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MADRAS RECORD OFFICE

GOVERNMENT OF MADRAS

Revenue DEPARTMENT

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No. 214. Read the following Proceedings of the Government of India, Public Works Department, (Civil Works—Irrigation,) dated Fort William, 27th November 1874, Nos. 707—22 C. W.—I. :—

Review of the wants and prospects of India in regard to Irrigation Works.

Read again—

Public Works Department Resolution, No. 377 A.—G., dated 18th July 1873.

Read—

A memorandum of the progress of Irrigation schemes in relation to famine aspects by Colonel F. H. Rundall, R.E., Inspector-General of Irrigation Works, dated the 13th April 1874.

Resolution.—When the famine in Behar was anticipated in the autumn of 1873, Colonel Rundall, who was just about to quit office on the expiration of his period of re-appointment as Inspector-General of Irrigation, was desired to review the progress and prospects of irrigation in view to the prevention or mitigation of future famines. He has sent in the memorandum just read, which contains very interesting and valuable information.

2. Colonel Rundall's paper is rather a review of the works of irrigation that appear to be desirable in different parts of India than a statement of the position of any particular works which, in his opinion, are urgently and immediately called for in view to the prevention of famine (paragraphs 80 and 84.)

3. He selects twelve projects, which he arranges in the order of the degree of urgency which he assigns to them. These projects he calculates will add £12,750,000 to the outlay of £20,325,000 which the Government of India contemplated in preparing the Forecast of 1873, and he calculates that, if the annual grant can be raised from its present amount to £2,000,000 per annum, the whole may be finished in fourteen years from the present time.

4. The projects set down by Colonel Rundall, with the sums he has placed against them as indicating, as far as present information goes, what they are likely to cost, are as follows, the works being placed in order of urgency according to Colonel Rundall's views :—

	£
1.—The Bundelkhund Project	750,000
2.—The Gunduck Project	3,000,000
3.—The Upper Sind-Sagur Doab	2,000,000
4.—The Damooda	1,000,000
5.—The Rechna Doab	2,000,000
6.—The Sungum Project ... ... }	
7.—The Eastern Ganges Canal ... ... } Not separately given.	1,838,000
8.—The Swat Project ... ... }	
9.—The Tanks Project in the Central Provinces }	
10.—The Derajat Canals	500,000
11.—The Upper Toombuddra Project	1,500,000
12.—The Nuddea Canal	200,000
	14,588,000

Of these, the projects linked together as likely to cost £1,838,000 were included in h e Forecast of 1873, and the aggregate cost of the rest is £12,750,000.

5. It is first to be mentioned that in all these cases Colonel Rundall has set down what is expected to be the entire cost of the complete projects, and has thus given a view of the extreme outlay (subject, however, to possible increase of estimates—paragraph 87) the Government would have to adopt in carrying out to the full the entire series of projects sketched out. But even if they were all undertaken, in many cases, it would not be necessary or desirable to carry them out to their full extent.

6. Again, it is to be remarked that Colonel Rundall does not desire to disturb existing arrangements. The schemes proposed by him are recommended as additions to the series of operations now in progress, or contemplated. It is now to be considered whether any of these proposed additions are of such urgency as to require the Government to enlarge financially its scale of operations. The several projects will now be taken in order and examined in this view :—

(1).—*The Bundelkhund Project.*—There is no doubt that the country for which these works are designed has suffered severely and frequently from drought. The projects have been many years in contemplation, and the only doubt now remaining as to the expediency of undertaking them is the sufficiency of the water-supply in time of dearth. This subject is undergoing searching inquiry, and the undertaking of the works must depend upon the result. In any case, the amount required is such as could be provided without seriously disturbing the scale of expenditure.

(2).—*The Gunduck Project.*—Colonel Rundall takes the estimate of 1869, and both the lower project of Major Jeffreys, and the upper one of Mr. Stoney. It is doubted if the estimates would suffice now for the works as designed, and the prospects of irrigation are not so encouraging as to induce the Government to undertake more than a moderate scheme. The subject has been fully discussed, and the decision arrived at is contained in a Resolution in this Department No. 618—24, dated 8th October last. A series of small works may be sanctioned hereafter without disturbing the existing scale of outlay.

(3).—*The upper part of the Sind-Sagur Doab.*—The estimates for these works are not yet before the Government of India. It is understood that the Punjab Government is not likely to recommend any early outlay exceeding one million sterling. But the project is only indirectly connected with the prevention of famine. Its aim is to collect in a well-watered tract to be created by the canal the sparse populations of the neighbouring almost desert tracts whose food supplies are precarious. It is evidently not a work to undertake as immediately required for the prevention of famine.

(4).—*The Damooda Canal Project.*—This work is intended to protect a tract of country between the Damooda and the Hoogly which has suffered recently from want of water. The Government of India has already sanctioned a small experimental work, which may, if found to answer, be hereafter developed. Meanwhile, this project may stand over. The country is nowhere far from the East Indian Railway, and there can be little or no danger of a deficiency of supplies in the event of a local failure.

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(5).—*The Rechna Doab.*—The case of this country is nearly the same as that of No. 3, the Sind-Sagur Doab.

(6).—*The Sungum Project.*—This is a project for the extension of irrigation already existing. The country may be considered to be already protected from severe famine, and is, moreover, within reach of the importation of grain by sea. The prospects of this project are now under discussion with the Madras Government. It does not require to be undertaken as specially urgent on account of danger of famine.

(7).—*The Eastern Ganges Canal.*—Parts of the country for which this project is designed have suffered severely from famine. Other parts have the spring level so near the surface, that it is doubtful how far irrigation is really necessary. Again, there is the doubt whether it will not be better to utilize the entire dry season supply of water in the Ganges on the right bank in the Upper and Lower Ganges Canals, where there is no doubt of the want of irrigation. These doubtful points are under discussion with the Government of the North-Western Provinces, and, pending their settlement, this project cannot be undertaken. The country is at all events near the Oudh and Rohilkhund Railway at Moradabad, and can easily obtain supplies of grain in cases of severe drought. In case of its being decided not to proceed with the Eastern Ganges Canal, the smaller project from the Ramgunga will require to be considered.

(8).—*The Swat Project.*—This small project was designed chiefly to assist in inducing settled habits on a turbulent population, and, though most desirable in itself, cannot be considered as specially required in view to the prevention of famine. It is, moreover, too small to affect financial arrangements.

(9).—*The Tanks in the Central Provinces.*—Of these, two designs have been worked out in view to making an experiment on the value of irrigation in the Central Provinces. It still remains to consider how far it is expedient to proceed to actual construction. The work cannot be considered as urgently required.

(10).—*The Derajat Canals.*—The local Government has a project ready, which is estimated to cost £330,000, the outlay on which will be spread over several years. It has not yet been submitted. The works will, no doubt, tend to secure the crops, but cannot be considered as urgently required for the prevention of famine. The amount of the expenditure at present contemplated is not such as to disturb existing arrangements.

(11).—*The Upper Toombuddra Project.*—It is doubtful if this project can be carried out without interfering with the Madras Irrigation Company's works, and whether it can be carried out in any case within such limits of expense as to make it practicable. It cannot, therefore, be undertaken as an urgent work.

(12).—*The Nuddea Project.*—This is a project designed to take its source from the Ganges at Sahibgunj to irrigate the country south of the Ganges in the Moorshedabad and Nuddea Districts. There is no record of severe

famine in these districts since 1770, but relief works were required in 1865-66. It is doubtful if the work should be constructed at all, and it cannot be considered urgent. The country is within reach of railways and of river navigation.

7. From this review it appears that the Bundelkhund Projects can, if proved to be satisfactory, be provided for within the existing scale of operations. The same may be said of the works projected for Tirhoot under decision contained in the Government Resolution No. 618, of the 8th of October. Generally, therefore, it may be said that there is no project at present so urgently required in view to the prevention of famine as to render it necessary to extend financially the scale of operations in Irrigation Works.

8. Such projects as are now in hand may be carried forward on the scale of expenditure now in force, or as it may be modified from time to time by financial considerations; and new projects may be added as those in hand are finished off, after such new projects have been carefully examined and have been shown to be such as the Government will be financially justified in undertaking.

9. There are some other points in Colonel Rundall's memorandum beyond the immediate undertaking of projects for irrigation which may be noticed here. The first of these refers to certain proposals for surveys. In paragraph 19 the Goruckpoor District is referred to. This and the adjacent district of Oudh have been considered in the recent Resolutions of the Government of India on Irrigation and Railways in North Behar. In paragraphs 32 and 34, surveys in connection with irrigation from the Koosi, Mahanuddi, and Teesta are suggested. The possibility of using the waters of the Koosi on the Tirhoot side is one of the subjects of investigation provided for in the Resolution of the 8th October last. In the other cases it appears to the Government of India that the works are not urgently required. The Northern Bengal Railway will afford protection from severe distress. But surveys in view to small projects, such as have been contemplated for Tirhoot, may be set in hand if considered desirable by the local Government when the other more pressing work before the Irrigation Department of Bengal permits. Meanwhile, the local district authorities should consider the question of introducing irrigation in Northern Bengal. The same course may be pursued regarding the small tank projects suggested in paragraphs 36 and 41 for the Sonthal Country and Chota Nagpore.

10. In paragraphs 43 to 50, Colonel Rundall strongly urges the necessity for completing the Midnapore and Orissa series of works. Provision has been made in the Budget Estimate and the Forecast for a moderate progress to this end; and the Lieutenant-Governor of Bengal has been consulted as to the scale on which operations should be carried on. Sir Richard Temple has arranged to visit Orissa, and will communicate his views to the Government of India.

11. The attention of the Government of the North-Western Provinces will be drawn to the remarks on the Ganges Canal Navigation in paragraph 15.

12. The question of the extension of the East Coast Canal, which is a local work, is believed to be under the consideration of the Madras Government. There is no objection to a loan being granted for that object if there are funds available

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and the requirements of the Local Loans Act are complied with. The navigation of the Upper Godavery referred to in paragraph 54 is under discussion with the Madras Government.

13. Colonel Rundall, in paragraphs 29 and 30, refers to the advantages of making the canals in North Behar navigable; and the subject of navigation in conjunction with irrigation canals is strongly advocated in the concluding paragraphs of the memorandum. The Government of India is quite sensible of the advantages in many cases of combining navigation with irrigation, and the consideration of the subject should never be omitted in preparing and submitting Irrigation projects. But economy in the construction of irrigation canals is an object of such paramount importance, that all other considerations must give way to it, and in this view navigation can only be afforded when there is an assured prospect of a return for the outlay, or when the extra expense of supplying facilities for navigation is comparatively small.

14. The Local Governments and Administrations will be invited to report their views on the matters noted in Colonel Rundall's memorandum.

ORDER.—Ordered that the foregoing, with the papers above read, be communicated to the several Local Governments and Administrations in the Public Works Department, Irrigation Branch, for information and guidance.

Ordered, also, that copies be forwarded to the Secretary of State, the Financial Department, and the Department of Revenue, Agriculture, and Commerce, for information; and further, that the papers, with the Resolution, be published in the *Gazette of India*.

(Signed) C. H. DICKENS, Colonel, R.A.,
Secy. to the Govt. of India.

No. 215. ORDER THEREON, 9th June 1875, No. 1,629.

IRRIGATION, No. 20.

THE works or projects referred to in Colonel Rundall's review, with which the Madras Presidency is concerned, are noticed at pages 14 to 18, and are—

1. The Rooshkoolia project in Ganjam, for which estimates have been prepared on which orders will be passed shortly.

2. The Godavery Delta scheme, for which probably nearly all the estimates which will be required have been sanctioned, and are being steadily carried out.

3. The Kistna Delta project, the completion of the estimates for which has taken much longer than was anticipated, but some of these have been passed and entered in the Budget of 1875-76, while others are ready and will now shortly be reviewed.

4. The Sungum project in Nellore, of which the estimates have been submitted to the Government of India and to the Secretary of State. The scheme has been subsequently discussed in many of its bearings, and the further information required by the Government of India will shortly be submitted.

G. O., No. 2,492, dated 3rd September 1874.

5. The East Coast Canal, one section* of which from Dugarajapatam, its terminus for many years, to the Kistnapatam backwater, distant about 14 miles from Nellore, will in a few weeks be opened to traffic. Estimates for another section of 25 miles to the Pennair have been lately passed, and it is understood that for about 80 miles north of that river the line has been selected, and the estimates are under preparation. It will in due course be considered, with reference to paragraph 12 of the Resolution of the Government of India, whether a loan under the conditions of the Local Loans Act will be necessary to allow of this line of communication being proceeded with as rapidly as the labor available will admit. The importance of the canal is fully recognized, and the Government desire to see a junction effected with the Kistna system of canals as soon as may be practicable.

* About 20 miles.

6. The project for a canal from the Toombuddra for the irrigation of a part of the Bellary District was fully investigated several years since by the Madras Irrigation and Canal Company, and the conclusions arrived at from their examination of the country, together with that made previously by Government Officers, were that the works would necessarily be very costly and also difficult of execution. The Company appear not to be likely to be in a position to take advantage of their claim under the contract to carry out this project. The Government, however, consider that this project is one of such considerable importance in connection with the protection of the part of the Bellary District affected by it from famine, that, if it should appear that it can be carried out without any serious loss, an effort should be made to prevent its being postponed indefinitely. Consequently the estimates will be referred to the Revenue Department, with a view to a comprehensive report being drawn up of the financial aspect of the project in all its bearings. The papers already reviewed in the Public Works Department show that the cost of irrigating 212,500 acres by the low level project* would be about Rupees 128 lakhs, and it should be shown what direct returns from water rates are likely to be obtainable, what remissions of assessment will be avoided, and what saving of expenditure on the relief of the population of this part of the district from periodical scarcity will be obviated. The area of country within the influence of the project would be about 700 square miles, and the influence of the Railway which traverses part of the tract and is capable of carrying food to many points both on the Bellary and main lines will have to be duly taken into account in calculating the beneficial effects in times of famine, seeing that manifestly the Railway has, since 1866, materially altered the circumstances of the country. On the receipt of this report the Government will determine whether there are *primâ facie* grounds for supposing that funds can be obtained for the scheme, and, if so, the Secretary of State will be moved to call upon the Company to state definitely whether they have any intention of making proposals in connection with it, in order that in case there should be no such intention, the project may be carried out by the State.

Vide report communicated to Revenue Department, with G. O., No. 518, 21st February 1867; also Proceedings, Madras Government, 18th October 1873, No. 2,549.
G. O., 6th September 1867, No. 2,750.

* The high level project which presents greater engineering difficulties was expected to irrigate 150,000 acres at a cost of Rupees 1,16,70,500—*vide* paragraph 4 of Note in Proceedings, Madras Government, 18th October 1873, No. 2,549.

7. The provision of reservoirs for the benefit of the Company's existing canal from Kurnool to Cuddapah has been frequently under consideration, but until more

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Review of the progress of Irrigation Schemes in relation to famine aspects, by Colonel F. H. Rundall, R.E., *Inspector-General of Irrigation Works.*

In reviewing the progress which has been made with the various Irrigation schemes throughout India, and the extent to which at this time they are capable of affording protection against famine, it will be most convenient to examine first the present condition of the respective Provinces of the Empire in their geographical order, and afterwards the relative urgency of their further requirements. Commencing with the Punjab, the first tract of country which continually suffers from drought is the Yusufzai Plain on the left bank of the River Swat. The investigations for this small scheme are, I believe, complete, and the estimates ready for submission.

The plain is situated in the extreme northern corner of the Empire, approachable only by unmetalled roads from Nowshera and Peshawur. It is thinly populated; but on the right bank of the same river, where a system of native works has been in operation for many years, there is now every sign of prosperity, and a formerly turbulent set of freebooters have settled down into a peaceful community of agriculturists. The project on the left bank of the same river will, it is hoped, produce similar results. The estimate, I believe, amounts to between £150,000 and £200,000.

Proceeding along the frontier, the next irrigation met with is in the Bunnoo Valley, where there are a series of old native works, the management of which is left entirely in the hands of the villagers under the general supervision of the District Officers, and should continue so, the Canal Officers only affording help and advice whenever it may be necessary. Following the course of the right bank of the Indus, the first canals met with are a series of Inundation Canals watering the lower part of the tract known as the Derajat. For the improvement of this series, investigations have been going on some years, having originated from political, perhaps, as much as from fiscal considerations.

The next tract of country for which a scheme is in course of investigation is the Sind-Sagur

Doab, lying between the Indus, Jhelum and Chenab. It is almost a rainless country, and but thinly populated. The principal means of carriage available are camels, except along the line of the Indus, on which, of course, there are plenty of boats, and to a certain extent the Chenab may also be said to be navigable. These two rivers, however, only skirt the tract which is 250 miles long, with an average breadth of 50 miles. The project in process of investigation is a canal from the Indus to be taken out from below the gorge at Kalabagh.

The next two tracts of country as yet unprovided with any works are the Jetch and Rechna Doabs, comprised between the Jhelum, Chenab and Ravee. For the first, comprising 3,000 square miles, no scheme has yet been worked out; but for the second, containing 12,000 square miles, one has been intermittently under investigation for some years. The Northern State Railway from Lahore will pass through both these tracts, but with that exception, ordinary roads only are available, the Chenab being navigated with difficulty. In the Baree Doab the tract lying between the Ravee and the Beas, the upper portion for 160 miles from the foot of the hills, may be said to be protected from famine by the canal which takes off the Ravee at Madhopoor. The two main branches to Kussoor and Sobraon are now in course of completion.

The Sindh, Punjab and Delhi Railway runs across this Doab, the trunk road between Lahore and Ferozepoor intersects it lower down, but there is scarcely any water-carriage available at present, as the Sutlej is only navigated with difficulty. In the remodelling scheme of the Baree Doab, which is now before the Government of India, navigation has, however, been provided for.

For the protection of the lower portion of this Doab, a complete scheme of canals to be taken off the Sutlej near Ferozepoor was designed and estimated, but owing to its cost and the sparse population of the tract, it was decided that, for the present, the project was to be confined to enlarging the present system of inundation canals in such manner as to work into the complete scheme hereafter. At its extreme end there are several of those canals from both the Chenab and the Indus, watering about 1,000 square miles. The area of the whole tract is about 13,000 square miles, of which 9,000 are as yet unprovided with means of irrigation,

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while the principal means of communication i confined to the Railway from Lahore to Mooltan.

Crossing the Sutlej, the first tract met with is the Jullundur Doab, which is usually considered as not standing in need of canal irrigation, because water is met with generally near the surface, and the soil is of known fertility. Beyond this, however, occurs an arid tract of very large area extending as far as the Jumna. For the protection of this area, the Sirhind Canal scheme has been devised and is now in rapid progress. The waters of the Sutlej will be conveyed by it up to the River Guggur. The area protected by the Sirhind Canal amounts to 8,500 square miles.

The present capacity of the Western Jumna Canal, which irrigates 500,000 acres and may be said to protect 2,500 square miles, is, however, insufficient to provide water for one of the driest tracts in the Punjab, *viz.*, Hissar and Sirsa, containing about 2,000 square miles. Whether it will be possible to devote any of the present cold-weather supply of the Jumna to a canal for Sirsa is doubtful, but the possibility of conveying a monsoon supply has been considered, and a canal for that purpose must, I think, be eventually carried out.

The means of communication, apart from the ordinary roads, is confined at present to the Scind and Punjab Railway which traverses the upper part of this tract; there is as yet no water-carriage available, but in the Sirhind Canal Project, and in the remodelling of the Western Jumna Canal, navigation is provided for, and when all the connecting links have been made, there will be water communication from Lahore to the Jumna at Agra, and so with the river system of Bengal.

Assuming, then, that the area of the Punjab between the Indus and the Jumna amounts roughly to 56,000 square miles, it may be said that, while projects are either in operation or in course of construction sufficient to provide for 17,500 square miles, 38,500 square miles are as yet without means of irrigation and but scantily provided with communications.

To the south-west of the Punjab lie the independent States of Bikoneer, Jeysulmere, and others comprised in the Rajpootana Agency, all of which have been the scenes of frequent distress from drought. With the exception of the small tract in Ajmere and Mhairwarra, which is British territory, there is no State expenditure on

Thus—

	Sq. miles.
Protected.	
By Baree Doab Canal	3,000
By Jullundur Doab...	1,000
By Sirhind Canal	8,500
By Western Jumna Canal	4,000
Inundation Canals	1,000
	17,500
Unprotected.	
Sind Sagur Doab	12,500
Jetch ,, ...	3,000
Rechna ,, ...	12,000
Baree Doab	9,000
Sirsa and Hissar	2,000
	38,500

Irrigation works. The State Railways recently projected in Rajpootana will intersect a considerable portion of it, and it is apparently on them alone that traffic there must depend, for the rivers in that tract are only spasmodically supplied with water.

The extension of the State Railway from Ajmere to Deesa to meet the Bombay and Baroda line from Ahmedabad would seem to be the only means by which food-grains could be supplied cheaply from other localities to that arid region.

On the left bank of the Jumna the first portion of the territory of the North-Western Provinces is the Ganges-Jumna Doab. The whole of this tract, comprising an area of 20,000 square miles, may be said to be thoroughly protected by the Eastern Jumna and the Ganges Canals as far as the available cold-weather supply of those rivers will admit of irrigation. The principal means of communication are, the East Indian Railway between Allahabad and Delhi ; the Ganges Canal, at present available from Hurdwar to Cawnpoor only, but to be eventually extended to Allahabad by the lower canal. The Doab itself is intersected also by numerous roads metalled and unmetalled ; but cross lines of canal to connect the Ganges with the Eastern Jumna, and the latter with the Agra Canal, are required to make the water lines more useful and to ensure alternative routes being available in the event of any necessity occurring for closing a portion or the whole of either of the main lines. For this reason, the Futtehghur Branch should have been made navigable ; for, had it been connected with the lower canal, it would have served to remedy any sudden suspension of traffic such as lately has taken place by the failure of the Salawa Lock. The additional cost of the navigation works for that branch was estimated at about Rs. 7,000 per mile, or little more than is paid for the construction of ordinary metalled roads in the Doab.

The traffic on the Ganges Canal is now entirely confined to the canal itself, as at present there are obstacles to the free passage of boats in and out of the river at Cawnpoor. These obstacles ought to be removed and every facility given ; for, until the canal is made perfectly accessible and connected with the great chain of river communication, a large part of its utility as a line of navigation is sacrificed. I believe Colonel Greathed is about to submit estimates for the necessary improvements, and these should at once be sanctioned.

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On the left bank of the Ganges, and between it and the Ramgunga, lie the districts of Bijnour, Moradabad and Budaon, occupying an area of 4,000 square miles. The first and third of these districts have always shared in a greater or less degree the famines which have overtaken the North-Western Provinces.

The Eastern Ganges Canal project was designed for the protection of those districts, but final orders have yet to be passed thereon. The portion of the Oudh and Rohilkhund Railway which runs from Bareilly to Moradabad, and the branch to Allyghur passing by Rajghât, are the only means of communication in addition to the ordinary roads. When the whole cold-weather supply of the Ganges has been drawn off at Rajghât, the navigation of that river as far as Allahabad will be closed until the supply is replenished during the rainy season. In view of this contingency, one branch at least of the projected Eastern Ganges Canal should be made navigable.

Bareilly and Eastern Rohilkhund also appear to have shared in the full severity of the five great famines of the present century.* The only means of irrigation existing there at present are a few small channels led off from some minor streams which issue from the Terai. There can scarcely be a doubt as to the necessity of providing some kind of permanent canal irrigation for that tract, and this would be best secured from the Sardah Canal whenever it may be found expedient to carry on that work.

Eastward of the North-Western Provinces lies the province of Oudh, for the upper districts of which the Sardah Canal scheme provided. The central districts are considered to be sufficiently furnished with wells and other means of irrigation, but the lower districts of Benares and Goruckpoor, especially the former, have been frequently visited with drought, while Goruckpoor has this year come within the influence of the scarcity which has visited the neighbouring divisions of Bengal. There are good means of communication on the confines of these two districts in the Rivers Ganges and Gogra, while the lower portion of the Goomtee is also navigable. As yet no works of irrigation have been carried out in Benares and Goruckpoor. In the original complete scheme, the Sardah Canal would have irrigated Benares, but nothing has been hitherto proposed for Goruckpoor as it was supposed to be sufficiently supplied with natural facilities for irrigation. There are no railways

* Viz., 1803-4.
1825-6.
1837-8.
1860-1.
1868-9.
Vide reports by Messrs. Girdlestone and Henvy on Famines in the North-Western Provinces.

as yet, but if the contemplated connection of the Oudh and Rohilkhund system with the Northern Bengal State Railway be ever carried out, one line would run across the Goruckpoor District.

Turning to the districts belonging to the North-Western Provinces on the right bank of the Jumna, the Agra Canal, which has lately been opened, will furnish irrigation to about 300,000 acres, and protect a strip of country averaging twenty miles wide parallel to the river. Beyond this to the south-west lie the districts of Bundelkhund, a tract which has been desolated over and over again, and which all accounts go to show is in a most depressed condition. It is traversed by three considerable streams, the Betwa, Dussan and Keyn, which have all been investigated, and orders have been issued for the preparation of a project from the Betwa. It is absolutely necessary that irrigation should be provided as early as possible for this tract; but as the rivers are spasmodic in their action, and carry but a small volume in the cold weather, it is necessary that their waters be utilized principally for the autumn crop.

There are no means of communication beyond the ordinary roads, and, therefore, in my reviews of the schemes for Bundelkhund, I urged the importance of not neglecting to provide a small line of navigation, which, being connected with the Jumna, would enable produce to be conveyed in the cheapest manner from the Doab and the districts to the southward. Mr. Ricketts' reports on Bundelkhund have forcibly brought to light the necessity for works both of irrigation and communication, and pointed out the losses which have accrued to Government both directly and indirectly for the want of such works.

Lastly, the district of Mirzapoor, on the right bank of the Ganges, has felt the effects of drought simultaneously with the adjacent province of Behar, but for that portion of it through which the Western Main Canal of the Soane Project must be carried, irrigation and communication can both be provided. The terminus of that canal should be at Mirzapoor. Beyond that place I think it will be feasible to supply a connecting link with the terminus of the Lower Ganges Canal at Allahabad from the River Tonse. This line has not as yet been investigated, but if found to be practicable at a reasonable expense, it is a work which should without doubt be carried out. The East Indian Railway runs through lower portion of the district which borders the Ganges.

Thus—

	Sq. Miles.	
Protected—		
Ganges-Jumna Doab	20,000	
Agra Canal	3,000	
With partial irrigation—		
Part of Rohilkhund...	2,500	
		25,500
Partially provided with communications, but with no Irrigation Works—		
Benares and Goruckpoor		4,400
Wholly unprovided with either—		
West Rohilkhund	4,000	
Mirzapoor	800	
Bundelkhund	5,000	
		9,800
		39,700

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Summarizing, then, the condition of the North-Western Provinces, it may be said that, out of a total area of 40,000 square miles, 25,500 square miles are protected with works of irrigation, 4,400 square miles are partially provided with improved communication, but have need of a more permanent system of Irrigation works, and 9,800 square miles are wholly destitute of both.

Proceeding southwards, the first province met with in Bengal is Behar, where the scarcity of the present year has told with the most severity. The frequency with which this province has been subjected to droughts led to the projection of the scheme of canals from the Soane, by means of which all Shahabad, Behar, the tract between the Kurumnassa and the Ganges, and a portion of Gya and Patna as far as Monghyr, will be thoroughly secure as far as the rice-crop is concerned, while for the spring crop there is water in the Soane itself for about half the acreage that can be brought under cultivation throughout the 7,500 square miles under command of the canals, and by a judicious storage of the minor streams, probably a considerable further area of the cold-weather crops may be supplied with irrigation.

The provision of Navigation works in these canals will further secure inter-communication amongst all parts of the province, and as all the various lines of canal will be connected with the Ganges, South Behar will always be accessible to the entire river systems of Bengal, the North-Western Provinces, and Oudh. Besides this, the East Indian Railway skirts the extremity of the Patna and Shahabad Districts.

For Northern Behar, two similar schemes have been thoroughly investigated and designed, but as yet no work has been actually carried out thereon. Recently, however, orders have issued for a commencement of the High-level Canal from the Gunduck along the frontier of the Chumparun District as far as the River Bagmuttee, but the scheme for Lower Tirhoot still remains in abeyance.

The existing means of communication are principally confined to the ordinary roads, scarcely any of which are metalled.

The Gunduck is navigable for boats of light draught during the cold weather for a distance of 70 miles, or as far as Govindgunge. Boats also find their way during the rains by the tortuous route of the Bagmuttee and Boor Gunduck as far as Mozufferpoor.

The Government has, I believe, under contemplation a system of State Railways throughout the entire tract of country north of the Ganges, by which the Oudh and Rohilkhund system will be connected with that of Lower Bengal, and in so far as that may be carried out, the inter-communication of the various districts will to a great extent be secured, but I would earnestly press upon Government the desirability of at the same time not omitting to render the canal system of North Behar navigable similarly to that which is being carried out on the Soane scheme, for the districts to the north of the Ganges are under precisely similar conditions as those of the south in relation to the great river system of Bengal. The additional cost of the works necessary to make the canals in North Behar navigable will be much less than in those from the Soane, owing to the gentle slope of the country and the larger volume of water continuously available, whereby the necessity, and consequently the extent and expense of resorting to still-water navigation are considerably reduced.

The peculiar advantages attendant on water-carriage and its suitability to the circumstances of India generally and to Bengal in particular will be explained further on in this note, and, therefore, I will only state here that it enables the mass of the population to effect what no other means of transit can accomplish, and that is to carry on an interchange of food-grain and every other commodity perfectly independent of extraneous assistance either from the Government or the European capitalist; and is thus calculated to regulate, especially in times of scarcity, the food supply with the least disturbance of the ordinary operations of trade.

The Patna Division comprises about 23,700 square miles. Of that area, the Soane scheme will thoroughly protect 7,500 square miles south of the Ganges, leaving 16,200 square miles yet to be provided for, of which the two Gunduck schemes would protect 5,000 square miles more.

Eastward of the Bagmuttee, and between it and the Koosi, are the estate of Durbungah and the northern districts of the Bhaugulpoor Commissionership. These appear to have always suffered in common with the districts of Behar, and are this year in the centre of the severest scarcity. Durbungah being at present under the Court of Wards has its public works managed by a special officer attached to the estate, but it might be brought within a comprehensive system which seems feasible from the

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River Koosi, and which could be arranged so as to work in with, and be connected with the Gunduck system.

The Koosi is a snow-fed river, and carries at all times a considerable volume of water. Nothing that I am aware of has ever been attempted in the way of improving the river as regards navigation; neither has any effort been made to utilize its water for irrigation purposes. The area contained in this tract measures about 6,000 square miles, and may be said to be at this present time without any communication beyond the ordinary unmetalled roads. The State Railway lately commenced from Chumpta Ghat on the Ganges to Durbungah will, when complete, be the first improvement in the communications of this tract.

Between the Koosi and the Bramahpootra lie the districts of Dinagepoor, Maldah and Rungpoor, occupying an area of 17,700 square miles, and all affected to a greater or less degree by the drought of this year. The normal agricultural condition of these districts has hitherto been so good, that nothing in the way of artificial irrigation has ever been considered necessary. They are traversed by many streams, amongst which are two very considerable rivers, the Mahanuddy and the Teesta, both of which being snow-fed carry a large cold-weather volume. Of the possibility of improving them for navigation purposes, I cannot offer an opinion, as I am not personally acquainted with their capabilities, but the matter is well worth investigation, as also the practicability of leading out irrigation channels, if not for the rice, at all events for the spring crops.

The Northern Bengal State Railway will run through Rungpoor, and the contemplated connecting link with the Oudh and Rohilkhund Railway will traverse it as well as Dinagepoor at right angles, but until those works are carried out, the districts in question are, with the exception of the Ganges and Darjeeling road, dependent on the ordinary country tracks.

Between the Soane and Damooda nothing has yet been attempted in the way of irrigation works. Intermediately lie the Sonthal Pergunnahs, which have been frequently visited with scarcity. The description of works suitable for this area of 5,500 square miles would be a series of small tanks similar to those which are to be found all over the Madras Presidency, and which are scattered over the tableland of Mysore. The several streams which now drain off into the Ganges, or into its minor tributaries, the More

and Adjye, might thus be turned to useful account with, probably, a very moderate expenditure.

The Loop and Chord Lines of the East Indian Railway skirt the extremity of these Pergunnahs, the greatest intermediate distance being about 100 miles. There are also various cross-roads intersecting them, and the Ganges flows past the north-east corner, so this tract is perfectly accessible, and there should be no difficulty in furnishing it with food when need so requires.

In the Commissionership of Burdwan, the districts of Hooghly, Burdwan, and Midnapoor, containing about 10,000 square miles, suffered badly in the great famine of 1866. Burdwan, besides having ten inches less rain than Calcutta, is peculiarly liable to experience a failure of it in the end of September and beginning of October, just at the time when the rice crop is about to mature, and when an absence of rain is likely to imperil the entire crop. In both Hooghly and Burdwan this year such a failure has occurred, and there has been a corresponding short outturn in the harvest except where, by a timely supply of water given in a rude manner from the Damooda, a considerable area of cultivation was saved. An estimate for a small scheme from that river for leading water into the old channels of the Damooda running through Hooghly has been sanctioned, but this will not be of the slightest assistance to the Burdwan District, the upper portion of which is in much need of irrigation. The original comprehensive scheme of the Damooda Canal taken off from Raneegunge can alone furnish a supply to Burdwan, and by its connection with the River Hooghly, all the country through which it runs will be placed in communication with the rest of the river system. As regards communications, the lower part of the Hooghly District is traversed by natural tidal channels navigable by small boats. The Damooda itself is also navigated with difficulty during the rainy season as far as Raneegunge, but there are no means of access to the greater portion of Burdwan except by the East Indian Railway which skirts the right bank of the Damooda. An extension of the original Canal project into the eastern part of that district, and a navigable branch from the town of Burdwan to the Hooghly at Culna, as suggested lately by Colonel Haig, would, without doubt, increase the usefulness as well as improve the financial aspect of the scheme.

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The districts comprised in the Commissionership of the Presidency Division, *viz.*, Nuddea and Jessore, embracing an area of 9,875 square miles, suffered badly, though in a less degree, than the western districts in the famine of 1866. In the present year it is believed that, beyond the pressure resulting from high prices, there will be no distress. The usual rain-fall in the Nuddea Districts is in most years sufficient to ensure the maturity of the rice-crop, but there is a considerable area of spring cultivation in various portions of it which has been hitherto entirely dependent on the winter rains, and for which there is little doubt canal irrigation would be always acceptable.

A scheme which was very thoroughly investigated and designed a few years ago, but which had for its principal object the construction of a first-class navigation canal from the Ganges at Sahibgunge with a view to accommodate the enormous traffic with Calcutta that now passes by the Nuddea Rivers in the rains, but is obliged to take the circuitous route of the Sunderbunds for five months of the year, would furnish an ample supply of water for the cold-weather crops of Nuddea and Moorshedabad. This project, which was originally drawn up under my own orders while Chief Engineer in Bengal, has not been submitted to the Government of India, owing, I believe, to the magnitude of some of the works involved, but if anything is to be done for the improvement of the Nuddea Districts, or for giving increased facilities for the vast water-borne traffic to Calcutta, it can only be accomplished by such a project, or some modification of it. As regards means of communication, these districts themselves are well off as long as the rivers remain navigable. The Eastern Bengal Railway skirts the southern extremity of Nuddea, and the Nulhattee Railway runs on the west to Moorshedabad, while the Ganges is available for the eastward. The district is also well intersected with roads, so that in respect of furnishing supplies of food there could never be any difficulty.

Chota Nagpoor, which covers an extent of 43,900 square miles, with a population of 3¾ millions, has not, that I am aware of, ever been properly investigated as to its capabilities for Irrigation works. I am not acquainted with the tract of country myself, and, therefore, am unable to indicate exactly what steps should be taken; but I expect that something analogous to the Tank system of Madras will be found suitable for Chota Nagpoor. The districts comprising it

suffered in the great Orissa famine of 1866. Situated away from the line of navigable rivers, as well as from the East Indian Railway, the nearest point to which is on the Chord Line, it is, perhaps, of all Bengal the least accessible tract. A great portion of it is, however, uninhabited, and the population is stated to be somewhat under 90 to the square mile. How far it would serve as an outlet for the teeming districts adjoining it, in the event of facilities being afforded for cultivation by the construction of minor works of irrigation and by improved means of communication, I cannot say, but it is a matter worthy of consideration, and may, perhaps, have already engaged the attention of the Bengal Government.

The chief wants of the eastern districts of Bengal are improved means of communication, or rather of utilizing the magnificent water-ways of which they are possessed. A canal from Dacca to near the confluence of the Ganges and Brahmapootra was lately proposed by the Government of Bengal, and as the cost was beyond the means of the provincial resources, a loan was asked for from the Government of India. I have no doubt of the expediency of the proposed work if properly carried out, but instead of stopping it at the Brahmapootra, I consider it should be carried on until it is connected with the present system of the Calcutta Canals. The traffic from the eastern districts which now enter those canals is shown by the statement which accompanied the Goalundo Committee's report to have amounted in 1872-73 to 1½ millions of tons, or, after deducting 800,000 tons of firewood, to three times as much as was carried by the Eastern Bengal Railway, notwithstanding that it has to follow a most circuitous, and, at certain seasons of the year, a somewhat dangerous route. This large traffic certainly deserves more attention than it has yet received, and there can be little doubt but that if a more direct and perfectly safe route were secured for it, it would largely increase and would repay the interest of such outlay as the improvement of the route might entail, for the saving in distance and risk would be much more than sufficient to enable the boat-owners to pay the canal tolls.

The remaining portion of Bengal is the province of Orissa, with which the Midnapoor District may properly be considered. Exclusive of the Tributary Mehals and Midnapore, it contains 7,700 square miles. The security of this province from any further visitation of famine

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can only be effected by the completion of the Orissa scheme in its integrity. The works hitherto constructed, or in progress, will secure the northern portion of the Mahanuddy, Brahminee and Byturnee Deltas—an area of 1,200 square miles.

The Midnapoor Canal, which is in operation throughout its whole length, protects the tract of country between the Cossye and the River Huldee—an area of about 600 square miles.

There yet remain to be provided for, the Central and Southern Deltas of the Mahanuddy, the high level tract from the Salundee to Balasore, that portion of the Balasore District between the Balasore River and the Subanreeka, and so much of the Midnapoor District as is contained between the Rivers Subanreeka and Cossye.

The gross area of these several tracts amounts to 2,700 square miles as marginally shown.

	Sq. miles.
1.—Central Delta...	500
2.—Southern ,, ...	650
3.—High-level tract to Balasore	600
4.—From Balasore to the Subanreeka	300
5.—From the Subanreeka to Midnapoor ...	650
Total ...	2,700

There is not the slightest doubt that any one of these sections of Orissa, if visited by another drought, will suffer severely. The estimates for the Central Delta Sections are ready with the Superintending Engineer, and only require the sanction of Government to admit of their being carried out and completed in a couple of years. The details of the Pooree Section have not yet been finally settled. With the Northern and Central Deltas fully provided for, any failure in Pooree could for the time, perhaps, be supplemented, as there would be sufficient food forthcoming, and the distances to which it would have to be transported would not be great; still the district suffers greatly from floods as well as drought, and urgently requires to be protected from both evils.

It would not, however, be so easy to supply the tract between Bhuddruck on the Salundee and Midnapoor, a length of 120 miles. Grain could, of course, be conveyed by sea to Balasore, but the entrance to its river is not easy during the south-west monsoon, and food would have to be conveyed by land from the two present termini of the High-level Canal.

The early completion, therefore, of these intermediate links is an urgent necessity, for it is not only the preservation of the country lying between that canal and the coast that has to be considered, but of the Hill tracts stretching away to the borders of Chota Nagpoor, and which are only accessible by roads from certain points on the line of the canal. The surveys of the fourth section of the High-level Canal between Bhuddruck and Balasore, which were

on the eve of completion, have lately been suspended, and the Officer engaged thereon transferred to Tirhoot. Those between Balasore and Midnapoor will probably require to be prepared anew, as it is many years since the original estimates were framed, and many of the designs then prepared have been mislaid. By carrying on work simultaneously from both ends, the completion of the canal and inland water-communication between Cuttack and Calcutta ought not to occupy many years.

The length of navigable canals already in operation is about 210 miles, but the total length of connected navigation which these canals admit of being utilized by joining the natural tidal creeks and river estuaries at the mouths of the Mahanuddy, Brahminee, Byturnee, Hooghly and adjacent rivers cannot be less than 400 miles.

In Bengal, then, out of an area of about 78,000* square miles in which this year the crops have suffered more or less from scarcity of rain, about 12,000 only will be protected by the Orissa and Soane schemes.

In the Madras Presidency the two northern districts, Ganjam and Vizagapatam, generally known as the Northern Circars, have been frequently subjected to drought of more or less severity, the condition of Ganjam in 1866 being similar to that of Orissa. There are a number of small Irrigation works scattered throughout it. The only contemplated new work of any importance is that called the Rooshkoolia Project, the designs and estimates of which are, I believe, under the consideration of the Madras Government. The district of Vizagapatam consists principally of the large estates of Vizianagram and Bobbili; the numerous Irrigation works in which, consisting of tanks and small river channels, are all managed by their respective owners. There are no other means of communication in these districts beyond the ordinary roads, of which, however, there is an excellent system laid out and constructed for the most part during the scarcity of 1852-53, and as these all converge to the ports, of which there are several along the eastern coast, the Vizagapatam District can be always supplied without difficulty with grain from other localities. The Ganjam District, however, can best draw its supplies from Orissa *viâ* the Chilka Lake, with which the Pooree system of canals will be connected, and hence the requirements for Ganjam present an additional reason for pushing on with that portion of the Orissa scheme and completing

* Thus:—

	Sq. miles.
Patna Division	16,200
East of ditto to River Koosi	6,000
East of Koosi to Brahmapootra	17,700
Southal Pergunnahs	5,500
In Burdwan Commissionership	10,000
In Nuddea District	9,900
Orissa	7,700
Midnapoor	5,000
	78,000

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the links yet wanting in the chain of water communication. South of Vizagapatam are the great Deltas of the Godavery and Kistna. The grand system of canals in the former is approaching completion, but that of the Kistna is still backward. As the two Deltas are, however, linked together by an admirable chain of navigable canals, not only are they thoroughly protected from a recurrence of such a famine as that by which they were decimated in 1833, but they are able to contribute out of their abundance to the rest of India.

The completion of the Kistna scheme should, however, now be pushed forward and not allowed to linger on as it has been doing for several years.

In the Nellore District, the Southern Pennair scheme is in operation, but a similar one, called the Sungum Project, estimated for the northern portion, has been recommended to the Secretary of State, and only awaits sanction pending the receipt of certain explanations called for by Her Majesty's Government. The required explanations having been furnished by the Madras Government, should be forwarded without further delay. The principal work of communication in connection with the littoral districts north of Madras is the East Coast Canal, the early extension of which from its present terminus is most desirable, as by its means the Deltas of the Godavery and Kistna, and the upper portions of the River Godavery, where the recently discovered coal measures are situated, will be connected with the Railway system of Madras.

This canal extension, which has been under consideration for the last 20 years, does not appear to have yet got beyond the region of discussion, but it is a most important work and should not be delayed.

The districts of North Arcot, Chingleput and Cuddapah are essentially dependent on tank irrigation, as well as those of Madura and Tinnevelly, where almost every drop of the small rivers which traverse them is stored in reservoirs, some of which are of considerable size.

Tanjore, part of Trichinopoly and South Arcot are provided for by the Cauvery series of canals. There is but one line of navigation in the Cauvery Delta, and that very inferior, but the Great Southern Railway traverses the districts of Tanjore and Trichinopoly. Its northern terminus connects it with the South-Western Line at Erode, and the extension of the Carnatic Railway will connect its southern extremity. The extension to Madura will link that district

also with the Madras system. It was, I believe, originally contemplated to extend the East Coast Canal southwards as far as Negapatam, the port of Tanjore. It is to be hoped that this has not been abandoned, for it is likely to prove just as useful and important as the northern extension.

The district of Coimbatore is partly supplied by river channels and partly by tanks; that of Salem almost entirely by the latter. On the western coast, the State of Travancore manages its own works, and the two districts of Malabar and South Canara, enjoying the full influence of the S.-W. monsoon, are naturally well supplied with water. The Madras Railway skirts the boundary of the Malabar District and Travancore State, ending at the port of Beypoor. There is also a good inland navigation along a succession of backwaters parallel to the coast.

The Madras Provinces possess one great advantage from their geographical position. With an enormous length of coast line studded with ports, almost every district is accessible by sea, and the distances across the peninsula being but short in comparison with those of Northern India, the labor of transport should be a much less difficult task. Still the distances from the interior to the coast are sufficiently long to add greatly to the cost of carriage of food-grains, the prices of which, generally speaking, range higher than in Northern India, and hence the desirability of carrying out such works as navigable canals and a system of cheap railways wherever feasible. Much of the advantage of the coast communication is, however, counteracted by the fact of there being so few harbours, and of vessels having to load and discharge their cargoes in open roadsteads,—an operation attended with much difficulty in the S.-W. monsoon.

The province of Mysore, whose administration is directly under the Government of India, has, generally speaking, a small rain-fall, and hence it being necessary to store every available drop, it is principally dependent on an extensive system of tanks, the whole of which is at the present time being placed in perfect repair from the surplus funds of that State. The branch of the Madras Railway to Bangalore connects that large place with the general Railway system, while the province is intersected with numerous excellent roads.

North of Mysore are situated the districts of Bellary and Kurnool, in both of which drought may be said to be the rule rather than the exception. The first-named district is studded with tanks, some of very large capacity, but all more

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or less dependent on local rain-fall. What is needed for its better security from drought is a canal from the River Tumbuddra, the execution of which formed part of the Madras Irrigation Company's project, but which it seems scarcely probable they will have the means to accomplish within a reasonable period. The project is an expensive one, but unless carried out, the district of Bellary must remain always more or less dependent on the small and variable rain-fall which obtains in that part of the Peninsula.

In Kurnool the Madras Irrigation Company's canal, which is taken off the River Tumbuddra, will do all that is necessary for the monsoon cultivation; without storage, however, the supply in that river is insufficient to assist the cold-weather crops, and the Company is not allowed to draw off any water until the Government canals in the Kistna Delta are fully supplied. The construction of reservoirs is much required also to maintain perennial navigation in the Company's canal, but it seems doubtful when they will be able to raise sufficient capital to undertake them. The extension of this scheme to meet the East Coast Canal is an important link in the communications which should be borne in mind. Whether this extension will be feasible as long as the works belong to the Company seems doubtful, but until it is carried out, the usefulness of the Kurnool-Cuddapah line of navigation will be very restricted. As soon as it is connected with the East Coast Canal, however, the central districts of the Peninsula will be placed in communication with the great delta system to the north, and with Madras and the general Railway system to the south.

The total area under irrigation in the Madras territories according to the latest accounts amounts to over 4¾ million acres.

* * * *

So much of that large area as is supplied from rivers which are filled by the S. W. monsoon may be considered secure, but that which is cultivated under tanks dependent entirely on local rains must of necessity be more or less precarious; for it, there is no remedy beyond improving the communications so as to place such tracts within reach of those districts where the food supply is always secure. Hence the importance of the East Coast Canal and its connection with the inland districts wherever practicable. The works still required for Madras have been provided for in the forecast statement with the exception of the East Coast Canal, Bellary project, and extension of the Kurnool Canal. There

appears to be some technical difficulty in assigning Loan Funds for the Coast Canal, and therefore special grants should be made for it from the Ordinary Agricultural Funds. The two others are still included in the limits of the Irrigation Company's scheme, and therefore, of course, could not be entered in the forecast. I shall, however, assume that the Bellary project will sooner or later have to be undertaken by the Government.

In the centre of the Peninsula lie the Nizam's dominions, and beyond them the Berars. In the latter, little has been done as yet beyond the investigation of small projects, but parts of Hyderabad are studded with very fine tanks. The branch of the Great Indian Peninsula Railway between Bhosawul and Nagpoor runs through the centre of the Berars, and the line from Poona to the Kistna skirts a portion of Hyderabad, with the Capital of which it is connected by a direct line from Gulburga.

To the north of the Nizam's territory lie the Central Provinces, in which no new Irrigation works have as yet been carried out. Investigations have been made for three or four projects, but the very low rates which the Revenue Officers assert can only be levied for irrigation water will scarcely admit of securing adequate returns. These Provinces, however, have generally shared in the droughts which have overtaken the North-Western Provinces, and only as lately as 1868-69 suffered considerably. It is incumbent, however, therefore, that steps should be taken to meet the repeated deficiencies of rain-fall, and the best remedy will, I think, be found in the construction of a series of inexpensive tanks such as those which abound in the neighbouring tracts of the Nizam's dominions. There are several rivers, feeders of the Godavery, from which a reliable supply of water might be obtained, and which would render the tracts of country under their command independent of the local rain-fall.

Two lines of rail at present traverse part of the Central Provinces. On the eastward the River Mahanuddy skirts the districts of Chutteesghur and Sumbulpoor. A canal from a few miles above the latter place could be carried parallel to that river down to within reach of the navigable portion near Cuttack, and thus an outlet for those districts to the sea-board would be opened *viâ* Orissa, and irrigation be afforded on the way to a part of Sumbulpoor. This project was partly investigated by the Officers of the East India Irrigation Company. But the

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most important line of communication for the Central Provinces is undoubtedly the River Godavery, the works for whose improvement have undergone the most unfortunate vicissitudes, and, after a large expenditure, have been left in just such a state as to obtain from that expenditure the least possible result. The completion even of the First Barrier Canal would utilize about 200 miles of the river, while the construction of the Second Barrier works would carry the navigation well into the Nizam's dominions and to the outskirts of the populous portion of the Central Provinces. The completion of the communication to the latter, however, would procure for them at the cheapest possible prices the various food-grains, salt, sugar, and other products of the fertile delta districts in exchange for their cotton and other products. The importance of the Godavery navigation has been so often and so forcibly urged by those best acquainted with it, that it would be superfluous for me to dwell on it further than to express my own belief, based on intimate personal knowledge of the river and its capabilities, that it is one of those lines of communication, the perfecting of which will prove of the highest value to the tracts of country which will be connected by it.

In the Bombay Presidency, both Khandeish and the Deccan are liable to droughts, but Irrigation works are principally confined to small channels from the rivers or tanks. No large projects have been carried out there as yet, with the exception of the Kurruckwasla Reservoir near Poona, and the Moota Moola Canals leading therefrom, the Ekrook Tank near Sholapoor, and the canals from the Rivers Krishna and Hathmuttee.

The Taptee Project for the irrigation of Guzerat, the estimates of which are now before the Government of India, is the largest yet designed. Final orders have not as yet issued thereon.

The area under irrigation in the Bombay Presidency from all sources, excepting wells and exclusive of Sindh, is somewhat under 150,000 acres. The works now under construction provide for a further area of only 176,000 acres, and if the Taptee Project, commanding 194,000 acres, be added, the total area provided for would not exceed 370,000 acres. The present and prospective irrigated area in the Bombay Presidency proper being so small would seem to indicate that cultivation was, as a rule, independent of it. From the new works in the Deccan, the

progress of irrigation has certainly been very gradual, but this, no doubt, is partly owing to the expense and labor involved in an undulating country in preparing the fields for wet cultivation where hitherto only dry crops have been raised in sole dependence on the rains.

Whether owing to a difference in fiscal administration, or to other causes, the people in Khandeish and the Deccan seem better able to weather out seasons of scarcity, but they are nevertheless often exposed to droughts, and there are several minor schemes which will, no doubt, prove valuable to the tracts concerned. Some of these have been provided for in the forecast under the head of "Other Projects."

As regards communication, with the exception of the coasting trade, the traffic in Bombay is all dependent on land carriage. With its three lines of Railway and their branches running through each of its principal territorial divisions, it has the means of importing food from other Provinces at a comparatively low rate in times of scarcity, and with a coast line fringing almost its entire length, the task of supplying the Bombay districts with food, should the necessity ever arise, would be comparatively easy.

It only remains to describe the Province of Sindh. To all intents and purposes, Sindh is a perfectly rainless country, but, as far as cultivation is concerned, this is partly compensated for in the magnificent river which flows through its midst, and which is capable of being led over every part of its delta.

Hitherto, irrigation from the Indus has been confined to the season of the freshes simply because the canals which have been taken out of it are all on the inundation system, but seeing the enormous volume which it carries in the lowest season, seldom less than 60,000 cubic feet per second, it seems matter for regret that, where water is so valuable, so large a quantity should be allowed to run to waste to the sea, and that the cultivated area in Sindh should be limited to what can be raised during the inundation months, thus practically leaving the agricultural community without occupation during the remainder of the year. Colonel Fife proposed to remedy this defect by the construction of a system of perennial canals, for the first of which he designed a large canal from the left bank of the gorge at Rorce, but the wholesale silting up of the Sukkur Canal on the opposite bank of the river raised discussions as to the possibility of keeping open the Roree Canal as designed.

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There are certainly difficulties connected with the great deposit of silt in the Indus Canals, but I believe they are not insuperable, and, seeing the advantages that would accrue from the cultivation of spring crops in a climate suited to the growth of wheat and similar cereals, I think the subject of perennial canals in Sindh should not be allowed to drop altogether. After a tour through Sindh I made suggestions by which the Eastern Narra series might be converted into a perennial system, and if a commencement made with these is found to be attended with successful results, the general scheme could be extended hereafter. The irrigated area in Sindh this year amounted to 1,618,400 acres; in fact, without water, cultivation is impossible, and the only limit to the extension of canals is the population. Experience, however, on the canals constructed of late years from the Eastern Narra shows that immigration from the neighbouring desert tract of Jeysulmere quickly follows the introduction of water in any new locality.

The chief means of communication in Sindh is the River Indus, but this at present is unconnected with the Kurrachee Harbour, and now that the break-water there has been completed, and ships are beginning to resort to that port again, the connection of the Indus with that harbour is a matter of importance. There is also the Railway from Kotree to Kurrachee, and its connection with Mooltan is also in progress, but some years must elapse before it is completed. When the extension of the Eastern Narra series is undertaken, not only should the main canal be rendered navigable, but at least one cross line should be carried from Oomerkote to the Indus at Hyderabad, as at present all traffic is dependent on camel carriage, which is very costly, and a high cost of transit is one of the disadvantages under which Sindh at present labors.

Having thus described the circumstances and existing conditions of each Province in their geographical order, it remains to examine how far their respective requirements, as regards means of irrigation and communication—for the two are inseparably connected—are met by the several schemes already sanctioned and in progress.

In the forecast of expenditure on Irrigation works prepared last year were entered all the schemes which have as yet been sanctioned either in whole or in part.

The estimates amounted in aggregate to £18,487,000, and the estimated expenditure to the end of the current year 1873-74 to £6,927,000. The actual outlay has been £6,255,411. There were also a certain number of projects entered as "contemplated," whose estimated cost was set down as £1,838,000, and the expenditure on these, chiefly on investigation, was set down at £97,000. The actual outlay has amounted to £80,270.

Of the sanctioned schemes, I do not think that those in any one Province can be accelerated at the expense of those in another without prejudice, nay, even without danger to the locality in which the retarded works may be situated, unless it be the works in the Bombay Presidency, where the recurrence and pressure of scarcity seem to be less frequent and severe than in any other part of India.

If the relative amount of rain-fall is alone to be taken as a standard by which the requirements of the respective provinces of India are to be gauged, then Sindh and the rainless tracts of Punjab in the north, and Mysore and adjacent districts in the Peninsula, would stand first; but several other points have also to be considered, such as the degree of regularity of the actual rain-fall, the staple food of each locality, and the quantity as well as the regularity of the supply of water required for its growth, the population dependent on such food, the accessibility of the locality from other Provinces, the nature and extent of its communications, the cost of transit, and the ruling prices of grain and other produce. It will be at once evident that all these points must be considered together, and that, if precedence is to be given to any one part of India more than to another in providing an insurance against famine, Irrigation works are most urgently required in those localities where the food of the people is dependent on a single crop, which is liable to be suddenly and seriously injured, if not altogether lost, by either irregularity, insufficiency, or too early cessation of the periodical rains, and where the population dependent on such crop is densest; for a failure in such a locality is liable to be entire is much more difficult to contend with, more disastrous in its effects, and far more lasting in its consequences, than where the population is comparatively scanty, and is not wholly dependent on any single staple of food. Hence the famines in the North-Western Provinces have been more intense than those in the Punjab, and those in Bengal, though less frequent, generally attended with

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more loss of life than in the North-Western Provinces. For instance, the mortality in Orissa in 1866 is stated to have been 31·34 per cent., while that in the North-Western Provinces in 1869 was about eight per cent. additional to that occurring in an ordinary year. Forty years ago, famine in Madras decimated the population of the districts in which it occurred, but, owing to increased facilities of communication, the droughts of later years have been more easily met, and, therefore, attended with less loss of life.

On the other hand, as far as experience up to the present time serves as a guide, the demand and utilization of water in Northern India is more regular in tracts where the rain-fall is normally small than where it is larger, and therefore the income from irrigation is likely to be both larger and less fluctuating, so that, perhaps, the capital outlay on irrigation schemes may be sooner repaid. Against this view, however, it may be urged that, as regards the only Province in Bengal in which Irrigation works have as yet been constructed, there has scarcely been time to judge whether the demand for water will be fluctuating according to the seasons, or whether, when the practice of irrigation has once taken root, it will not continue to be perfectly regular. My own opinion is that, in purely rice-growing tracts, artificial irrigation *must* eventually be resorted to as a permanency, *first*, because it permits of agricultural operations being commenced much earlier and carried on with more regularity and comparative absence of all risk; *second*, that river water will always be preferred to the natural rain-fall on account of its fertilizing property and its effect in lessening the exhaustion of the soil.

Therefore, as regards the utility of artificial irrigation, and the degree of regularity with which it will be resorted to, I think that, though its development in Bengal may be slower at first, yet that eventually it is likely to be as extensively and as permanently appreciated as in the Upper Provinces. Viewed commercially, it is probable that the direct receipts from canals in Northern India, after the water has once become available for distribution, will be larger annually and increase more rapidly than in Lower Bengal; but, if the losses to the State from periodically recurring droughts be taken into consideration, and their prevention be set against the slower development of direct revenue, I suspect that the financial results would be in favor of the Lower Provinces. For instance, the expenditure in the famine of 1866 cost the Government—

	£
For importation of food and remission of revenue	1,538,800
For Public Works	643,500
Total...	2,182,300

Vide Mr. Geddes' compilation, page 304.

In the present year the net outlay may probably reach five millions, so that in a period of eight years, drought in Bengal alone will have cost the State over seven millions sterling, or nearly at the rate of one million in a year. A very small portion of this outlay can yield any return, and hence it may be taken as a measure of what it really is worth the State's while to expend in the way of insuring those provinces against future similar visitations.

I think, therefore, that all the sanctioned schemes enumerated in the forecast must continue to be diligently prosecuted, and that, if it be found necessary to omit any for the present, it is only the Taptee Project in Bombay that can be discontinued, for the large Moota scheme and the minor projects have progressed so far, that they must be completed. The amount allowed in the forecast for these schemes is—

	Sanctioned Schemes. £	Contemplated. £	Total. £
For 1874-75.	1,373,000	202,000	
1875-76.	1,292,000	257,000	
1876-77.	1,256,000	245,000	
1877-78.	1,225,000	204,000	
Total ...	5,146,000	908,000	
Average ...	1,286,500	227,000	1,513,500
Deduct contributions from Native States			106,250
			1,307,250

or a little more than 1¼ millions. For the "contemplated" schemes, an average allowance of £227,000 was allotted, but amongst these no provision has been entered for the Rechna Doab project in the Punjab, or for Bundelkund in the North-Western Provinces, or for the Gunduck and other schemes in Bengal, alluded to in this Note, for, at the time the forecast was prepared, there were no prognostications of the scarcity which has since occurred, and the Government of Bengal had indicated no intention or desire of submitting them for sanction within any specified time.

If the works recommended in this Note be added to the list of "Contemplated Projects," the aggregate estimate of such works will be increased from £1,838,000 to £14,088,000 by the following schemes :—

		£
Punjab	1.—Sind-Sagur Doab ...	2,000,000
	2.—Rechna ,, ...	2,000,000
	3.—Derajat Canals ...	500,000
N.W. P.	4.—Bundelkhund Works.	750,000
Bengal	5.—The Gunduck schemes	3,000,000
	6.—The Damooda Canal (Colonel Haig's Estimate.)	1,000,000
	7.—The Nuddea or Lower Ganges Canal ...	2,000,000
Madras	8.—The Upper Tumbuddra...	1,500,000
		12,750,000
	Add already entered ...	1,838,000
	Total ...	14,088,000

If their relative importance is to be regarded in the light of Irrigation works only, I should classify the principal contemplated works, thus—

1.—Bundelkhund.
2.—The Gunduck.
3.—The upper part of the Sind-Sagur Doab.
4.—The Damooda.
5.—The Rechna Doab.
6.—The Pennair Extension (Sungum Project), Madras.
7.—The Eastern Ganges Canal.
8.—The Swat Project.
9.—The tanks in the Central Provinces.
10.—The Derajat Canals.
11.—The Upper Tumbuddra Project in Madras.
12.—The Nuddea Canals.

Supposing that the grant for Irrigation works could be increased from £1,300,000 to £2,000,000 per annum, there would remain £700,000 available for carrying out the above additional works, which, at that rate of progress, would therefore occupy about twenty years; but as after 1877-78 there would remain only £11,580,000 to be expended on the sanctioned works, and £881,000 on the contemplated works already entered, besides £9,550,000 on the additional works just enumerated, the total to be expended after 1877-78 would be roughly £22,000,000. If the grant for £2,000,000 annually continue to be maintained, the whole would be completed in eleven years from that time, or by the year 1888-89. It may be prudent perhaps to allow for an increase of ten per cent. on the above sum as a possible excess over the estimates.

The net income from the *total* Capital outlay on Irrigation works in operation in Northern India for the current year is 4·25 per cent., including the item of enhanced land revenue. The effect on the general prosperity of the country, such as increasing the export trade, adding to the circulation of bullion, diminishing the cost of transport, and equalizing prices, cannot be set down in figures, but the results of irrigation and communications combined have this year been made evident in the large contributions of food-grains from the Upper Provinces and from Orissa. I believe, therefore, the indirect effects of completing the several projected schemes will be such on the country generally, that, though there may not be a direct income in the shape of water-rates from each specific project for some years to come sufficient to cover the interest on the total Capital outlay, yet that, by the security of the land revenue from those periodical fluctuations to which it has hitherto been so often subjected, no only will no additional burden in the shape of extra taxation be laid on the country by incurring that outlay, but the State will both be saved from such expenditure as the present year has imposed, and its general revenues will rise in consequence of the stimulus given by increased production and by the increased facilities for conveying that produce to all parts of the empire as well as to the markets of the world.

A review professedly discussing the class of works necessary for either the mitigation or prevention of famine would be incomplete if it did not deal with the kindred subject of communications as well as with that of irrigation. In every visitation of drought which has overtaken India, the efforts of the Government have been most severely taxed, not so much in the procuring of foot, as in its conveyance to the required destination, and the fact has been made unmistakably clear that, notwithstanding all that has been done, and all the outlay incurred, the country, as a whole, is as yet but very imperfectly supplied with cheap means of transit.

In considering, then, what yet requires to be done towards supplementing deficiencies in this respect, regard should be had at the outset to whatever natural facilities may exist ready to our hands. Particular tracts of country throughout this vast Continent doubtless require exceptional measures, and local peculiarities of position require to be specially considered; but there are two fundamental principles which must always govern the question :—

First.—The necessity for connecting the different Provinces one with another and with the sea-board by as many routes as possible; and

Second.—The enormous distances which have to be traversed render it imperative that the cost of transit by those routes should be reduced to a minimum.

The best method of combining these two requisites is the problem that presents itself for solution.

It cannot be laid down that any particular system of communication must be rigidly adhered to—whether railways or water-carriage; for, under certain geographical conditions, it is clear that in either case the cost both of first construction and subsequent working expenses may be so great as to render it impossible to reduce the cost of transit to the necessary low unit at which bulky goods of small value can afford to be moved, and hence it may happen that in some cases railways may prove to be the cheaper mode of conveyance, as for instance, in hilly or undulating tracts, or where, as in Central India, the rain-fall is not only small, but spasmodic, and where there is no possibility of storage at any reasonable cost. On the other hand, the construction of a line of railway across a country subject to the overflow of such enormous bodies of water as the drainage of the Himalayas, or of rivers fed by the S. W. monsoon, must necessarily be attended with such a high cost for bridging, that to meet only the interest on first cost would entail the imposition of rates of freight which would be perfectly prohibitory to such goods as form the great mass of traffic in a poor country. As a general rule, it is certain that wherever practicable within a reasonable outlay, water-carriage admits of the cheapest mode of conveyance, inasmuch as the working expenses are so exceedingly small. An inspection of the map will show its applicability to a great part of India, while the enormous traffic that takes place on the rivers of Bengal indicates its pre-eminent suitability to the circumstances of its Provinces, and its thorough appreciation by the people of the country.

But cheap as transport on rivers is, the working expenses can never be reduced to the same low rate as is obtainable on canals, because on the latter—

First.—The current can be reduced to a minimum.

Second.—There is an absence of all risk from storms, and therefore no need of incurring the expense for insurance.

Third.—The distances are generally shorter.

Fourth.—Canals can be worked by night as well as by day.

Fifth.—Smaller crews will suffice.

Besides that of cheapness, water-carriage by canals possesses the following advantages :—

First.—It admits of any class of goods being carried in the manner and at the speed which proves to be most economical and suitable for it without the slightest interference to any other class.

Second.—The landing or shipment of cargo is not confined to certain fixed stations as is the case with Railways, but boats can stop anywhere on their journey to load and unload.

Third.—The boat itself often serves as a ware-house in which the owner can keep his cargo until it is sold.

Fourth.—The capacity for traffic is almost unlimited, even in the case of canals with locks, provided the locks are properly designed. A lock 150 feet long by 20 feet broad will pass single boats of 300 tons, or say only half that amount of tonnage if distributed amongst a number of small boats. The locks on the Midnapoor Canal are manœuvered in three minutes ; but supposing twice that time were occupied, then at the rate of ten lock-fulls of 150 tons per hour, the capacity of a single lock would be at the rate of $10 \times 150 \times 24 = 36{,}000$ tons per day, or over 13 million tons per annum. If a larger traffic required to be accommodated, it could be met either by increasing the speed at which the locks were worked, or doubling their number.

Fifth.—In the case of State canals, unless worked by the State, there is no necessity for maintaining an enormous and expensive apparatus, or establishment for working the traffic, as all that is carried on by a separate agency and by private capital, thus avoiding a large expenditure by the State both in the first cost and subsequent maintenance of rolling-stock.

Whatever, then, may be said for other parts of India, it can scarcely, I think, be gainsaid that for Bengal and all those portions of the Upper Provinces also where canals can be taken out of rivers with a permanent supply of water, and which can be worked into the immense existing system of navigable rivers, advantage should be taken so to design them at the outset as to combine the property of navigation with irrigation. Nowhere in the world can canals be

constructed so cheaply, for the *additional* expense attendant on making irrigation canals navigable is comparatively small, varying from one-third in a country with a steep fall to one-tenth of the whole cost in one with a flat slope, or from £3,200 per mile as on the irrigation reaches of the Midnapoor Canal, to between £700 and £1,200 on the Punjab and North-Western Provinces canals. In every case that a canal is connected with one of the Bengal rivers, it becomes immediately accessible to the whole of the water system, which measures about 3,300 miles. The consequence is that, as soon as it becomes known that any particular article of food or of household consumption or trade is in demand, the whole existing river plant is set in motion to convey the required article from [illegible]place where it abounds to that where it is [illegible]d. Wherever such intercommunications exist, it is quite certain that food at all events will always be conveyed to the places where it is in demand. In no other way can it be so effectively and cheaply distributed, for boats will not only stop at the exact place where there is a demand, but will serve as ware-houses until their cargoes are discharged. The fact that many boat-owners are petty merchants trading on their own account is a peculiar feature in the water-borne traffic of this country, and a wider diffusion of trade is thereby ensured than where the boatmen are simply carriers of other people's goods. As an illustration of the manner in which boats ply from one distant place to another, I may mention that, when inspecting the Midnapoor Canal the other day, I found boats from such opposite places as Benares, Dacca, and Patna all plying in that canal, though only six months had elapsed since it had been opened for through traffic.

The activity on the canals during the past year has been very considerable. On the Ganges Canal there has been a traffic of 91,000 tons carried probably between 200 to 300 miles.

On the Calcutta Canals about 1,800,000 tons have been moved.

On the Orissa Canals there have been 221,000 tons lifted on 210 miles, or at the rate of 1,000 tons per mile.

On the Godavery Canals 870,000 tons were lifted over a length of 300 miles, or at the rate of 2,900 tons per mile.

No figures for comparison with the Railway for the current year are yet available, but during the first-half year of 1872, 646,000 tons were lifted over a length of 1,280 miles on the East

Indian Railway, giving about 500 tons per mil of railway, or if an equal amount of traffic obtained in the second-half of the same year, the total lifted was about 1,000 tons per mile during the year.

It has been remarked, if such be the case with canal traffic, how is it that no corresponding receipts are forthcoming such as are obtained on the railways. The answer is very simple, that the receipts on the railways consist of the whole traffic earnings, while those from the canals are only tolls which are a very small fraction of the earnings of the carrier. Were the Government to work their canals themselves, as they are doing the State Railways, instead of only allowing others to work them, then there would be equally large receipts forthcoming; but, except in the case of passenger traffic, this is not desirable, and even for passengers it would be better to leave their conveyance to private enterprize.

The actual *cost* of transit on canals is very low, probably in most instances not more than $\frac{1}{10}$th of a penny per ton-mile, but the *charge* varies everywhere, and is regulated by the relative amount of demand and supply of carriage available.

In Orissa and the Godavery the charge fluctuates between 3 and 6 pies, equal to $\frac{3}{8}$ and $\frac{6}{8}$ of a penny per ton mile, and on the River Ganges it is even less for long distances.

Seeing, therefore, the vital importance of multiplying intercommunications, and the absolute necessity of keeping the cost of transit as low as possible, I am sure that the Government will find that the additional cost of rendering navigable all the Irrigation canals which are either in course of construction or contemplated, will be money economically expended, and nowhere more so than on the canals in North Behar, where, owing to special facilities in the gentle slope of the country, the works requisite to render them navigable can be added at so small a cost.

In a Memoir on the famines which affected Bengal in the last century, Sir George Campbell has insisted strongly on the necessity for intercommunication.

In the "conclusions" which he draws from the history of the various famines he observes—

3.—That, looking to the fatal effects of a failure of the rice crop in the countries of the Lower Ganges which are not supplied by artificial irrigation,

and the known frightful results of famine in the Punjab in 1783, efforts should be made to supply irrigation to those countries as far as is compatible with financial necessities.

4.—And that, above all, the means of intercommunication should be placed on such a footing that they may really be efficient to supply the millions of one province from the abundance of others in case of future famine.

45. It will doubtless always be remembered that to transport food sufficient for the supply of great masses of population we shall require means of carriage far beyond the requirements of any ordinary trade. The line of the Oudh and Rohilkhund Railway, which has now been sanctioned, communicating with the more navigable waters of the Ganges, will, in conjunction with the East Indian Railway, afford a double line of communication between the Upper and Lower Gangetic countries; and by the time that both lines are double, and that their traffic arrangements are rendered thoroughly efficient, it may be hoped that these lines, aided by water carriage, will suffice to render available the resources of one zone of the country to the necessities of another. I will only venture to express again a hope that this end may be attained before another famine overtakes us.

46. I would further urge the extreme desirableness of pushing on the means of communication between the Punjab and the Gangetic country, the conditions of which are so dissimilar, that it has usually happened that want in one has been accompanied by great abundance in the other.

* * * * *

After recommending certain additions and extensions which have since been carried out on the Railways, he adds—

In case the Western Jumna Canal is remodelled (as has long been recommended), and a canal is made from the Sutlej, water communication between the Punjab and Gangetic countries might also be established.

In the projects which have lately been sanctioned, and are in progress, the above suggested connection of the Punjab with the Gangetic countries has been provided for. The Baree Doab Canal will be connected with the Sutlej and Sirhind Canal. This last is to be joined to the Western Jumna, which in its turn will be connected with the Agra Canal, and so with the Jumna itself at Agra. The navigation following

that river will pick up the Western Main Canal of the Sone series, either at Mirzapore or Chunar, and be carried on by the Eastern Main Canal to the Ganges at Monghyr. The intermediate lines will connect it with the Gunduck system and with the Oudh Rivers, and the Ganges itself will carry on the connection with all the rivers as far as the Brahmapootra to the east, while the Hooghly will lead it to the Damooda, the Midnapoor and Orissa series of canals on the south and west. If the Hindun Cut and the Eastern Jumna Canal be made navigable and connected with the Ganges Canal, then the system of the North-Western Provinces will be linked in with that of the Punjab, otherwise it will remain isolated, and its usefulness comparatively restricted. If this design be faithfully adhered to and properly carried out, then every Province will in its turn be able to contribute to the necessities of any other, and all their varied products will be interchangeable at the lowest possible rates. Further, by the construction of the Lower Sutlej series of canals from the weir at Hurreekee Pattan, the line of communication will be continued to the Indus, and a traffic will then be generated, the limits to which are beyond the possibilities of calculation, but an idea of which may be formed from that which is now taking place on the great water-systems of America.

(Signed) F. H. RUNDALL,
Inspector-General of Irrigation.

31*st March* 1874.

Rev 2394/75

use shall have been made of the water already available, it is thought that it would not be desirable to sink more capital solely for the purpose of securing perennial navigation.

8. The extension of the Kurnool and Cuddapah Canal to the Nellore District would be a very costly work, and there are no present inducements to warrant this Government in proposing that it should be undertaken. The continuation of this line of canal through the Nellore District to the coast appears to show no special facilities for navigation, while as an irrigation work it will not be of such importance as to render it necessary to take any steps, under the present circumstances of the Company, in connection with it.

9. Ordered that a copy of these Proceedings be transmitted for the information of the Government of India.

(True Extract.)

(Signed) HASTED, Major, R.E.,
Offg. Joint Secretary to Government.

/True Copy/

Jt Secretary Major R.E.
Jt Secy to Govt
P.W.D.

To the District Engineers, Godavery, Nellore, Ganjam, Kurnool, and Cuddapah.
" Superintending Engineers, Bellary and Kistna.
" Collectors of Kurnool and Cuddapah.
" Chief Engineer and Manager, Madras Irrigation and Canal Company.
" Chief Engineer for Irrigation.
" Revenue Department. ✓

Exd. A. Grubert.
20 Spare Copies sent forthwith

Rev: 1875: 214

N. 2394

Govt. of {1875} Madras.

PUBLIC WORKS.

To

THE DISTRICT ENGINEERS,

GODAVERY, &c.,

&c., &c., &c.

Dated June 9th.

Issued

G. O., 9th June 1875, No. 1,620.

JUNE.

Nos. 214-215

No 1336
Referred to the
Board of Rev: for report on
the subject of para 6 of
the foregoing order.
24 June/75.

Colonel Rundall's Review of the wants and prospects of India in regard to Irrigation Works.—Passing orders on —