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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

## 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	208.2	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	227.8	227.8	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.

(v) 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.

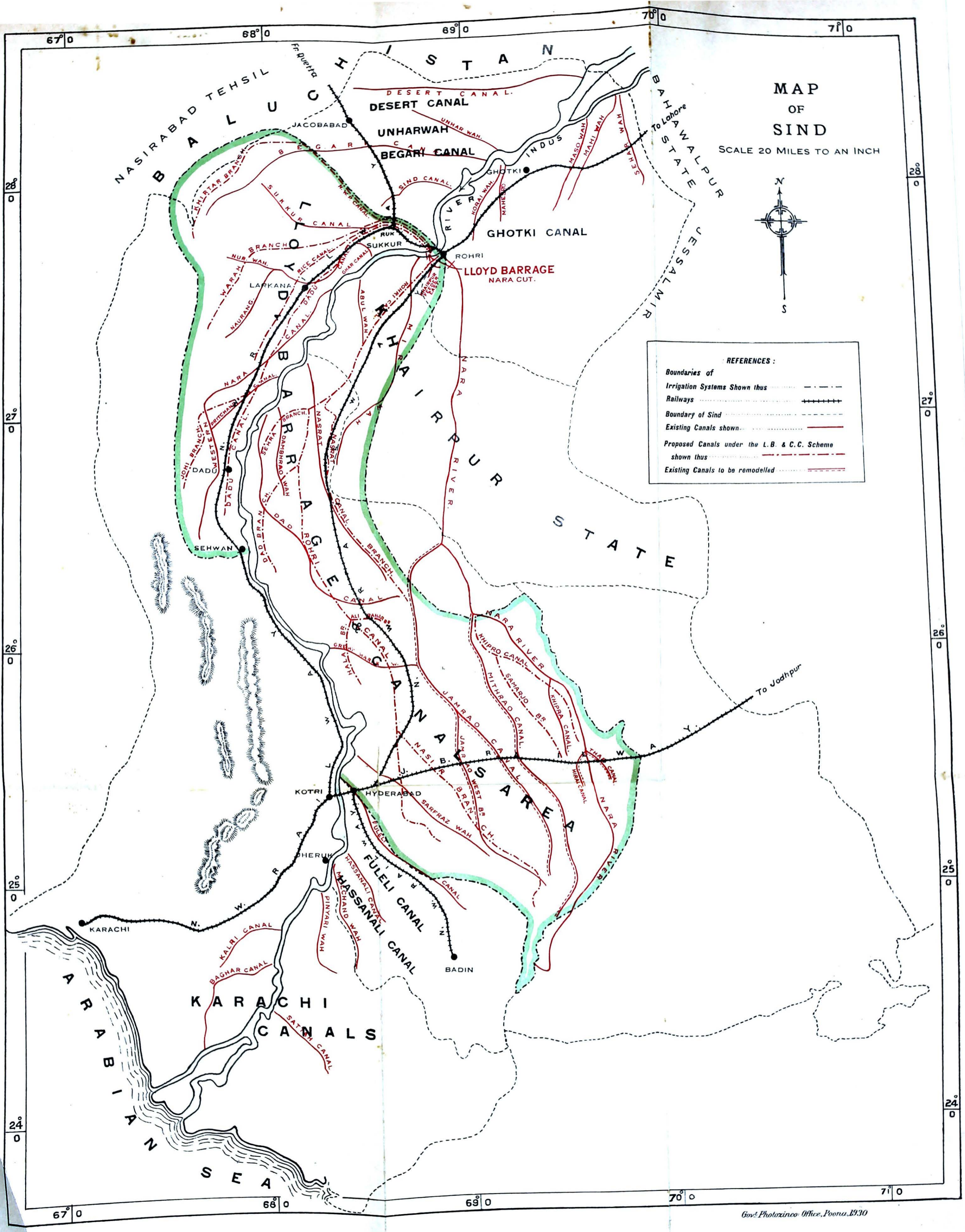
In *paragraph 21* of the report the intensity of cultivation has been criticised, apparently with reference to the danger of the resultant water-logging. The intensity of cultivation provided for in the kharif season will be 27 per cent. and in the rabi season it will be 54 per cent. Thus the maximum 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.



**MAP OF SIND**

SCALE 20 MILES TO AN INCH



**REFERENCES :**

- Boundaries of Irrigation Systems Shown thus
- Railways
- Boundary of Sind
- Existing Canals shown
- Proposed Canals under the L. B. & C. C. Scheme shown thus
- Existing Canals to be remodelled

**67° 0**    **68° 0**    **69° 0**    **70° 0**    **71° 0**

**28° 0**    **27° 0**    **26° 0**    **25° 0**    **24° 0**

**67° 0**    **68° 0**    **69° 0**    **70° 0**    **71° 0**

**28° 0**    **27° 0**    **26° 0**    **25° 0**    **24° 0**