislation the adulteration of produce and the mixture of crops and seeds should be supported by the commercial community. It is questionable, however, whether in practice legislation would have the desired effect. My committee is rather inclined to favour any scheme which will allow the cultivator to be taught the advantages of growing a pure article by a body of agricultural experts, who either on the spot or at specially organized Government model farms, will gradually educate them."

The difficulties of legislation on such a subject are clearly very great. In regard to the alternative suggestion, whilst it is no doubt the duty of the Department of Agriculture to persuade the agriculturist to produce a pure article, it is equally the duty of the trade to provide an incentive to him to do so by offering better prices than he obtains at present. So far as is known, although between one and two million acres of Pusa 12 wheat have been grown in India for many years past, the trade has not made any attempt to organize a special export market for it.

(6) The Bombay Chamber of Commerce considers that, as soon as new land is available for cultivation, the improved varieties should be introduced from the start to avoid mixing with older varieties. This obviously means an extension of seed supply organization.

(7) A further study of the types of wheat to be grown in Sind, with reference to the world economics of wheat, is immediately required. The world production of wheat has doubled in the last thirty years. In European countries wheat production has shrunk. Canada, Australia and the U. S. A. now export large quantities. So far therefore as the world's markets are concerned two conditions must be fulfilled:—

- (a) the wheat must be of the kind required.
- (b) it must be relatively cheap.

So far as the Indian market is concerned a further study is also needed, particularly in view of the fact that wheat is actually imported into India. These economic problems will engage the immediate attention of the Chief Agricultural Officer.

(iii) *Cotton*.—The Royal Commission has raised the question whether it is prudent, in the left bank-area, to rely on cotton only as a main crop or whether efforts should be made to find alternative money crops which can be grown successfully in this tract. The Karachi Chamber of Commerce has also expressed the opinion that it is very undesirable to increase the production of the indigenous variety of cotton commonly known as Sind cotton. Though there has never been any great difficulty in disposing of the whole crop of this cotton, it is apprehended that a further plentiful supply would not easily find a market and would have to be sold at ruinous prices. It has been suggested that the present qualities could be improved by the establishment of experimental farms, selection of the best strains by the best available experts, provision of seed growing farms and distributing centres for the supply of pure seed, prevention of mixing by licensing ginning factories, prevention of adulteration, etc., also that applications for lands from experienced farmers who would be willing to arrange for the supply of pure seed through Government agency and to experiment with various qualities will be favourably considered.

In reply to this it may be pointed out that Sind will no doubt become a very important cotton producing province under perennial irrigation, because the other conditions are very favourable to the production of heavy yields, while there are strong indications that cotton of a higher quality can be produced in Sind than elsewhere. In these circumstances a full programme

of work has been undertaken at Sakrand, and the possibilities of Egyptian and American cottons are being investigated. In addition to the process of selection the process of hybridization is being made full use of. Work on *deshi* Sind cotton is also in progress, because it has been found to be capable of much improvement, and it possesses greater powers of resistance to the severe climatic conditions that obtain than the Egyptian and American varieties do. In this connection the Punjab has found it necessary to exercise some control over the location and working of ginneries. The necessity of exercising similar control in Sind is a matter for consideration at an early date.

It is anticipated that under the new conditions the total area under cotton will rise from three hundred thousand to eight hundred thousand acres. There is however a danger that the existing variety, if increased in this proportion, would glut its own market. The world economics of cotton, like those of wheat, therefore need the closest study, before the kinds of cotton best suited for cultivation on a large scale can be determined. Among the cottons now under test at Sakrand will be found types suitable for all purposes. But in any case, it is not desirable to depend entirely on one kharif money crop, and the Department of Agriculture is considering what are the most promising alternative ones. These are probably one or more of the kharif oil-seeds such as groundnuts and soya-beans referred to in the next paragraph.

(iv) *Other Crops*.—The most likely alternative money-crops to cotton, in the kharif season, are the leguminous oil-seeds mentioned in the foregoing paragraph. Groundnuts are largely an export crop, but in several parts of India crushing is developing as a village industry. The quantity exported depends partly upon the condition of other oil-seeds such as sesamum. The groundnut crop is mainly confined at present to Peninsular India, but experiments at Sakrand indicate that it can be grown successfully in Sind. Both the Spanish peanut and the big Japanese varieties have given satisfactory yields. The world market, present and future, of this crop also needs attention.

Soya-beans have become one of the most important oil-seeds in international trade. They have been grown for centuries in the Far East, but have been imported into Europe only during the last 25 years, the first large cargo reaching England in 1909. For many years they could only be used as a source of oil owing to the bitter taste and unpleasant effects of the meal. This difficulty has now been got over, and as the soya flour is exceptionally rich in proteins it is now being used in the preparation of many forms of human food. The world's demand is accordingly increasing. Experiments conducted at Mirpurkhas have shown that yields of 10 maunds per acre can be obtained.

The Royal Commission on Agriculture has drawn special attention to berseem. This is an Egyptian crop which adds to the fertility of the soil and improves its texture. It provides a very valuable fodder and is particularly useful in connection with the reclamation of alkaline lands. Berseem can be grown luxuriantly anywhere in Sind, but seed does not set well in lower Sind. In Central and Upper Sind, however, a good sample and satisfactory yield of seed is obtainable. This crop is likely to have a large future in Sind. It is of particular value in connection with the feeding of cattle and milk animals, and in the cropping and feeding system practised at the Agricultural Research Institute, Pusa, it has a very important place.

D—Animal Husbandry—

(i) *Dairy Industry*.—The possibility of increasing the development of a dairy industry based on fodder crops grown on irrigated land is also being investigated as suggested by the Royal Commission. One of the greatest problems which will confront the agriculturist in Sind under perennial irrigation will be to find manure for his land, while the most obvious way of providing this need is through some form of stock farming such as dairying. Experiments made on the Sukkur farm show that, if land is sown with jowar in the kharif season and berseem in rabi, it will support the largest type of milch buffalo at the rate of one buffalo per acre of the best land and per two acres of inferior land.

(ii) *Cattle Supply*.—The existing supply of plough cattle in Sind is reported to be deficient both in number and quality, and it is necessary to examine its

sufficiency with special reference to the changes in cultivation as a result of the construction of the Barrage. A committee consisting of officials and non-officials, with the Revenue Officer as chairman, has been appointed to investigate the matter and to consider the measures necessary to increase the number and to improve the quality.

A contingency that may have an important bearing on the question of cattle supply is the possible extension of mechanical cultivation in the Barrage area, and this aspect will be duly considered by the committee. In the Sudan mechanical methods of cultivation have been successfully adopted on a large scale in spite of the low standard of general education and agricultural practice prevalent among the cultivators. There are peculiar difficulties in Sind, where even in the larger estates the expenses of cultivation are considered to be mainly the concern of the actual cultivator; but some of the more progressive zamindars are already experimenting in this direction, and some of the firms interested in agricultural machinery are making a closer study of the difficulties of the cultivator. This question of the adoption of mechanical methods of cultivation has been further dealt with in paragraph iii of section G of this chapter.

(iii) *Mixed Farming*.—There are several systems of farming which combine the two main branches of agriculture, namely crops and animals. The Royal Commission has suggested that a system of mixed farming might prove of much value both from the point of view of direct financial return and in its effect in promoting and maintaining soil fertility. But this last advantage will depend upon the adoption by the cultivators of sound practice in conserving and using natural manure. The Agricultural Department has this matter under consideration, and it will probably be found that dairying and sheep-breeding will most suitably fit in with crop-farming in Sind. If the personnel of the department is suitably enlarged, it will be possible to take up the work of sheep farming.

E—Water-logging and alkaline formation—

The Royal Commission has emphasized the desirability that the water-requirements of the crops which will be grown when perennial irrigation is assured should be determined as soon as possible and that from the outset investigations should be carried out with a view to ensuring that the problems which have arisen in other irrigated tracts from water-logging and alkaline formations do not appear in this tract. It attaches great importance to obtaining timely and authoritative information in regard to these and kindred matters which affect the welfare of the cultivator. These investigations are being conducted by the Agricultural Department at Sakrand as regards "Middle Sind," but similar investigations on the right bank in Western and Eastern Sind can only be undertaken when additional research stations are established. In the opinion of the Agricultural Department it is not possible to forecast water-logging and alkaline formations with any degree of certainty, unless a comprehensive and scientific survey of the soil and sub-soil is undertaken. Such a survey should not only pertain to the surface soil, but it should be carried down to the water-table or such less depth as circumstances might require. This survey would bear both on the agricultural and engineering problems, and it would provide the data necessary for their rational and economical solution. The following data would be recorded :—

- (1) the composition of successive soil-strata classified into such divisions as sand, free draining, etc.;
- (2) the thickness of each sand bar and its depth below the surface;
- (3) the quantity and composition of the alkaline salts at different depths; and
- (4) the depth of the water-table.

A scientific soil and sub-soil survey would, in the opinion of the Agricultural Department, enable the irrigation officers to determine the areas wherein water-logging may be anticipated, and the data would further make it possible to design a scientific drainage system.

The data about alkaline salts taken along with the mechanical character of the soil-strata would enable the Agricultural Department to forecast the effects of irrigation in each locality, and these forecasts would be useful in determining the allocation of irrigation water and the system of distribution

of water. Such a survey would also assist the department in dividing the country into zones suitable for special purposes, e.g., long staple cottons, soya beans, etc. The Agricultural Engineer to Government has devised a machine, fitted on to a motor lorry, for rapidly taking soil samples to a considerable depth. The agricultural and irrigation departments are in consultation as to the best way of taking and analysing the samples during the proposed survey.

A doubt has been expressed that there may be differences in soil between Sind and the Punjab which may seriously affect the project financially and that this should be ascertained for certain by the establishment of large experimental farms. Such farms cannot be opened at present for want of water facilities. In the opinion of the Agricultural Department the best way to obtain comprehensive data upon soil and sub-soil is a detailed soil survey of the nature indicated above.

F—Training of staff—

The position in regard to the adequacy or otherwise of the training of the staff which will be confronted with problems hitherto unknown is as follows. Scholarships have been given at the Poona Agricultural College to students from Sind since 1907, special rates being sanctioned owing to the extra cost of living in Poona. Owing to the lower standard of general education in Sind students who only passed the University Matriculation Examination were at the outset accepted failing suitable candidates with higher qualifications. Selections were made by the Commissioner in Sind, and a bond was taken from each scholar that if required he would work in the Agricultural Department after graduation for a period of five years. Two scholarships were awarded each year, and usually there were six Sind scholars at the College at one and the same time. In the year 1918 the tenure of these scholarships was transferred to the Punjab Agricultural College at Lyallpur, as the conditions under which training was received there approximated more closely to those prevailing in Sind. In the year 1922 they were retransferred to Poona owing to a demand by the Punjab Government that the full cost of the training of such scholars should be paid by the Bombay Government. In 1925 the number of scholars was increased to six per annum, making eighteen scholars from Sind in residence at Poona at the same time. This was done in view of the strong recommendation of the advisory committee of 1923. The Royal Commission has considered this question to be one of considerable difficulty, and has taken the view that the arrangement with the Punjab Government, whereby Sindhi candidates attended the college at Lyallpur, which was given up owing to financial disagreement, should be revived at the earliest possible date. This matter requires re-examination. The problem of agricultural education in Sind must be studied, however, not only as a question of providing the staff for a department, but as a much larger question, namely, the best way of improving the agricultural knowledge and practice of the zamindar and the peasant.

G—Expenditure on Agricultural Research and Propaganda—

The financial information contained in the July 1929 issue of this pamphlet and subsequent information are tabulated below :—

Serial No.	Name of section.	Proposed expenditure.		Expenditure incurred up to October 1929.		Remarks.
		Capital.	Recurring.	Capital.	Recurring.	
I	<i>Sakrand Station—</i>					
	As proposed by the Advisory Committee ...	Rs. (a) 1,58,400	Rs.	Rs. (b) 2,61,869	Rs. ...	(a) This is one-third of the estimates excluding the cost of land as proposed by the Advisory Committee for 8 stations.
	Completion of the equipment as per paragraph XXII on page 28 of the White Book published in July 1929 ...	84,925	(c) 5,000	...	...	(b) This consists of Rs. 1,41,192 spent by the Public Works Department and of Rs. 1,20,237 spent by the Agricultural Department.
	Further requirements ...	52,000	8,000	...	...
	Agricultural Engineering section ...	1,00,000	25,000	...	...	(c) For minor works.

Serial No.	Name of section.	Proposed expenditure.		Expenditure incurred up to October 1929.		Remarks.
		Capital.	Recurring.	Capital.	Recurring.	
		Rs.	Rs.	Rs.	Rs.	
I	<i>Sakrand Station—contd.</i>					
	Dairy section ...	20,000	15,000	...	...
	Crop Pest section ...	10,000	10,000	...	...
	Total expenditure since the inception of the scheme.	.....	.....	...	2,96,546	
II	<i>Fruit Farms—</i>					
	Mirpurkhas Fruit Farm ...	5,000	.....	...	...
	Horticultural Operations ... (Nurseries and sub-stations).	.....	10,000	...	...
III	<i>Cattle Farms—</i>					
	Willingdon Cattle Farm ...	16,000	.....	...	...
	Livestock section ...	1,00,000	60,000	...	...
IV	<i>Other Farms—</i>					
	Six demonstration Farms. (to be also seed farms).	2,50,000	4,50,000	...	...
	Research Station at Larkana ...	1,50,000	75,000	...	...
	Research Station in East Sind ...	2,00,000	1,00,000	...	...
	Depôts for seeds and implements ...	.....	1,00,000	...	...
V	<i>Propaganda Operations</i> ...	...	2,50,000	...	...
VI	<i>Agricultural Education</i> ...	7,50,000	1,50,000	...	...
VII	<i>Chief Agricultural Officer</i> ...	.....	26,700	...	...
	Chief Officer's establishment.	.....	{ 10,650 or 20,000 (e) }	...	...	(d) Staff as proposed by the Committee excluding the existing establishment of the Deputy Director and the posts of Price Inspector, Auditor and Artist, etc.
	Additional T. A. and contingencies ...	.....	8,000	...	...	(e) Staff of Chief Agricultural Officer as proposed on page 20 of the White Book published in July 1929.
	Totals (* Being redundant items are omitted from the totals) ...	17,86,925	13,07,700	2,61,869	2,96,546	

(i) Some of the schemes involve a large capital expenditure, and therefore definite continuity of policy in the interests both of economy and of efficiency is essential. The best way of achieving this would be to lay down a definite programme of operations for a period of say five years. In many cases details of the various schemes have to be worked up and only such expenditure as is required for schemes which have been actually sanctioned and approved by Government can be provided in the budget. It is, for example, impossible at present to budget for the establishment of an experimental station at Larkana [see paragraph (ii) below] where the site has not even been selected and the details of the scheme have not been worked out. Government are providing an extra expenditure of Rs. 1 lakh as a beginning in the ensuing year's estimates. This amount will be in addition to the ordinary expenditure estimated to be Rs. 1,45,000 for agricultural development of the Barrage area.

(ii) *Experimental Station at Larkana.*—The advisory committee recommended the establishment of an experimental station on the right bank of the Indus at Larkana by extending the farm at that place. This station is intended to provide for jowar and wheat and perhaps cotton as well as rice, as these crops are likely to be quite as important as rice. A capital cost of Rs. 1,50,000 will be required for expanding the present farm, while a recurring expenditure of Rs. 75,000 will be required for the staff, its allowances and contingencies including materials and wages. The establishment of demonstration and seed farms however is at present of greater urgency than the opening of further research stations.

(iii) *Agricultural Engineering.*—The Agricultural Engineering section has not yet been established. The advisory committee considered the appointment of an agricultural engineer necessary, and the application of other mechanical devices to cultivation. It recommended the appointment of an engineer on Rs. 900 to Rs. 1,250. When the scheme was started, the Director suggested that the post should be advertised. Government agreed, and this was done; but no suitable candidate was forthcoming. In order that the agricultural engineering side should not be neglected, it was decided to appoint an assistant agricultural engineer. The necessity for making the appointment of a duly qualified engineer however remains. This post will be filled after the Chief Agricultural Officer has been appointed.

Both the Bombay and the Karachi Chambers of Commerce are anxious that the possibilities of developing the extensive use of mechanical cultivation should be investigated, and a resolution stressing the advisability of the investigation was moved at the annual general meeting of the Associated Chambers of Commerce of India and Ceylon held at Bombay in December 1929. If an Agricultural Engineering section can be established in Sind, there will be no difficulty in trying out mechanical tractors on a really effective scale. It is believed that tractor companies are willing to meet cultivators by offering a hire-purchase system, but on the whole cultivators are still chary of buying the tractors outright and would rather either hire one or pay for its work. It is hoped that some enterprising land-holders will be prepared to purchase the tractors for their own use and afterwards do contract work for their neighbours. This and similar other questions will be considered, as soon as the Agricultural Engineer has been appointed.

(iv) *Dairying Section.*—Some experiments in this direction have been made at the Sukkur Farm and the results are very promising. It is considered desirable to conduct similar experiments at Sakrand.

(v) *Crop Pests Section.*—With the cultivation of a variety of crops under the new conditions it is necessary to provide against the danger of their destruction by crop pests. In order to deal with some of the crop pests like boll-worm it is necessary to collect information by local observation during different periods of the season. For this purpose it is hoped to establish a crop pests section at Sakrand.

(vi) *Equipment of the Sakrand Station.*—The equipment of the Sakrand station is not yet complete. There is at present one tube well on the farm to be used when the Sakrand dhand dries up annually for two to five months preceding the inundation. This well is normally capable of giving a discharge of 250 to 300 gallons a minute. A second well is therefore necessary, and is now under construction.

Additional expenditure is also required for the provision of engines, bullock and implement sheds, cooly lines, field implements, carts, fencing, roads, culverts, water channels, additional quarters for the staff, wheat threshing machine and cotton gin, apparatus for the chemist and botanist, e.g., gas plant, laboratory fittings, also books and furniture, photographic materials, etc.

The existing contingent and travelling allowance grants have hitherto proved inadequate.

The propaganda work is also a very important factor. The advisory committee considered that the organization of agricultural propaganda in Sind had lagged far behind the experimental work done and that the majority of the zamindars were not aware of the extent of the activities of the department. They laid stress on the point that touring parties were essential for this purpose and recommended an increased provision of Rs. 75,000 on this account. To begin with Government sanctioned a staff of six graduate and six non-graduate assistants for this work. So far the staff consists of three graduate and three non-graduate assistants and seventeen kangars. This staff is utilized in organizing parties of zamindars and taking them to Sakrand and acquainting them with the investigations that are being conducted there. It seems likely that in future demonstration farms or plots will be more suitable for propaganda purposes than a research station.

(vii) *Horticulture*.—The advisory committee laid considerable stress on the development of fruit-growing. For this purpose the Mirpurkhas fruit farm was to be solely utilized and the work placed in the hands of a specialist. Government accepted the committee's view and directed that work in connection with fruit culture should be commenced at once. A post of horticultural expert on pay at the rate of Rs. 250—20—500 was created in October 1925. The work on the farm requires to be further developed, as the possibilities of certain kinds of fruit trees in Sind, especially dates, are very great.

(viii) *Equipment of the Willingdon Cattle Farm*.—An equally important matter in connection with agricultural development is cattle breeding. The advisory committee emphasized the need for the appointment of a separate Deputy Director of Agriculture for this purpose and for the opening of farms for the Thar Parkar and Bhagnari breeds of cattle. So far the financial situation has precluded the possibility of employing a special officer in charge of cattle breeding operations in Sind. Some breeding work is at present being done on the Willingdon cattle farm near Karachi, but further development is necessary. At present the farm has to purchase its concentrates at a large cost. A large part of the farm remains to be cleared of jungle. New wells are required. The fodder resources have been left unexploited. It is also essential to provide the farm with fencing, etc. Considerable expenditure is therefore necessary to place the farm on a sounder footing. It was agreed at the conference that these proposals would form the basis of a programme on which the officer in charge of the department in Sind could at once proceed to work and that in the light of experience it could be amplified or modified.

(ix) *Demonstration Farms*.—Great stress has been laid on the necessity of adding to the research station of Sakrand a number of separate areas elsewhere to be allocated for "operational" developments. That is to say when a satisfactory research result has been obtained at Sakrand, it would then be tried out on separate demonstration farms on an "operational" basis. The Deputy Director of Agriculture has selected nine likely sites for farms which can be used for this purpose and also as seed farms. The opinion of the irrigation and revenue officers of the Barrage is being obtained regarding these sites and the soil is being examined by the Soil Physicist at Sakrand. Proposals regarding these farms will be considered shortly. As stated in Chapter III—Land Policy and Revenue—the grant of long term leases for special purposes may in part obviate the necessity of setting apart a large area for Government seed farms. The best farmers will have to be chosen for the first trials of selected varieties of seed, as failure to produce good results at first would inevitably create a prejudice against the new seed.

(x) In regard to finance the expenditure on agriculture in Sind, including the Sakrand farm, has hitherto been met out of the ordinary revenues, *i.e.*, it is included in the major head "34-Agriculture" under the control of the Honourable Minister for Agriculture. The result has been to put a severe strain on the budget in view of the increasing cost of the Sakrand Farm. The suggestion has been made more than once that the expenditure should be met from the Barrage funds. The question is under consideration, and in the meantime the provision for ordinary expenditure on agriculture in Sind, including the Sakrand farm, is being made under the major head "34-Agriculture" for the year 1930-31 while the extra expenditure of Rs. 1 lakh for further agricultural development within the Barrage area is being provided under "47-Miscellaneous".

H—Summary—

The following matters thus require decision :—

- (1) Organization of the department after the appointment of the Chief Agricultural Officer.
- (2) Consideration of the Director's requirements.
- (3) Major head under which these requirements should be financed.

V.—Forests.

(A) GENERAL DESCRIPTION.

(i) The forests of Sind, approximately 1,150 square miles in extent, lie for the most part along the banks of the river Indus from the Punjab frontier to within thirty miles of the mouth of the delta. Inland forests, as distinct from the riverain forests, are mainly in the Sukkur district and the Larkana district, while in other districts there are small outlying areas. All these forests were originally inundation forests, as the Indus floods swept unconfined over the country before the protection bunds were constructed. Such inland forests as came outside these bunds have since suffered materially, especially in the Sukkur district, since no provision could be made for the supply of canal water when the flood waters were averted. The forests which remain within the protective bunds receive an annual inundation of varying depths and duration from June to September, and they contain as a whole an excellent growth of trees.

(ii) The system of working the forests has varied from time to time until the present system of clear felling, with subsequent reboisement from seed in the case of babul and a combination of seed and coppice in the case of kandi, was adopted from about the year 1905, when formal working plans were introduced. These have been revised from time to time.

(iii) The forest growth consists of very few species of importance, as the peculiar rigours of the Sind climate preclude the growth of any but the most hardy of trees. In the winter the temperature sinks below freezing point and in the summer temperatures of over 125° in the shade are recorded. With these extremes of climate is coupled the precariousness of the water-supply: certain areas are not inundated for several years together, while the rainfall is at the best scanty and always capricious in its incidence. These in particular are the difficulties which beset any attempt to grow the more valuable species of trees. Should the vast area to be brought under irrigation in Sind affect the climate, as it may, by reducing the rigours of the winter and raising the sub-soil water level, it is possible that the composition of the forests will change considerably.

(iv) The major portion of the produce of the Sind forests is fuel, babul being excellent for this purpose, kandi and tamarisk very fair. Babul also furnishes a very good timber, but the demand is not great, as it is very heavy and hard to work. Tali gives an excellent, though heavier, timber. Bahan and kirir (*Capparis aphylla*) yield small rafters and the former also a light wood very suitable for turnery. The principal markets for fuel and charcoal are Karachi and Quetta, and the export overseas to the Persian Gulf, Kathiawar and even so far as Egypt is considerable.

(v) Grazing, relatively to the number of cattle in Sind, is of small importance. Most of the cattle grazed belong to professional graziers, or maldars, and only a small proportion belongs to the villages in the vicinity of the forests.

(vi) The rate ordinarily payable by the Forest Department to the Irrigation Department for a regular supply of water from an existing canal is Rs. 1-8-0 per acre of forest irrigated. Surplus water which is occasionally available for forest lands is generally free of charge.

(vii) The forest area actually irrigated varies very greatly from year to year according to the flood levels of the river, *i.e.*, whether the full supply level is maintained on the canals, and whether the Irrigation department can spare water for the forests.

(viii) The existing forests are far in excess of the present needs of Sind for fuel and timber. Sind is a fuel-exporting country, and when the export trade is poor, large stocks remain on the hands of merchants, there being no local demand to absorb them. The grazing area is more than ample.

(B) THE FUTURE OF THE SIND FORESTS.

It is necessary now to examine the point whether the existing forests will be adequate to supply the needs of the future under the new conditions, i.e., whether further land should be taken up or whether land can be relinquished for cultivation. Under this head the following four schemes require consideration :—

1. Afforestation in Thar Parkar District.
2. The Ghotki Canals Project.
3. The Begari Canal Remodelling Project.
4. The Barrage Project.

1. *Afforestation in Thar Parkar.*—There are large areas along the Mithrao Canal, admeasuring in the aggregate nearly 50,000 acres, which have been notified under section 4 of the Indian Forest Act, 1878, since 1891. They are under the control of the Collector of Thar Parkar. Proposals have been put forward from time to time by the Forest department for their final notification as reserved forests, but they have not materialised so far, and it is possible that such large areas will not all be required for forest. These areas will all come within the Barrage zone.

2. *The Ghotki Canals Project.*—This scheme affects the whole of the inland forests of the Sukkur District on the left bank of the river. These areas, which years ago were subject to river floods from which the river bunds now shield them, are at present little more than scrub jungle. In order to make the Ghotki Canals project a paying scheme a large tract out of these forests will have to be disafforested. The arguments against the wholesale disafforestation arise from the necessity for an adequate fuel supply and for ample grazing ground for cattle. The revenue from these forests is not insignificant. Under proper irrigation they would yield many times the present revenue, and it is very likely that the market will absorb all that they could supply. The forest areas will have therefore to be carefully surveyed and only such land should be disafforested as is of good quality for cultivation except where the existing blocks will be so reduced in area as not to justify their retention as forest land. At the same time the local needs of fuel and grazing will have to be ascertained.

3. *The Begari Remodelling Project.*—(i) In the year 1919 Mr. G. M. Ryan, a retired Deputy Conservator of Forests, submitted a note in which he urged the formation of an artificially irrigated timber, fuel and fodder reserve at Kot Sultan in the Sukkur Forest division similar to that which had already been established at Changa Manga in the Punjab. According to him the main advantages of the plantation would be :—

(a) Regular and good supplies of fuel, especially for the Military Department in Baluchistan.

(b) Surplus stocks of fuel for transmission to Quetta and surrounding stations for domestic consumption, thereby relieving the pressure on the forests and waste lands of that mountainous region which was becoming more and more denuded by virtue of the demands made on it.

(c) Supplies of timber and fuel for domestic consumption and the agricultural needs of Sind.

(d) The climatological aspects of the country would be immensely improved.

The irrigation of this forest area depended upon the materialisation of the right bank canal system of the Barrage project and more particularly on the two canals which were additional to the original project, namely, the Begari branch of the Rice Canal and the Khirtar branch. It was realized that with the development of Upper Sind under the Barrage fuel and timber would be needed in the country. Looking to this and to the other advantages of the scheme and to the possibility of water being made available Government approved the formation of a plantation at Kot Sultan in the year 1921. In the

following year they sanctioned the distribution of land in the following areas of the Kot Sultan Forest and the neighbouring forest of Garhi Yasin:—

Forest.	Area for which a guaranteed supply was to be made available from the Khirtar Canal.	Area for which surplus water was to be made available.
	Acres.	Acres.
Kot Sultan	11,000	7,056
Garhi Yasin	Nil	14,100

The rate chargeable to the Forest Department for the guaranteed supply of water in these areas was fixed at Rs. 2 per acre and that for surplus water at Rs. 1-8-0.

(ii) In the year 1927 the scheme for a Begari Rice branch *ex* the central rice canal was abandoned, and the whole of the existing Begari inundation canal was ordered to be remodelled. The preparation of the plans and estimates of this remodelling project was entrusted to the Barrage establishment. It was then proposed that a considerable area of the forest land should be disafforested, not merely in order to make this remodelling project financially productive, but also because it had long been a local grievance that so much of the land had originally been put under forest. The whole area would not have been declared forest, but for the fact that there was no sufficiently assured water-supply to allow of cultivation. The remodelling project would remove the insufficiency of the water-supply, and consequently the demand that some of the land should be disafforested and made available for cultivation was revived. Accordingly discussions took place, and it was proposed that the Forest department should give up an area of about 4,379 acres of good land and 1,569 acres of third class land from the Kot Sultan forest and 3,431 acres of third class land from the Garhi Yasin forest. The question of this disafforestation is still under consideration. When the remodelling project has materialised, 11,000 acres of forest land in Sind will be given an assured supply of water at a rate which will probably be Rs. 2 per acre, and 15,429 acres will receive surplus water free of charge.

4. *The Barrage Project.*—(i) This is the most far-reaching of the four schemes. Nearly one-quarter of the existing forest area in the Barrage area will receive the benefits of canal irrigation, when this project is completed. The forest areas are comparatively small and the quantity of water required for their irrigation will not therefore be large. The supply will be equivalent to a foot-depth over the forests during the months of May to September, while during the remaining months there will be sufficient surplus water in the canals to permit of heavy floodings being given to the forests whenever and wherever required.

(ii) If these anticipations are realised, the forests in this zone will be amply sufficient for the fuel, timber and grazing needs of the area in future. Should the inundation forests not receive their anticipated flood water and any unforeseen water-logging of irrigated forests occur or the anticipated future yield of these forests not result, disforestation of the existing forest area will not be permissible. While it is not considered necessary, when irrigation is given, to add to the forest area, it is advisable, where possible, to plant strips on the canal banks, not merely to supplement the supply but to improve its accessibility and distribution. The problem of providing plantations in different parts of the country to be irrigated by canal water was considered by the Royal Commission on Agriculture. Their recommendations are now being considered by the Revenue Officer of the Barrage in conjunction with the Conservator of Forests, and will then be referred to the standing committee mentioned in the following chapter.

(C) SUMMARY.

The existing forests in Sind are considerably in excess of its present needs as regards fuel, timber and grazing facilities. They contain, apart from

supplies from private "huris", zamindari lands, Government waste lands and from Khairpur and Bahawalpur States, a large margin to meet expansion in the future. In order to reap the advantage of the irrigation projects and at the same time to make them pay, it will be necessary, especially in connection with the Ghotki and the Begari Remodelling projects, to disafforest some of the land and bring it under cultivation. This policy must, however, be pursued with discrimination in order to supplement the supply of forest produce and grazing grounds, so as to ensure that any larger demand which may be anticipated as a result of the development under the Barrage will be adequately met.

VI.—Administration.

(i) All the districts in Sind, except Karachi, are directly affected by the construction of the Barrage, inasmuch as the new canals will flow through them. The Upper Sind Frontier District and the Sukkur District will only be affected to a small extent, but in Larkana, Nawabshah, Hyderabad and Thar Parkar the very large areas that will become available for cultivation will throw a very heavy additional burden upon every branch of the administration. Accordingly the question of the creation of new districts and talukas has for some time been under the consideration of the Commissioner in Sind in close consultation with the Chief Engineer of the Barrage and the Revenue Officer, and a comprehensive scheme indicating the eventual requirements was submitted to Government in 1928. Briefly summarized, the scheme contemplates the creation of two new districts to be named Dadu and Guni, the former on the right bank of the Indus and the latter on the left bank, and ten new talukas. The Province, as so organized, would be constituted as under :—

	Talukas.
<i>Upper Sind Frontier</i> (2 sub-divisions): Jacobabad, Garhi Khairo,* Thul, Kandbhkot, Kashmir.	5
<i>Sukkur</i> (3 sub-divisions): Sukkur, Shikarpur, Garhi Yasin, Rohri, Pano Akil, Ghotki, Mirpur Mathelo, Ubauro.	8
<i>Larkana</i> (2 sub-divisions): Kambar, Shahdadkot, Miro Khan, Larkana, Rato Dero, Labdarya.	6
<i>Dadu</i> (2 sub-divisions): Warah, Sita,* Mehar, Kakar, Dadu, Sehwan, Johi.	7
<i>Nawabshah</i> (2 sub-divisions): Kandiaro, Naushahro, Moro, Pad Idan,* Daur,* Kazi Ahmed,* Nawabshah, Sakrand.	8
<i>Hyderabad</i> (3 sub-divisions): Shahdadpur, Hala, Tando Adam,* Hyderabad, Tando Allahyar, Kotri, Manjhand, Kohistan.	8
<i>Guni</i> (2 sub-divisions): Guni, Tando Ghulam Ali,* Dero Mohbat, Talhar,* Tando Bago, Jhudo,* Badin, Digri.	8
<i>Thar Parkar</i> (3 sub-divisions): Sinjhor, Mirpurkhas, Jamesabad, Samaro, Shadi Pali,* Khipro, Sanghar, Umarnkot, Mithi, Diplo, Chachro, Nagar Parkar.	12
<i>Karachi</i> (2 sub-divisions): Karachi, Tatta, Mirpur Sakro, Ghorabari, Mirpur Bathoro, Sujawal, Jati, Shahbandar.	8

(ii) The estimated average annual cost of the new revenue establishments required for the new districts and talukas was calculated at Rs. 6,10,060, and a rough estimate of the cost of the revenue buildings required was Rs. 10,35,000. Government accepted in principle the necessity for two districts, but inasmuch as the development of the lands to be commanded by the Barrage canals must be the work of years, they took the view that it was not necessary to create the two districts and all the extra talukas simultaneously, but that the work should be taken in hand gradually. Accordingly the Commissioner in Sind was requested to submit a revised programme which was to include provision for the Police. This Government have now received. It is proposed that the new district on the right bank shall come into existence on April 1st, 1931, in view of the fact that the canals in that area are expected to be in working order in the following year. In connection with this scheme it is proposed to create only one new taluka for the moment, i.e., at Garhi Khairo in the Upper Sind Frontier District.

* New talukas.

The following is a summary of the cost of the buildings, both revenue and police, required for the execution of this scheme, provision for which has been made in the budget for the year 1930-31. For the purpose of these estimates it has been assumed that the headquarters buildings will be erected at Dadu:—

<i>Headquarters.</i>				Rs.
Collector's kacheri	...	...	...	2,00,000
Collector's bungalow	...	...	...	40,000
<i>Garhi Khairo.</i>				
Taluka kacheri	...	...	...	85,000
Total				3,25,000
Land compensation				12,000
Total				3,37,000

As a measure of economy it has been decided for the present not to proceed with the construction of a Treasury kacheri at Jacobabad, which was estimated to cost Rs. 40,000.

Headquarters Police Buildings.

				Rs.
District Superintendent's bungalow...	...	...	...	10,000
District Superintendent's office	...	...	...	19,000
Deputy Superintendent's bungalow and office	...	...	...	20,000
Headquarters Lines	...	...	...	3,30,000
Quarters for four Sub-Inspectors	...	...	...	30,000
Total				4,09,000
Police Lines at Garhi Khairo	...	...	...	15,000
Total				4,24,000

It is however estimated that only Rs. 4 lakhs will be spent on the police buildings in 1930-31. And consequently a provision of Rs. 7,37,000 for the construction of both revenue and police buildings has been entered in the budget estimates of that year.

(iii) The question of the location of the headquarters of the new district has been the subject of a lively controversy, the claims of Sehwan having been advanced in opposition to those of Dadu. The matter came before the Legislative Council on July 31, 1929, when Mr. Pahalajani moved the following resolution:—

“This Council recommends to the Governor in Council that in the readjustment and redistribution of districts due to the construction of the Barrage the headquarters of one of the proposed new districts be fixed at Sehwan.”

The resolution was withdrawn on an assurance being given by Government that public opinion would be consulted as to the location of the headquarters. Steps were at once taken to this end, and the Commissioner in Sind published a memorandum explaining the points at issue and asking for the opinions of public bodies and individuals. These were received in October last. The

Taluka Local Boards of Sehwan, Johi, Warah, Kakar and Mehar and the Municipalities of Sehwan and Bubak expressed a preference for Sehwan, whilst the Taluka Local Board of Dadu and the Notified Area Committees of Dadu, Mehar and Khairpur Nathan Shah expressed a preference for Dadu. The Manjhand Municipality stated its aversion to the incorporation of the mahal in a new district with headquarters at Sehwan. The views of individuals were more or less evenly divided. All officials, whose opinions were on record were, with the exception of one former Collector of Larkana, found to be in favour of Dadu.

The arguments advanced in favour of Sehwan are :—

- (1) its past history ;
- (2) its sanctity ;
- (3) its attractiveness ;
- (4) its immunity from flooding.

Those in favour of Dadu are :—

- (1) its superior climate ;
- (2) its immunity from flooding ;
- (3) its large spaces available for the erection of new Government buildings ;
- (4) its position as a Railway and Irrigation headquarters ;
- (5) its central position.

After the most exhaustive consideration Government have come to the conclusion that Dadu is the preferable place. It is true that from the historical and picturesque point of view Sehwan stands easily first, but these are unimportant factors compared to those of space available, healthiness, and immunity from flooding. Every possible site for Government buildings at Sehwan has been examined, and the only one in any way suitable lies to the west of the town bounded by the Railway embankment, the Aral River, an old disused road to the south-west, and the town itself. It is however very low lying, unhealthy, and admits of no expansion. That the climate of Sehwan is one of the severest in Sind is well known, since it is the first place to become hot in the spring and the last place to cool down in the autumn. Moreover the famous Lal Shahbaz fair attracts enormous crowds every year, and such a congregation of people may easily become a menace to the public health. In regard to flooding the opinion of the Irrigation officers is that Sehwan is more liable to flooding than Dadu, that in any case the danger is much closer, and that a considerable additional expenditure on buildings would be necessitated by the provision of much higher plinths than are normally required. Another important objection to Sehwan is its situation in respect to the remainder of the proposed district. That its supporters realized this is shown by the fact that they suggested the incorporation of the Manjhand Mahal into the new district in order to give Sehwan a more central position. There is however no real affinity between Manjhand and Sehwan ; they are separated by the Laki hills, and their communications are practically confined to the Railway. The communications between Sehwan and the rest of the world, both to the north and to the south, are in fact very poor.

By comparison the advantages of Dadu are considerable. The climate is certainly less strenuous than that of Sehwan, the town is a healthier one, the river Indus is at a greater distance, and there is ample space not only for building the new headquarters, but for expanding them to any reasonable extent. Dadu is a Railway headquarters. It is already an Irrigation headquarters, and there are obvious advantages, especially when a new irrigation system is being introduced, of the Executive Engineer being in close touch with the Collector. Dadu is in a more central spot than Sehwan, and numerous roads from all directions lead to it.

On all essential grounds therefore Government hold that the balance of advantage lies with Dadu.

(iv) When it is decided to create the new district on the left bank, the following headquarters buildings will be required:—

	Rs.
Collector's kacheri and treasury	2,00,000
Three District Deputy Collectors' bungalows	50,000
One District Superintendent of Police's bungalow	35,000
One District Superintendent of Police's office	19,000
One Deputy Superintendent of Police's bungalow and office.	20,000
Headquarters Police Lines	2,87,600
Total ...	6,11,600

Further, the creation of eight new talukas in the three districts of the left bank will involve an expenditure on buildings of Rs. 8,50,500. The total expenditure on buildings will be Rs. 14,62,100, and the recurring expenditure on establishments will be:—

	Rs.
Revenue establishment	3,40,446
Police establishment	1,06,000

(v) There does not appear to be any necessity to make any far-reaching changes in the present system of the administration of Sind. It has, however, been decided to set up two committees in the province, one a standing committee consisting of officials and the other an advisory committee consisting of non-official gentlemen, to assist Government in the prosecution of the Barrage scheme. The standing committee consists of the following officers:—

Chairman.

The Commissioner in Sind.

Members.

The Chief Engineer, Lloyd Barrage and Canals Construction.

The Revenue Officer, Lloyd Barrage and Canals Construction.

The Chief Agricultural Officer in Sind (when appointed).

The Deputy Financial Adviser, Lloyd Barrage and Canals Construction.

The Conservator of Forests (Sind Circle) (when questions concerning the Forests are under consideration).

The object with which this committee has been appointed is that any major proposals affecting the project or requiring the orders of Government may reach Government in a form giving the considered opinions of all the local heads of the responsible departments. The committee has accordingly been instructed to deal with:—

(a) all matters of importance in which action taken in the Barrage area is likely to affect Government policy or administration outside that area or *vice versa*;

(b) all matters of importance in which action taken by one of the Barrage departments is likely to affect the working of another of the Barrage departments;

(c) all financial considerations arising out of (a) and (b) *supra*;

(d) all suggestions and recommendations submitted by the advisory committee.

The advisory committee consists of 12 non-official gentlemen, 8 from Sind and 4 from the Presidency proper. Its functions are (1) to advise Government generally on all matters connected with the Barrage project and (2) to offer advice on any matter referred to it by Government or by the standing committee. It will hold a joint meeting with the standing committee at least once a year and more often if required. The members of the committee will hold office for a term of 3 years.

(vi) *Summary.*—The following matters thus require decision:—

(1) Creation of a new district at Dadu in 1931.

(2) Subsequent creation of a new district on the left bank of the Indus.

VII.—Finance.

(A) BASIS OF CALCULATION AND FUTURE COST.

It is anticipated that the Barrage will be completed in 1932 and the canal-system dependent upon it in 1934. So that up to and including that year there will be heavy capital expenditure both upon the project and upon its consequent developments. And that expenditure will be in excess of the receipts from land sales. These calculations are therefore based upon the assumption that repayment of the money borrowed for this scheme will not be begun until 1935. This date will also coincide with a change in the provincial debt position, as it is in this year that the $6\frac{1}{2}$ per cent. Development Loan falls due for repayment, and it is hoped that some reduction in interest charges will be effected by funding it at a lower rate of interest. The rate of interest charged by the Government of India on borrowings in 1929-30 for productive expenditure is $5\frac{1}{2}$ per cent., and this has been taken as the probable cost of borrowings in later years.

(B) FINANCIAL EFFECT OF DATA PRESENTED UNDER OTHER HEADS.

It will be convenient if an attempt is made at this point to summarise the financial effect of what has been presented in the preceding sections of this memorandum.

(i) *Loan-money borrowed for main project including interest.*—In the irrigation section it has been stated that the latest estimate is that the whole project will cost Rs. 20,03 lakhs. Of this Rs. 63 lakhs are indirect charges, namely, pensionary liabilities and land revenue abatement, and Rs. 19,50 lakhs are direct charges for which Government borrow. This is the cost exclusive of the interest charges on the money which has been or will have to be borrowed for the project. Nearly Rs. 10 lakhs per annum of the interest charges have been provided from other sources, mainly from the famine fund excess. After allowing for this it is estimated that the amount borrowed for the direct charges up to the end of 1934-35 will be Rs. 25,25 lakhs (see Appendix A).

(ii) *Lower Sind Canals.*—The liability in sight on account of commitments to landholders in respect of canals in Lower Sind, whose water-supply will be reduced by the construction of the Barrage, amounts to Rs. 1,13 lakhs and works to that extent should be completed by 1934-35. On this account a provision of Rs. 16 lakhs has been made in the budget estimates of 1930-31. This does not include Rs. 125 lakhs, required for canals north of the sphere of the Barrage, and so unaffected by it, and Rs. 26 lakhs for the Mekrani Canal Project, which, although it is in Lower Sind, is not a commitment and need only be taken up on the basis of its merits as a productive project.

(iii) *Agriculture.*—Under this head the proposed expenditure and that hitherto incurred are as follows:—

Proposed expenditure.		Expenditure incurred up to October 1929.	
Non-recurring.	Recurring.	Non-recurring.	Recurring.
17.4	13.1	2.6	3.0

The figures of recurring expenditure include no provision for repairs to or replacement of the various buildings and other items included under non-recurring expenditure. The proposed expenditure on seed-farms and depôts for agricultural requisites will be largely set off by receipts. At this stage no estimate has been made of these. But the provision made in the financial statement for agriculture is throughout for net expenditure.

The provision for the Agricultural department in the budget estimates for 1930-31 is Rs. 18½ lakhs for the whole Presidency under the head "34, Agriculture" of which Rs. 1½ lakhs are for agricultural development in the Barrage area. And a lump-sum of Rs. 1 lakh has been provided for further agricultural development in Sind. As full details of the way in which it is

proposed to spend this money are not yet ready, the provision has been made under the head "47, Miscellaneous—Transferred", and a supplementary demand will be presented to the Legislative Council when detailed proposals are available.

Provision has been made in the financial forecast for Rs. 4 lakhs non-recurring expenditure in the course of the next four years plus Rs. 1½ lakhs recurring expenditure worked up to in the course of the next four years, and for Rs. 6 lakhs non-recurring spread over six years from 1935-36 onwards plus Rs. 4 lakhs recurring worked up to in the course of eight years. Recurring expenditure on the agricultural department in the Barrage will then amount to Rs. 7 lakhs per annum.

(iv) *Administrative*.—The new district on the right bank of the Indus is to come into existence on April 1st, 1931. On this account Rs. 7.4* lakhs of non-recurring expenditure have been provided in the budget estimate of 1930-31 for the revenue and police departments, and a recurring cost of Rs. 2½† lakhs per annum will have to be provided in the budget estimates of 1931-32 and succeeding years.

The district on the left bank and the eight new talukas will be required later, and it is estimated by the Commissioner in Sind that their revenue and police departments will cost nearly Rs. 15 lakhs non-recurring and Rs. 4½ lakhs per annum recurring. It is difficult to estimate when these developments will be required. For the purpose of this financial forecast the expenditure has been estimated as follows:—

Year.	(In lakhs of rupees.)	
	Non-recurring.	Recurring.
1935-36	5½	...
1936-37	4	1½
1937-38	3	2½
1938-39	2	3½
1939-40	½	4½ + ‡
Succeeding years	...	4½ + ‡

In short, the estimates show that the annual cost on this account may be taken as about Rs. 5½ lakhs per annum from 1935-36 onwards. They provide only for the revenue and police departments.

(v) *Roads*.—As already stated on page 12 above a P. W. D. officer was specially appointed to deal with this subject. And he has reported that Rs. 321 lakhs' worth of roads are necessary in the Barrage area and that a further Rs. 130 lakhs' worth should be constructed "when funds are available". He has estimated entirely for surfaced roads. Sind has had practically no surfaced roads up to the present time. During the five years 1924-25 to 1928-29 the average annual expenditure on new roads of any kind in Sind was Rs. 1½ lakhs, and the highest expenditure to date on repairs to all roads in Sind was just over Rs. 2 lakhs in the year. So that, when Government are asked to embark upon a scheme of new roads to cost Rs. 321 lakhs in the near future and a further Rs. 130 lakhs later, they need to have very clear and substantial justification for such a scheme before they even consider the question of the ways and means for financing it. Government have, for instance, to consider what is going to be realised in increased or improved land-sales in return for making surfaced roads at a cost of about a quarter of a lakh of rupees per mile plus not less than five to seven hundred rupees per mile per annum in repair charges. It seems possible that all that may be necessary, at this stage, is to determine the alignment of trunk roads, set apart land for them, and provide for the building of essential bridges along their routes. Other expenditure on roads which may be considered desirable on more general grounds must be left for consideration in later years and

* Rs. 9.1 lakhs including establishment and tools and plant charges (see entry in Appendix B).

† Establishment Rs. 2,82,000 plus repairs Rs. 40,000.

‡ For repairs to Rs. 15 lakhs' worth of buildings.

after Government have more reliable information as to the revenue available. The whole question of communications will require further general consideration, and the standing committee will prepare a complete report on the subject. For the present a provision of Rs. 5 lakhs per annum, worked up to over a period of ten years, has been included in Appendix B.

(C) MATTERS WHICH ARE OF FINANCIAL IMPORTANCE BUT WHICH HAVE EITHER NOT YET BEEN SETTLED OR NOT YET ESTIMATED FOR.

(i) *Recoupment of cost of sections in Baluchistan and Khairpur.*—Terms have yet to be arranged with the Government of India regarding the Khirtar branch in the Nasirabad tehsil in Baluchistan. A settlement which it is understood the Government of India are likely to favour is that they should reduce this Government's debt to the extent of the cost of the branch and should then take the receipts less the cost of management. Before coming to a final decision the Government of India have asked for further information, which is being collected for them. It is estimated that this branch will have cost Rs. 58 lakhs exclusive of interest. A similar question has to be settled with the Khairpur State in regard to its share of the cost of the Lloyd Barrage. That share has been calculated at Rs. 26 lakhs exclusive of interest charges. Credit for the latter has already been taken in framing the figures of direct charges in Appendix A. And on account of the former the figure taken in Appendix B as the basis of equated repayments is Rs. 75 lakhs* less than the final figure in Appendix A.

(ii) *Water Courses.*—Government will have to incur an additional cost of Rs. 156 lakhs on account of water courses and rectangulation charges. In so far as new lands are concerned such charges will be recovered as part of the occupancy price. But as indicated in paragraph 1 (v) of section I about three-fourths of the land concerned consist of land already occupied. And, as there stated, an amendment of the Irrigation Act to provide for the recovery from existing owners of the cost of water courses and rectangulation charges is under consideration. Assuming that such legislation will be accepted the money will be borrowed on the one side and recovered, with interest, on the other side. It has, therefore, not been entered in the financial statements.

(iii) *Local Fund Cess.*—It has been the practice to recover local fund cess in addition to the sale price of all lands sold throughout the Presidency. In the past this has not involved large sums. But when the figures of realisations from land sales were framed as an integral part of the justification of this project, no allowance for this was made. Obviously a very large sum of money is involved, and the legal position has, therefore, recently been examined. The Advocate General has given it as his considered opinion that local fund cess is not leviable under the statute on ordinary land-sales. Government have accepted this opinion, and these funds will be available for administrative purposes and for the general development of the area.

(iv) *Additional Establishments.*—In the administrative section (vi) the probable cost has been stated of the additional revenue and police establishments which will be required in the two new districts and the eight new talukas in the three districts on the left bank. Those areas will also require some additions to the existing establishments in other departments, e.g., judicial (Rs. half a lakh per annum has been provided from 1930-31 onwards for a new District Judgeship at Nawabshah and a Resident Magistrate at Dadu; later some sub-judicial expansion will be required), medical, etc., and considerable sums will be required for grants to local bodies, particularly for education. And, apart from these charges, there will obviously be considerable sums required for public works establishments. The additional irrigational establishments which will be necessary are included in the larger head of "working expenses" for which separate provision has been made in Appendix B. The Roads and Buildings branch of the department will also need additional establishment. But it is difficult yet to estimate either for this or the other relatively small

* Rs. 58 lakhs plus interest charges in the same proportion as the debt outstanding on 1st April 1935 for the whole project will bear to its prime cost.

establishments mentioned above. Their cost will, however, be comparatively small. For educational grants the figure has been put at about Rs. 5 lakhs per annum. But this cannot, of course, be taken as an accurate estimate, and it will be many years before that figure is worked up to.

(v) *Famine Fund Excess*.—Under Schedule IV to the Devolution Rules, as amended in 1928, the Famine Assignment and the Famine Fund proper can only be spent upon the relief of famine. And famine prevention works, such as the Lloyd Barrage, can only be financed from the excess of the accumulated balance in the Fund on 1st April 1928. This year Rs. 22 lakhs of the interest on borrowings for this project are being met from that excess. At the end of the current year the famine fund excess is estimated to amount only to about Rs. 28 lakhs. The present value (at $4\frac{1}{2}$ per cent., which is the rate of interest which Government receive on the famine fund balance) of Rs. 10 lakhs per annum for only the five years 1930-31 to 1934-35 is Rs. 44 lakhs. For expenditure, other than Barrage interest, Government have this year provided nearly Rs. 29 lakhs from this source. These purposes include gratuitous relief in Sind (Rs. 6 lakhs), repairs to irrigation works in Sind damaged by floods (Rs. 4 lakhs) and various other measures for the prevention of famine (Rs. 19 lakhs). It is obvious that Government cannot continue to provide Rs. 10 lakhs per annum from this source for Barrage interest. For this reason this amount has been provided from revenue in the budget estimates for 1930-31. It will be set off by an equal amount expected to be realised from sales of land in the Barrage area. The provision of this interest from revenue will have the same effect on the finance of the project as if it were provided from the famine fund excess.

(vi) *Betterment Tax*.—This matter is under examination, but definite proposals have not yet been framed.

(D) FINANCIAL SUMMARY.

Appendix A shows the sums borrowed or to be borrowed for the main project, including borrowed interest.

The total irrigational expenditure may be summarised as at 1st April 1935 as follows:—

	Lakhs of rupees.
Outstanding debt for Lloyd Barrage and Canals Construction.	25,25
Less—Amount to be paid by the Government of India	... - 75
Outstanding debt for Lower Sind Canals	... 1,30
Capitalised value of working expenses up to fifty years from 1935-36	... 6,60
Total	... 32,40

This includes no provision for the agricultural experiments necessary for the project nor for any other expenditure other than that on the Barrage and canals.

Appendix B is a summary of probable expenditure. The first item is the provision necessary for the repayment, by equated instalments spread over fifty years, of the sum shown in Appendix A as outstanding debt at the end of 1934-35, less Rs. 75 lakhs which the Bombay Government expect to recover from the Government of India on account of the section in Baluchistan. The second item is the provision necessary to repay on the same basis the money borrowed for the construction of the Lower Sind Canals. The remaining items have already been explained.

Figures of realisations, both from land-sales and from increased land revenue, were framed when the project was inaugurated. Government are having a fresh examination made of these figures, and, when this scrutiny has been completed, a further report on this aspect of the project will be published.

VIII.—Conclusions.

This memorandum has been prepared in order to state in a connected form the existing situation and the various problems that await solution in connection with the development of Sind under Barrage conditions. Briefly summarized they are as follows :—

(i) In regard to irrigation a radical amendment of the Bombay Irrigation Act will be required, and it will also be necessary to legislate for recovering from the holders of land the cost of constructing water courses and that of the rectangulation survey. A settlement has to be reached with the Government of India and the Khairpur State in regard to the recovery from them of the cost of the canals, etc., constructed for their benefit. The canals of Lower Sind require remodelling in accordance with the undertakings given by Government in 1923 and subsequent years, in order to counteract the possible adverse effect on their working by reason of the construction of the Barrage. This work is already in hand.

(ii) A programme for the extensions of railways, roads and communications as a whole has to be worked out.

(iii) Modifications of the policy of disposing of land will have to be considered as suggestions are put forward. In the immediate future the area to be set apart for long leases and the terms upon which they are to be granted are to be settled.

(iv) The reorganization and the development of the Agricultural department consequent on the appointment of a Chief Agricultural Officer require immediate consideration. The strengthening of the directing staff is needed, and the suggestions of the Royal Commission on Agriculture and of the Karachi Chamber of Commerce and other public bodies for agricultural improvements have to be considered. The Director's programme of requirements has to be further examined and the method of financing it determined.

(v) The question of disafforestation of some of the land at present held as forest and of bringing it under cultivation will have to be considered.

(vi) The provision of funds for the establishment of a new district on the right bank of the Indus has to be made. When this district has been created, the question of creating a new district on the left bank will require consideration.

(vii) It is for consideration whether legislation should be undertaken providing for the levy of a betterment tax to cover part of the cost of development and administration in the Barrage area.

APPENDIX A.

Borrowings for the Lloyd Barrage and Canals Construction.

(in lakhs of rupees.)

	1930-31	1931-32	1932-33	1933-34	1934-35
(1) Outstandings at the beginning of the year.	18,75	17,19	20,00	22,19	23,99
(2) Borrowings in the year for direct charges excluding interest.	2,80	2,00	1,25	75	12
(3) Interest for the year [interest on (1) and half year's interest on (2)].	74	91	1,04	1,15	1,24
(4) Interest met from revenue ...	10	10	10	10	10
(5) Outstandings at the end of the year ...	17,19	20,00	22,19	23,99	25,25

APPENDIX B.

Forecast of Expenditure.

(In lakhs of rupees)

	1930-31	1931-32	1932-33	1933-34	1934-35	1935-36	1936-37	1937-38	1938-39	1939-40	1940-41	1941-42
Repayment of borrowings for the main project.	...	...	...	...	...	145	145	145	145	145	145	145
Repayment of borrowings for the Lower Sind Canals.	...	...	...	...	...	7.7	7.7	7.7	7.7	7.7	7.7	7.7
*Working expenses	...	...	...	12.6	16.5	20.3	23.8	27.0	28.2	29.1	30.0	30.8
Agriculture—												
Non-recurring	1.0	1	1	1	...	1	1	1	1	1	1	...
Recurring	...	0.5	1	1.5	1.5	2	2.5	3	3.5	4	4.5	5
Administration—												
Non-recurring	0.1	...	...	...	...	5.5	4	3	2	0.5	...	...
Recurring	...	3.5	3.5	3.5	3.5	3.5	5	6	7	9	9	9
Education	...	...	...	...	...	...	...	0.5	0.5	0.5	1	1
Roads	...	1	1.5	2	2.5	3	3.5	4	4.5	5	5	5
Total	10.1	6	7	20.6	24	28	29.5	27.2	29.4	30.8	30.8	30.5

	1943-43	1943-44	1944-45	1945-46	1946-47	1947-48	1948-49	1949-50	1950-51	1951-52	1952-53	1953-54
Repayment of borrowings for the main project.	145	145	145	145	145	145	145	145	145	145	145	145
Repayment of borrowings for the Lower Sind Canals.	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7
*Working expenses	31.7	33.4	33.2	34.0	35.0	36.0	36.8	38.0	39.2	40.5	41.9	43.3
Agriculture—												
Non-recurring	...	...	...	...	...	...	...	...	...	...	...	...
Recurring	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Administration—												
Non-recurring	...	...	...	...	...	...	...	...	...	...	...	...
Recurring	9	9	9	9	9	9	9	9	9	9	9	9
Education	1	1.5	1.5	1.5	2	2	2	2.5	2.5	2.5	3	3
Roads	5	5	5	5	5	5	5	5	5	5	5	5
Total	204.9	206.1	206.9	207.7	208.9	210.2	211.0	212.7	213.0	215.2	217.1	218.5

	1954-55	1955-56	1956-57	1957-58	1958-59	1959-60	1960-61	1961-62	1962-63	1963-64	1964-65
Repayment of borrowings for the main project.	145	145	145	145	145	145	145	145	145	145	145
Repayment of borrowings for the Lower Sind Canals.	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7
*Working expenses	44.4	45.8	47.2	48.5	50.6	50.6	50.5	50.6	50.6	50.8	50.8
Agriculture—											
Non-recurring	...	...	...	...	...	...	...	...	...	...	...
Recurring	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Administration—											
Non-recurring	...	...	...	...	...	...	...	...	...	...	...
Recurring	9	9	9	9	9	9	9	9	9	9	9
Education	3	3.5	3.5	3.5	4	4	4	4.5	4.5	4.5	5.0
Roads	5	5	5	5	5	5	5	5	5	5	5
Total	219.6	221.5	222.0	224.8	228.8	228.8	228.8	227.3	227.3	227.3	227.8

* This item represents the additional working expenses on the Barrage canals, in excess of that now incurred. The remodelling of the Lower Sind Canals should not involve any increase in their working expenses.

APPENDIX C.

Summary of the principal recommendations of the report on the Lloyd Barrage and Canals Project in Sind by Sir M. Visvesvaraya, K.C.I.E., M.I.C.E., and Nawab Ali Nawaz Jung Bahadur, F.C.R., and of the action taken thereon by Government.

(i) The Chief Engineer has a programme according to which the Barrage and the main canals will be completed and the greater part of the project brought into operation by 1932. He may be requested to furnish half-yearly reports to show how the expenditure is shaping as compared with the estimates, to make sure that the financial programme is rigidly adhered to.

Unless special circumstances intervene, there should be as few changes as possible till 1932 in the personnel of the Engineering staff of the higher grades responsible for the programme.

(ii) The work should be completed within the revised estimate of Rs. 20.04 (Rs. 20.03?) crores or including interest charges Rs. 25.25 crores by 1934-35. A special effort should be made to complete all working estimates and obtain or record sanction to them by 31st March 1930.

(iii) Excesses over estimates, if any, should be met by effecting corresponding savings, by the omission or postponement of some of the non-essential works required for the ultimate stage.

(iv) As the scheme is not expected to earn enough to pay the full interest charges on borrowed capital for ten years after completion, or for nearly twenty years from commencement of construction, the Government of India should be approached to take over the whole or a substantial share of the debt and with it also a reasonable share of the future revenues from the scheme, the principal reason being that the scheme is too big a financial proposition for the Presidency to handle with its slender resources, till the work begins to pay.

(i) The Chief Engineer, Lloyd Barrage and Canal Construction, at present submits a quarterly progress report (on which Government issues a Press Note) and a quarterly statement showing working rates for earthwork in the canals system. This statement gives the total quantity of earthwork to be done according to the estimates, the quantity completed to the end of the previous quarter and the quantity completed during the quarter under report. From this information charts are plotted in the Secretariat and it can at any stage be seen at a glance how progress is proceeding. In these statements information is also given regarding comparison of working rates with estimated rates, which comparison enables Government to watch and keep a check on the financial side of the construction work. Information comparing actual expenditure on masonry works with the estimated amounts will now be compiled.

The recommendation of the authors of the report regarding personnel has been a fixed policy of Government since the work was started and will continue to be so.

(ii) The recommendation in this paragraph is one which Government endorse and the Chief Engineer, Lloyd Barrage and Canals Construction, has been doing and will continue to do everything possible to give effect to it. The Central Designs Division was created specially for the purpose of expediting preparation of plans and estimates, and the result has been most satisfactory.

(iii) This recommendation will be borne in mind should the occasion arise. At present no fear is entertained that there will be any excess over the figure of Rs. 20.03 crores.

Such excesses as may occur on individual items are being met from savings on others.

(iv) It was originally proposed that the Government of India should take over some of the responsibility. This proposal has been informally pressed upon the Central Government several times but they show no readiness to accept any share of the responsibility. The report unfortunately omits to take account of one very important factor concerned in the proposal. The bulk of the receipts will be realised from increased revenue. That revenue will depend upon the rates which will be charged; and those rates will, according to the present constitution,

If this is not done and if the land sales fail to bring in substantial proceeds the charges on the revenues of the Bombay Presidency may prove a heavy burden and a source of continued embarrassment to the Bombay Government for a long term of years.

(v) The first consideration of the Irrigation Department should be to make the work productive within ten years from date of opening so as to give early relief or assurance to the tax-payer. This is a practical step of the highest importance to give confidence to the public.

(vi) It should be possible soon to reduce the establishment and overhead charges and effect economies by combining the Sukkur Barrage Construction Divisions and the Regular Maintenance Divisions of the Public Works Department in Sind.

(vii) Several questions connected with the preparations for the future are pending settlement, and rapid decisions seem necessary. The delay if prolonged will adversely affect the progress and eventually the financial prospects of the scheme.

(viii) River discharge observations should be taken and surveys made to watch the bed levels and changes in the river course, according to the latest needs of the Barrage Project.

(ix) The effect of the Barrage Scheme on the gauges at Sukkur and Kotri and on the full supply levels of the Fuleli and Karachi canals should be observed regularly for at least five years after the scheme comes into operation in order to ascertain the extent to which their supplies will be permanently affected and to provide the remedies they call for.

(x) Estimates may be prepared after survey for the proposal to feed the Fuleli Canal and if possible also other lower left bank canals through the Nara river.

be determined by this Government. It is obvious, therefore, that this Government cannot expect the Central Government to take over the responsibility for part of the debt in return for a promise of a part of the revenue before the rates which this Government will charge have been determined, or unless this Government agrees to make those rates subject to the sanction of the Central Government. So long as the constitutional position stands as at present the proposal is impracticable.

(v) This recommendation will be borne in mind and all steps possible to achieve the desired result will be taken.

(vi) For some time past the possibility of combining the Barrage Divisions with the Regular Maintenance Divisions has been kept in view, and it is now proposed to commence the process of amalgamating Divisions.

(vii) Decisions on outstanding questions are being expedited as much as possible. The recommendation is being acted on and such questions will be taken up as soon as recommendations thereon are submitted to Government by the Local Advisory and Standing Committees.

(viii) and (ix) The recommendations of the authors of the report will be acted on.

(x) This proposal is not considered practicable. The great objection is that any channel taking off from the Eastern Nara and running in a south-westerly direction to feed the Fuleli or any other left bank canal in Lower Sind would have to cross the natural drainage line running somewhere about the irrigation boundary now fixed between the Rohri Canal and the Eastern Nara systems. Such obstruction of natural drainage channels, especially in this low-lying part of the country, which was recently subjected to serious flooding, would be most dangerous and objectionable. In any case it is now too late to consider the matter in conjunction with the present Barrage and Canals Scheme in view of the advanced stage of the construction work on canals in this area.

(xi) The effect of Barrage irrigation on the sub-soil water levels of the irrigated tracts and the tendency to water-logging should be closely watched. Detailed projects for the necessary drainage cuts and channels should be kept ready so as to be able to put the necessary works in hand the moment circumstances necessitate their execution.

(xii) A Bureau of Research should be established and scientific investigation and research in irrigation and agriculture should be commenced and vigorously pursued. This work will be found to be invaluable for the financial success of the scheme.

(xiii) The Bombay Irrigation Act and the rules framed under it require modification to suit the future needs of the Barrage Scheme. The necessary amendments may be carried out by legislation as early as possible.

(xiv) A concise account of the Barrage Scheme should be prepared giving a summary and a complete description of the works and estimates as being carried out. A list should be appended to it of the principal publications and reports issued by Government. Such a publication is badly needed by the Engineers themselves and their staff. It will be greatly appreciated by the Members of the Legislative Council and the general public.

(xv) The Executive Engineers and lower officers should have opportunities of discussing and becoming acquainted with the entire scheme. More frequent meetings and consultations among the Engineers of all grades will be helpful in spreading a knowledge of the scope and objects of the scheme among them so as to ensure their putting forth initiative and giving closer co-operation in future.

(xvi) The policies followed by Government in the solution of the questions pending settlement should be made widely known so that the cultivators, particularly the poorer classes among them may have all the facilities needed to secure plots of land for themselves, to improve them and practise irrigation in a profitable manner. Suitable propaganda to make its policies, objects and future prospects widely known will smoothen the path of the Scheme.

(xvii) As this is a quasi commercial undertaking the issue of a Barrage Bulletin once a month similar to those published by Hydro-Electric and other productive schemes in other parts of the world is also recommended. The undertaking is unique and sufficiently big and important to justify the issue of such a publication.

(xi) It has already been proposed to open a Research Division in Sind, the functions of which will include the detailed survey of sub-soil conditions in the area to be irrigated so that the necessary measures may be adopted to prevent water-logging in the future. A total provision of Rs. 85 lakhs is being made in the revised figure of expenditure (Rs. 20.03 crores) to be earmarked for drainage schemes, and this very important question will always be kept to the fore.

(xii) A Research Division, as referred to in the preceding paragraph, will perform the functions of the Bureau of Research suggested in this recommendation so far as irrigation is concerned.

(xiii) This matter is already receiving the attention of Government.

(xiv) A quarterly Press Note is already being published describing the progress of the work in detail. In future it will be elaborated as suggested.

(xv) The Chief Engineer, Lloyd Barrage and Canals Construction, is already giving effect to this recommendation as much as feasible.

(xvi) Press Notes will be issued on such matters in due course and the Commissioner in Sind will be asked to arrange for notification of the decisions of Government to all concerned. The formation of an unofficial Advisory Committee has recently been announced by Government and this should provide a valuable means of disseminating Government's views and policies.

(xvii) It is considered that the quarterly Press Notes already referred to and the revision and issue twice a year of this publication, "Sind and the Lloyd Barrage", afford the publicity required.

Other Important Matters Referred to in the Report.

In *paragraph 21* of the report the intensity of cultivation has been criticised, apparently with reference to the danger of the resultant water-logging. The intensity of cultivation provided for in the kharif season will be 27 per cent. and in the rabi season it will be 54 per cent. Thus the maximum intensity at any one time—except for the very short periods of over-lapping between the kharif and rabi seasons—will be 54 per cent., an intensity already greatly exceeded during the kharif season over a large area in Sind. It is not anticipated therefore that the project intensity is so high as to involve the danger referred to. As already pointed out under *paragraph (xi)* of the principal recommendations, the question of water-logging will, however, receive close attention.

In *paragraph 23* the design of the canals has been criticised. In the case of the Left Bank Canals it has been suggested that the length of the Rohri Canal should have been curtailed and some area transferred from it to the Nara. This would have meant some reduction in size of the former, but this would have been counterbalanced by the increase in size necessitated in the latter. Such re-arrangement would not have been economical as the losses in transit in the Nara are greater than those expected in the Rohri Canal. Both of the canals inevitably suffer from the disadvantage mentioned of doing no service in the upper reaches, as both traverse Khairpur State. The existing canal systems have been made use of as much as was feasible and economically sound.

The criticism in *paragraph 33* that the number of regulators in the canal system is excessive is not supported by experience in the Punjab. The provision of an adequate number of regulators is a necessary integral part of any modern canal system, especially in such a flat country as Sind, to secure assured command.

Regarding the statement in *paragraph 37* regarding progress in Rohri Canal Circle, the opening of further Divisions in this Circle is not considered necessary as the average quantity of earthwork now turned out per month is in excess of requirements to keep up to the programme. The designs of the road bridges and regulators are being produced very expeditiously by the Central Designs Division, and it is not anticipated that work will be behind the programme so far as masonry works are concerned.

Regarding the recommendation made in *paragraph 62*, the question of improvement and extension of road communications in Sind is being referred to the Standing Committee appointed by Government in connection with the Barrage Project. On receipt of the recommendations of the Committee a definite policy for financing the work will be formulated.

