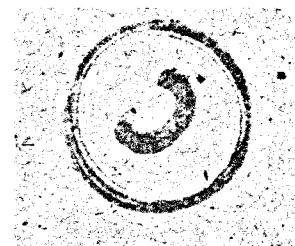


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Madras Irrigation Company



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MADRAS IRRIGATION COMPANY

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RETURN to an Address of the Honourable The House of Commons,
dated 25 April 1872;—for,

"COPY of any recent CORRESPONDENCE that may have taken place between
the Secretary of State for *India* and the Governments of *India* and
Madras, and between the Secretary of State and the Directors of the
Madras Irrigation and Canal Company, relative to the present Condition
and future Prospects of the Company."

India Office,
30 April 1872.

W. T. THORNTON, Secretary,
Public Works Department.

(Mr. Charles Dalrymple.)

Ordered, by The House of Commons, to be Printed,
10 May 1872.

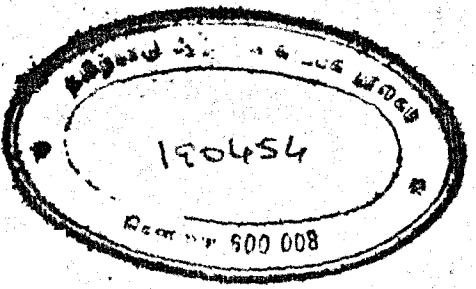


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COPY of any recent CORRESPONDENCE that may have taken place between the Secretary of State for India and the Governments of India and Madras, and between the Secretary of State and the Directors of the Madras Irrigation and Canal Company, relative to the present Condition and future Prospects of the Company.

— No. 1. —

The Secretary of the Madras Irrigation and Canal Company to the Under Secretary of State for India.

8 and 9, Queen-street-place, E.C., London,
23 January 1871 (No. 1).

Sir,

With reference to the supplementary contract under which this company has been carrying out the very important works in the Madras Presidency on which they have been engaged, the directors have desired me to inform you, for the information of his Grace the Secretary of State for India, that their chief engineer very lately, and after careful consideration, has to them expressed his conviction that the works between Soonkasala and Cuddapah will be completed in accordance with that contract, by means of the aid rendered by the Government to the company through the loan of 600,000*l.*, made expressly for the construction of those works.

The directors, however, at the same time consider it proper to state that, with the view of meeting the expressed wishes of the local Government, and under the directions of that Government, they have expended a considerable sum (*i.e.* about 32,000*l.*) out of the funds at their disposal, since the date of the supplementary contract, upon investigations not included therein, namely, the preparation of plans and estimates connected with the remaining sections of the Toombuddra project in Bellary and in Nellore, in searching for and investigating sites for reservoirs required to store water to maintain a continuous supply to the whole of the same project, and in preparing plans and estimates of some of such required reservoirs, and, further, in the construction of a number of additional bridges beyond those contained in the sanctioned plans of the main canal and works. In thus acting, the directors are aware that no portion of their funds existing at the date of the supplementary contract being entered into should, in strictness, be so expended, but that the same should be applied solely to the works between Soonkasala and Cuddapah; fully concurring, however, as they did with the Government of Madras in the importance and value of the desired extra operations, they have considered it their duty cheerfully to comply with, and follow out the views of that Government, under the assurance that, if necessary, but which the directors do not anticipate, this additional outlay will be regarded by his Grace, and so treated, as exceptional from the amount expressly set apart and provided by the contract for the completion of that portion of the company's project between Soonkasala and Cuddapah.

I am, &c.

J. Westwood, Secretary.

— No. 2. —

The Assistant Under Secretary of State for India to the Secretary of the Madras Irrigation Company.

Sir,

India Office, 10 February 1871.

I AM directed by the Secretary of State for India to acknowledge receipt of your letter of the 23rd ultimo, representing that, out of the loan of 600,000*l.* made to the Madras Irrigation Canal Company expressly for the construction of their works between Soonkasala and Cuddapah, a sum of about 32,000*l.* has,

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at the instance of the Madras Government, been expended on operations extra to those contemplated by the contract under which the loan in question was made, and requesting that this extra outlay may, if necessary, be treated as exceptional from the amount expressly set apart and provided by the contract for the portion of the company's contract between Soonkasala and Cuddapah.

In reply, I am to state, for the information of the directors of the Madras Irrigation and Canal Company, that a reference will be made to the Madras Government on the point raised in your letter.

I am, &c.
J. C. Melvill.

— No. 3. —

The Secretary of State for India to the Government of Madras.

My Lord,

16 February 1871 (No. 3).

I ENCLOSE herewith, for your Excellency's information, copy of a letter* from the directors of the Madras Irrigation and Canal Company, representing that, out of the loan of 600,000*l.*, made to them for the purposes of their works between Soonkasala and Cuddapah, about 32,000*l.* have, at the instance of your Government, been expended on operations extra to those contemplated in the contract under which the loan was made. I shall be glad to be favoured with your opinion on the Board's application that this extra outlay may, "if necessary," by which is apparently meant, in the improbable event of the loan proving insufficient to complete the works between Soonkasala and Cuddapah, be regarded and treated as exceptional from the amount expressly set apart and provided by the contract for the completion of those works.

I have, &c.
Argyll.

— No. 4. —

The Secretary of State for India to the Governor General in Council.

My Lord,

16 February 1871 (No. 16).

1. I HAVE received from the Directors of the Madras Irrigation and Canal Company a communication, of which a copy* is enclosed, relative to the distribution channels required for the utilisation of the water of their main canal between Sunkasala and Cuddapah.

2. From the papers which accompany the Board's letter, it will be seen that the consulting engineer to the Madras Government has represented that to complete the distribution channels by 30th June next, as the company are bound to do by the letter of their contract, would be to a great extent a mere waste of money, as many of them could not be brought into use until long afterwards, and that in the meantime "they would be filled in, their banks broken down, and their masonry works considerably injured." It will also be seen that the Madras Government take the same view of the matter, considering, that, if "instead of completing the works of distribution at once, as though all the land intended to be supplied was likely to be taken up for irrigation without hesitation or delay," they were carried out with sufficient speed to make them keep pace with the demand for water, "much waste of labour might be avoided, and a considerable saving of money effected."

3. It appears, however, that the Madras Government have refrained from acting upon the views thus expressed, from reluctance probably to relax the conditions of the company's contract without authority either from your Government or from myself. But there can be little doubt of the desirableness of preventing the apprehended misapplication of the funds of a guaranteed company, and I would, therefore, recommend that the Madras Government be immediately empowered by you to suspend, at its discretion, the prosecution of any of the distribution

* Purposely omitted from the Return, as unnecessary.

distribution channels in question, and to notify to the Irrigation Company that the consequence of the non-completion of those channels within the period originally prescribed will not of itself be deemed a breach of their contract, provided the latter be complied with in all other particulars.

I have, &c.
Argyll.

— No. 5. —

The Secretary of the Madras Irrigation and Canal Company to the Under Secretary of State for India.

8 and 9, Queen-street Place, London, E.C.,
7 March 1871 (No. 3).

Sir,

In view of the early completion of that portion of the company's "Toombuddra Project," which forms the special subject of the supplementary contract, as notified in my letter* to you of the 23rd ultimo, the directors have desired me to respectfully address his Grace the Secretary of State for India, with reference to the construction of the remaining portions of that project, viz., those intended to provide the districts of Bellary (Upper and Lower) and Nellore with irrigation and navigation, and to establish the means of storing water sufficient for maintaining a continuous supply throughout the year in connection with the whole of the works comprising the Toombuddra project. * See No.

2. Upwards of four years having elapsed since the directors last addressed the Secretary of State for India regarding the works now spoken of, it is desirable that the more special circumstances which have occurred in the interval should be reviewed somewhat in detail, because the necessity for, and the intent of, this communication will be the better illustrated, and the Duke of Argyll will be enabled to consider and decide the matter submitted to him the more conveniently and satisfactorily.

3. Under this view, the special attention of his Grace is earnestly solicited to the following narrative statement, viz. :—

In the month of November 1866, in consequence of the letter of which the Appendix 1 is a copy,† a deputation from the board of directors waited upon the then Secretary of State for India (Lord Cranborne, now the Marquis of Salisbury), and respectfully submitted the reasons which, in the mind of the board, rendered the case especially worthy of receiving from Government an extension of the existing guarantee to cover such an amount of capital as might be required to enable the company to complete the very important experiment, for the carrying out of which it had been established by his Lordship's predecessor in office, Lord Stanley (now the Earl of Derby), viz., to ascertain whether the employment of private enterprise and English capital could be advantageously adopted in aid of Governmental action in construction of works of irrigation and navigation in India.

At the foregoing interview, Lord Cranborne was pleased to admit that the matter was entitled to his favourable consideration, and that it could not be treated as a request for a new or additional guarantee in relation to an original work, but as a solicitation for an extension of an existing guarantee to complete a partially constructed project; and he requested that a statement in writing of the facts, &c., should be supplied to him, in order that he might forward the same to the Government of Madras, with instructions that the latter should procure further information, and should then report the same, and also their views thereon.

In obedience to Lord Cranborne's request, the directors caused the letter, of which the Appendix 2 is a printed copy, to be addressed by me to you on the 18th of December 1866, to the contents of which the attention of

† The enclosures to this letter being of old date, are purposely omitted from the Return as unnecessary.

of his Grace the Duke of Argyll is respectfully and specially solicited, because they disclose the early history of the company, and the circumstances under which the directors felt themselves justified in soliciting an extended guarantee.

In fulfilment of his promise (as will be seen by a reference to the letter dated 20th December 1866, of which the Appendix 3 is a copy), Lord Cranborne forwarded the above letter of the directors to the Government of Madras with his promised instructions.

Previously to this reference, the Government of Madras had then very lately (irrespective of the prior instances referred to in the Appendix 2), given their serious attention to the prompt provision of means for irrigating the district of Bellary; and in the month of August 1866, they arrived at the conclusion, with reference to the portion affecting Upper Bellary, that is, between Wallavapoor on the Toombuddra River, and the town and cantonments of Bellary, that "*the only certain and effectual mode of supplying irrigation to that locality was the construction of a canal from Wallavapoor, which canal formed part of the Toombuddra project, referred to in the preamble of the company's contract.*"

A copy of the proceedings of the Madras Government, containing the above quotation, accompanied by a letter from the Collector of Bellary, is set out in the Appendix 4, the whole of which will be found most conclusive as to the value and the urgent necessity for Upper Bellary of the work referred to.

Following up the proceedings just narrated, the Government of Madras, on the 13th of December 1866, by an order of which a copy will be found in the Appendix 5, instructed their consulting engineer (Captain Mullins) to proceed to Bellary, and in communication with the engineers of the company to examine thoroughly the designs, and scrutinise the estimates which had then been prepared by the latter, adding expressions indicative of their anxiety for the construction of the works, and a statement that they would again appeal to the Secretary of State for India on the subject, should Captain Mullins be able to report favourably, and to show fairly remunerative returns upon the required outlay.

Notification of the intended visit and examination by Captain Mullins was given to the Company, and the plans and estimates of what may be called the Company's Upper Bellary Section of the Toombuddra project were then at once completed, so far as they could be.

In obedience to his instructions, Captain Mullins, with the assistance of the company's engineers, made the investigation required, during which he went thoroughly into the matter in regard to the designs for the works, the rates allowed, which he thought ample (an opinion since confirmed by the company's consulting engineer, Colonel Smith, before whom the same were laid for consideration and report), and also the rate to be charged for irrigation, which, for safety's sake and for the purposes of his calculation, he assumed at five rupees per acre (six rupees being subsequently fixed by the Government); and he then forwarded to the Government of Madras a very elaborate report, which was in every respect highly favourable to the prosecution of the work, and proved that it would confer very great and permanent local benefits, and would produce an amply satisfactory return.

About or immediately before the date of this Report, the reference made by Lord Cranborne was received by the Madras Government; and on the 21st of February 1867, the latter directed that the same Report should be referred to the Revenue Department, "*with a view to the question of the amount of water rate per acre which might be imposed upon the land to be irrigated from the proposed canal for a first crop, and for a second crop, being considered in that department.*" They also directed inquiries to be made regarding the rates that had been paid for masonry works and tunneling on the Madras Railway, and on the Bhore and Thull Ghauts, some fear having been expressed by the chief engineer that the project as planned would be expensive in these matters. They also directed inquiries to be made regarding the concession to the company by the Bombay and Mysore Governments of sites for reservoirs.

Pending the proceedings above described, and those subsequently referred to in this letter, the company continued to prosecute surveys for the purpose

pose of selecting the best line of canal for the Lower Bellary District, that is down to Soonkasala, the commencement of the works now about to be completed, and also various sites for storage reservoirs, the storage of water being considered by all connected with the Government and the Company to be essentially necessary to develop the Toombuddra project as a whole, and every one of its sections separately. The company likewise contemporaneously prosecuted the surveying, planning, projecting, and estimating, of the terminal section of the same Toombuddra project through the district of Nellore, providing the necessary funds for all these matters, with the recorded sanction and approval from time to time, and to meet the views, of the Government of Madras—out of the capital which was then properly alone applicable under the supplementary contract to the section between Soonkasala and Cuddapah, the necessary establishments being submitted to and approved by that Government, who not only urged forward the prosecution of the investigations, &c., but insisted that the reservoir sites should be selected and examined, not with reference to the supply of the Bellary works solely (to which they expressed their fear that the company intended to limit itself), but to the supply of the whole Toombuddra project; and on the 17th of June 1867, having before them a resolution that had been passed by the board of directors, asserting the paramount importance of storing water for the entire Toombuddra scheme, the same Government recorded an order in the following words:—

"The Government concur in opinion with the Board of Directors of the Madras Irrigation and Canal Company as to the importance of constructing reservoirs for providing water for irrigation under their canal, and for maintaining its navigation throughout the year; and his Excellency the Governor in Council will be prepared to enter into negotiations for the transfer to the company of the land forming the sites mentioned as existing at Luckovally on the Buddra, Bagoli on the Toonga, and Mudduck Massoor on the Choardy, on the Government being furnished with the surveys and land plans adverted to in paragraph 3 of the consulting engineer's letter."

On the 2nd of September 1867, having received the aid of Reports from the Collector, the Revenue Commissioner, and the Consulting Engineer, the Board of Revenue of Madras, in reply to the reference made to them by the Government, as before stated, made a Report in which, in remarkably impressive language, they earnestly recommended that the Government should afford the company every reasonable assistance in raising the necessary funds, and completing the work as rapidly as possible; and, without hesitation, also recommended that the usual guarantee should be given for that purpose, and concluded by reporting in favour of a water rate of 6 rupees per acre per crop being adopted in all calculations regarding the returns to be derived; and the Government of Madras, by an Order dated 6th September 1867, directed that the rate thus recommended should be adopted. The contents of this Report and Order will be found in Appendix 6, and are well worthy of perusal.

Thus the Upper Bellary section of the company's Toombuddra project had, at the date last named, received the approval of the Consulting Engineer of Government, of the Collector of the district, of the Revenue Commissioner, and of the Board of Revenue, whilst the investigation into the Lower Bellary project, into sites for reservoirs to be connected with the whole scheme, and into the Nellore section, were being vigorously proceeded with by the company, with the full sanction and by the wish of the local government.

In the month of March 1868, the Consulting Engineer of the Government visited the principal reservoir sites, which had up to that time been investigated and planned generally, though not in detail, by the company's engineers, and on the 17th of that month he reported at considerable length and highly favourably, both as to capacity and returns upon outlay, regarding three of those sites; and he recommended that the company should be required to continue their labours to the perfecting of their plans and estimates; and in consequence the Government, on the 24th of April 1868, ordered the matter "to lie over till the submission of complete

"surveys and sections of the proposed reservoirs, with full plans and estimates."

The investigations thus required by the Government were continued by the company, the former from time to time arranging and sanctioning the establishments required for each of the four works in progress, viz., another suggested line of canal for Upper Bellary, a canal for the Lower Bellary section, reservoir sites, and canals for the Nellore district. Indeed, so anxious was that Government that the company's exertions in Bellary and upon the reservoir sites should not be interfered with, that in March 1869, when their consulting engineer expressed a fear that the company were about to remove the engineer who had superintended the operations, and to place him upon the works between Soonkasala and Cuddapah, to ensure the fulfilment of the supplementary contract, the Government declined to sanction the arrangement, except upon the understanding that the company should make satisfactory arrangements for the early completion of the Bellary and reservoir plans, &c.

About the time now referred to, the company's superintending engineer submitted to the consulting engineer of Government sketch plans and information connected with the other proposed line for Upper Bellary, and regarding the continuation of that and of the previously projected canal from the town of Bellary to Kurnool, called the Lower Bellary Projects, and the latter officer reported fully thereon to the Government, who, on the 22nd of March 1869, recorded an order in which, after expressing a conditional approval, and after stating that the Right Honourable the Governor in Council would await with interest the completion of the investigations, and that his Excellency concurred with the consulting engineer in doubts he had expressed as to the policy of combining navigation with irrigation from Bellary downwards, there occurs the following expression:—

"The first requisite for the Bellary district is an ample supply of water for irrigation, and, if the company can mature a project for affording such a supply at a moderate cost, such a scheme will be sure to obtain careful and attentive consideration from the Government, and it cannot be brought forward too soon."

In deference to the above order, the board of directors issued instructions that their engineers should at once proceed with the necessary surveys, and should plan a canal through the Lower Bellary district for the supply of irrigation only, and then submit the same to the Government; and accordingly sanction for the necessary establishment was procured from the latter.

The Government of Madras having transmitted to the Duke of Argyll their order of the 22nd March 1869, above quoted from, his Grace was pleased in a reply despatch, dated 12th October 1869, to express his approval of what had been done in the following words:—

"I trust, however, that there will be no delay in completing a well-digested scheme for an irrigation canal from the Toombuddra at Hoosoor, and I am glad to perceive that your Excellency's Government are impressed with the great importance of such a project, and are prepared to give it careful and attentive consideration."

A copy of which despatch was by the Government of Madras supplied to the company's manager, accompanied by directions that his attention should be called to certain requests made by his Grace in other parts of his Despatch, in order that the information there required might be at once supplied, which was done.

Thus supported and encouraged, the directors urged on the required operations, so that plans and estimates of the two separate schemes for Upper and Lower Bellary (prepared as to Upper Bellary in greater detail than are those deposited in Parliament by English railways), accompanied by full estimates and descriptions, were in the month of March 1870; submitted to the Government of Madras, and shortly after similar plans and estimates of the Nellore Section were also placed before the same Government.

The investigations required by Government concerning reservoir sites could not be completed so early as the other surveys, &c., but detailed plans

plans and estimates were in December last being collated for submission, and there is no doubt that these also are now in the hands of the Government.

4. From the foregoing narrative, the directors feel assured that his Grace the Secretary of State for India will not only perceive that the reference made by Lord Cranborne in December 1866 has been continuously acted upon, but will be satisfied that by means of the investigations made by the company, at the request and in accordance with the wishes of Government, it has been made manifest not only that the remaining portions of the company's entire scheme are really and urgently wanted in their localities to support and increase agriculture, and thus "avert the recurrence of the evils of pestilence and famine under which the people of that province have suffered," but that in a financial point of view the solicited guarantee may be safely (and with reference to the Kurnool section, now about to be completed, with great financial advantage) granted; and therefore they earnestly trust that his Grace will not hesitate to award to them the assistance sought by my letter of the 18th December 1866, or such other aid as to him may appear necessary and sufficient to afford to the politically important experiment, instituted by Lord Stauley, a fair trial, which it cannot possibly have until the one entire self-contained scheme, selected for the purpose by the Madras Government, shall have been constructed.

5. Beyond the paramount national considerations just adverted to, there is an additional reason of great importance why the company should, without delay, be enabled to enter immediately upon the construction of at least some of the works referred to, and it arises out of the fact that the Kurnool section of the Toombuddra Project is now fast approaching completion. Upon the construction of this section the company have in their service a chief engineer, who, besides possessing professional talents of the highest order, has been engaged upon the works first as an executive engineer, and then as chief engineer, from the beginning, and has perfected that special experience which will be essential to the successful prosecution of the remaining portions, and the more so, inasmuch as the now nearly constructed contains works second to none in India as regards character and engineering difficulties to be overcome. He has also, it is believed, gained the confidence of the Madras Government and of its officers. The company has likewise in their service a deputy chief engineer, possessing very high qualifications and equal practical experience, and whose proceedings and judgment in investigating and laying out the proposed works in Upper and Lower Bellary, and the reservoirs, has received the approval of all who have considered them, and whose local experience will add materially to the value of his services if employed upon the works still requiring construction. The company has also a staff of executive engineers of tried worth, experience, and who are all acclimatised.

6. The services of the whole of these (chief engineer, deputy chief engineer, and executive engineers), will not be required, after the 1st July next, upon the works they are now engaged upon, and they will therefore then (and some of them before) be available for employment upon the other portions of the Toombuddra Project, or upon any one of them. To permit this collection of special talent and experience to leave the company's service, and therefore to be rendered unavailable for the further operations, would be a subject for deep regret, seeing that in every point of view, as regards efficiency of construction, rapidity of progress, and economy, it is for the good of the country, the Government, and the company, that such services should be secured without delay for those extended operations. The reorganisation of a new staff would also necessitate a very heavy expenditure and loss, at least in the earlier stages of progress.

In conclusion, the board of directors most respectfully and earnestly urge to the really pressing claim of the districts of Bellary for protection from famine, to the very special circumstances under which the company has been enabled to proceed with the construction of its undertaking, as well as to the proceedings taken by it in connection with the same, and to the fact that his Grace the Secretary of State for India will

to complete the Toombuddra Project, the amount necessary for the latter being raised in such sums and at such times as the Secretary of State for India shall agree to.

I have, &c.
John Westwood, Secretary.

— No. 6. —

The Secretary of State for India to the Government of Madras.

My Lord,

9 March 1871 (No. 6).

1. I HAVE had before me in Council your Excellency's Despatch, No. 29, of the 14th of November last, wherein, referring to the desire of the Madras Irrigation and Canal Company to construct an irrigating and navigable canal from the River Pennaur at Loomaishiveram, on its right bank, and to a scheme which your Government have had under consideration for irrigating a large tract of land on the left bank of the same river, you request that, in drawing up any fresh agreement with the company, care be taken distinctly to assert the right of Government to the full natural supply from the Pennaur and its affluents, leaving to the company the privilege of utilising such surplus as may not be required by Government, in addition to all such other water as they may be able to make available by their works on the Toombuddra, or by the construction of reservoirs.

2. Your Excellency need be under no apprehension of any fresh agreement being entered into with the Madras Irrigation and Canal Company, without previous communication, both with your Government and with that of India, all points involved. Meanwhile, I may observe that, unless in the improbable event of the Irrigation Company succeeding in raising additional capital, a guarantee, I consider that no extension of their works beyond what need be sanctioned. In any case your Government would seem to be able to utilise a portion of the water of the Pennaur below Cuddalore, and to make available by their works on the Toombuddra, or by the construction of reservoirs, a sufficient quantity of land on the north bank of the river.

I have, &c.
Argyll.

— No 7. —

Government of Madras to the Secretary of State for India.

My Lord Duke,

30 March 1871 (No. 6).

WE have the honour herewith to forward, for your Grace's information, a copy of the Proceedings* of this Government on reports from the Consulting Engineer for the Madras Irrigation and Canal Company regarding the general financial position and present state and progress of the company's works, which were inspected by that officer between the 4th and 31st October 1870.

2. Your Grace will observe that, in the opinion of the Consulting Engineer, the funds at the disposal of the company will be found to be sufficient for completing the main canal and all the works on it, and that every probability is entertained of this being accomplished within the stipulated time; but Colonel W. P. P. does not consider that "the canal with all distribution and other subsidiary works will be in every respect complete and put in a thorough and perfect working condition" by the 30th June next, or the date when the contract will expire. We are convinced that much time will be required before this result can be satisfactorily attained.

3. A copy of the Consulting Engineer's report on the present circumstances of the company's works has been laid before the Government of India.

We have, &c.
Napier.
A. J. Arbuthnot.
J. D. Sim.

— No. 8. —

The Secretary of State for India to the Governor General in Council.

My Lord,

4 April 1871 (No. 28).

IN my Despatch to the Government of Madras, No. 6, dated 9th March, I mentioned that no apprehension need be entertained of any fresh agreement being entered into with the Madras Irrigation and Canal Company, without previous communication both with that and with your Excellency's Government; and I added that, unless in the improbable event of the Irrigation Company succeeding in raising additional capital without a guarantee, no extension of their works beyond Cuddalore, need, in my opinion, be sanctioned.

2. When thus writing, I was in no immediate expectation of being applied to by the company for any modification of the terms of their existing contract; but on the following day I received a letter, * copy of which is enclosed herewith, * See No. 5 wherein an extension of the company's guarantee, such as may furnish them with the means of completing what is termed by them their "original Toombuddra project," is solicited.

3. I shall be glad to be placed, as early as possible, in possession of the views taken both by your Government and by that of Madras, of this application. Among other points in connection with it, on which I should wish to have the assistance of your opinion in making up my own, are the following:—

The general character, as to design and execution, of those of the company's works which are finished or approaching completion. Their suitability for irrigating the country through which they pass. The probability of much hesitation on the part of the ryots in taking the water at the prescribed rates.

4. I would also request you to consider what force there may be in the company's argument that the remunerativeness of their works cannot be fairly tested, unless they be so extended as to comprehend the whole of their original project, and, further, whether your Government would either be prepared to complete the project in the event of the company being wound up, or could arrange for its completion by State agency, in case the company should insist upon retaining possession of the portion of the project already executed by them.

I have, &c.
Argyll.

— No. 9. —

The Under Secretary of State for India to the Secretary of the Madras Irrigation and Canal Company.

Sir,

India Office, 17 April 1871.

I AM directed by the Duke of Argyll to acknowledge receipt of your letter of 7th ult., No. 3, relative to certain works in Upper and Lower Bellary and in Nellore, represented as being necessary to complete the Toombuddra project of the Madras Irrigation and Canal Company, and to state that his Grace has had the same under consideration in Council. * See No. 5.

With regard, however, to the application, with which the letter concludes, for an extension of the company's guarantee, such as may suffice to cover all the capital required for completion of the works in question, and also for immediate

repayment of the loan of 600,000 L., which has within the last five years been made to the company, the Duke of Argyll desires to defer his decision until he shall have consulted on the subject with the Governments of India and Madras.

I am, &c.

M. E. Grant Duff.

— No. 10. —

The Government of Madras to the Secretary of State for India.

My Lord Duke,

22 May 1871 (No. 9).

WE have the honour to acknowledge the receipt of your Grace's Despatch of the 16th February 1871, No. 3, in which you request an expression of our opinion of the application of the directors of the Madras Irrigation and Canal Company to have reimbursed to them the amount they have expended, since the date of their Supplementary Contract, upon investigations not included therein, in searching for and investigating sites for reservoirs, for preparing plans and estimates for some such reservoirs, and on the construction of a number of additional bridges beyond those contained in the sanctioned plans of their main canal and works.

2. In support of their claim the directors state that no portion of the funds at their disposal, when the Supplementary Contract was entered into, was properly available for expenditure on other objects than the completion of their canal and works between Soonkasala and Cuddapah, in accordance with the stipulations of their contract; but that, in deference to the wishes of the Madras Government, and in consideration of the importance and value of the extra operations in question, they cheerfully undertook those operations, under the assurance that, if the moneys expressly set apart for the completion of their canal and works did not suffice for that purpose, the additional outlay would be treated as exceptional.

3. Desiring to have the views of our Consulting Engineer on the question thus submitted for our opinion, your Grace's Despatch was communicated to that officer, and we have herewith the honour to submit his reply,* from which it will be observed that, as at the date of the Supplementary Contract being entered into, the balance of the original guaranteed capital remaining in the hands of the company was 37,160 L., while the total outlay on the investigations referred to by the directors, and in the preparation of plans and estimates, has not exceeded 17,955 L., no part of the loan granted to the company for the express purpose of completing their canal and works has been treasured upon to meet the cost of these so-called extra operations. This being the case, we see no reason to think that the outlay of which reimbursement is sought was in any way exceptional, or otherwise than a perfectly legitimate expenditure of money for a purpose to which, under the company's contract, it was rightly applicable.

4. That this was at one time the view of the Board of Directors is clearly established by the extract from their communication to their Agent in India, under date the 3rd February 1868, No. 5, which is quoted by our Consulting Engineer in his letter above referred to; and nothing has since occurred which can, in our opinion, give the board any substantial grounds on which to found the claim they have now advanced.

5. With respect to the amount spent on the provision of additional bridges, we beg to invite attention to the concluding paragraph of our Consulting Engineer's letter, and to the communication on the same subject which he quotes, and which will be found amongst the papers now transmitted. It will be gathered from those letters that, although some bridges not appearing in the plans which were sanctioned at the date of the Supplementary Contract have since been constructed, the number of crossings provided is, on the whole, less than that originally intended, and the outlay incurred not, it is believed, much in excess of the amount anticipated, while the reasonable requirements of the ryots

* Enclosures purposely omitted.

ryots whose lands are intersected by the canal, and whose convenience the company are bound to consider, have not even yet, it is feared, been sufficiently provided for.

6. Under these circumstances, we consider that the Irrigation Company have no claim to the concession which the directors now seek.

We have, &c.

Napier.

A. J. Arbuthnot.

J. D. Sim.

— No. 11. —

The Government of Madras to the Secretary of State for India.

My Lord Duke,

22 May 1871 (No. 10).

WE have the honour to forward, for the information of your Grace in Council, the papers* marginally noted, relating to what is expected to be the condition of the works of the Madras Irrigation and Canal Company on the 30th proximo, the date on which, agreeably to the Supplementary Agreement dated 2nd October 1866, the main canal and all its works should be in proper working order, and having reference also to the position and means of the company for working the canal after that date.

Letter from the Consulting Engineer for Irrigation and Canal Company, No. 131, dated 6th March 1871, recorded in Government Order, No. 1039, dated 18th April 1871.

Letter from Government of India, No. 100-I., dated 22nd March 1871, recorded in Government Order, No. 1035, dated 14th April 1871.

Letter from the Consulting Engineer for Madras Irrigation and Canal Company, No. 13, dated 21st April 1871, recorded in Government Order, No. 1339, dated 15th May 1871.

2. Our Consulting Engineer's report † on the condition of the works generally as he found them on his last tour of inspection, and his opinion that the main canal and works, as then sanctioned, would be completed by the 30th June 1871, was in due course communicated to your Grace, and nothing has since occurred to disturb the belief that the main works, as then in progress, would be so completed, so far as a work of the kind can be said to be completed before it has been fairly brought into use and fully tested by actual trial as to its fitness for carrying the depth of water for which it had been designed. We have, however, since that date received from the company's local agent an application ‡ for sanction to estimates amounting to 31,977 rupees, exclusive of cost of establishments, for improving certain waste weirs on a portion of the canal between Soonkasala and Cuddapah, to adapt them for the safe discharge of flood waters, which the breaches of August 1870 suggested the necessity for, and this application was accompanied by an admission that the balance of capital was inadequate to meet the charge, and a request that the amount might be advanced by Government to form a charge against revenue.

† No. 93, dated 17th November 1870.

No. 6 of 1871.

‡ No. 1089, dated 18th April 1871.

3. It appeared to us, from a consideration of the general question, that there could be no doubt as to the necessity for improving the surplus waterworks of the canal, and that, whatever the cost might be, the charge was properly debitable to capital, and we accordingly declined to sanction any advance to aid the company in completing their canal and works, and putting the surplus weirs in a condition to act efficiently in relieving the canal of flood waters; and, seeing that the estimates referred to relate to a limited length of the canal, and that in our Consulting Engineer's opinion the cost of similarly improving the weirs on the remaining length would amount to about 50,000 rupees more, and looking to the circumstance that the contract time is now so nearly expired that there is no reasonable hope of the company being able to carry into effect these improvements in the weirs, even if no doubt existed in regard to available funds, while the balance of capital is confessedly inadequate for the purpose, it seems expedient that we should give your Grace this timely intimation of our opinion, namely, that, unless assured by our professional officers that the weirs on the canal have, by the 30th proximo, been altered so that they may be expected to efficiently relieve the canal of flood waters, we should not consider that the canal and works have been put

* Enclosures purposely omitted.

put in proper working order, and that they have been completed in the sense contemplated by the agreement with the company.

4. One of the enclosures is a letter from the Government of India, with an expression of opinion by that Government, that the intention and meaning of the Supplementary Agreement, regarding the completion of the works by the 30th June 1871, clearly was, that if the works were not, on the date in question, in fair operation, and earning a reasonable income from which the Government could look for a repayment of interest on the loan, if not indeed also, to some extent, repayment of the interest on guaranteed capital, the works could not be fairly said to have been completed in the sense contemplated by the agreement with the company, and to be in perfect working order to the satisfaction of the Local Government.

5. This Despatch was communicated to our Consulting Engineer, as we were desirous of being furnished with his opinion as to the probability of the works being in working order on the 1st July next, in the sense which the Government of India consider that their completeness should be judged; and that officer's reply forms the third enclosure, from which it will be seen that there is no reasonable hope of the revenue in the current year covering half the cost of maintenance, much less is there any prospect of even a small balance being available to go towards the payment of interest on the loan, or on the guaranteed capital. The Supplementary Agreement requires that our opinion on the condition of the works should be expressed after the 30th June next, and we shall have the honour of further addressing your Grace on the subject immediately after the 1st July. Meanwhile, we deem it expedient to lose no time in inviting your Grace's attention to what is understood to be the company's utter want of means for carrying on operations after the 30th proximo, as brought to notice in the fifth and following paragraphs of our Consulting Engineer's letter herewith forwarded; and we would beg to suggest to your Grace the propriety of calling on the Board of Directors of the Madras Irrigation and Canal Company for clear and distinct evidence of their ability to defray the cost of the establishment they propose maintaining in England and in India, after the 30th June; and, failing therein, to require them to give the necessary warning by telegram to the Agent, the Chief Engineer, and all other superior officers, of their intention to dispense with their services, that there may be no further fruitless expenditure of public money than may be absolutely necessary in taking over the works from the company, in the event of circumstances rendering such a course necessary and advisable.

We have, &c.,

Napier.

Fred. Haines.

J. D. Sim.

— No. 12. —

(Extract.)

The Governor General in Council to the Secretary of State for India.

My Lord Duke, Simla, 23 May 1871 (No. 58).

Despatch to your Grace (P. W.), No. 72 of 4th June 1870. Despatch from your Grace, No. 85 of 20th October 1870. Despatch from your Grace to Madras Government, No. 6 of 9th March 1871.

See No. 7.

IN continuation of the correspondence noted on the margin, we have the honour to transmit, for information, copies of a letter addressed by us to the Government of Madras (No. 100—I., dated 22nd March 1871, Proceedings, March 1871, No. 76), on receipt of a copy of its Proceedings, No. 2964, of 7th December last, and of the inspection report by the Consulting Engineer on the state of the works of the Madras Irrigation and Canal Company, which were forwarded to your Grace with Despatch from that Government, No. 6, dated the 30th March last, and to express a hope that our views in regard to the terms and intentions of the contract with the company as therein expounded will meet with your concurrence. It will be seen that we have desired the Government of Madras to lose no time in ascertaining what the intentions and means of the company are with regard to the fulfilment of the contract, and to favour us by an early date with a specific expression of its opinion as to the propriety of advising your Grace to require the surrender of the works in the event of the company

company not being able to comply with the conditions on which the loan of 600,000 £. was granted.

2. Your Grace's Despatch, No. 28, of 4th April, intimating that the directors of the company had applied for an extension of their guarantee to enable them to complete their works, as may be perceived from its date, was received some time after the issue of this letter. It has been forwarded to the Government of Madras, in continuation, for immediate report on the several points referred therein to us for opinion.

We have, &c.,

Mayo.

Napier of Magdala.

John Strachey.

R. Temple.

J. F. Stephen.

B. H. Ellis.

H. W. Norman.

Enclosure in No. 12.

The Secretary to the Government of India to the Secretary to the Government of Madras.

Sir,

Fort William, 22 March 1871 (No. 100—I.).

WITH reference to your endorsement No. 2964, dated 7th December 1870, forwarding a copy of the Proceedings of the Government of Madras, upon receipt of a report by the Consulting Engineer for the Irrigation and Canal Company, in which the state of that company's works at the time of his inspection is described in detail, I am directed to observe as follows.

2. The loan of 600,000 £. granted by the Secretary of State to the company, and for which they were to pay interest at 5 per cent. from the profits of the canal, was subject to the condition that, if the works were not completed and placed in perfect working order, to the satisfaction of the local Government, by the 1st July 1871, the company should, if the Secretary of State desired, give up the whole of the works to the Government, the Government paying the capital laid out on the works. The question, therefore, for consideration now is, whether the company appears to be in a position in which it can comply with the conditions, and, if not, what steps should be taken in consequence.

3. The first point raised by the Consulting Engineer, and commented on by his Excellency the Governor in Council, appears to be that, though the main canal will be finished so far as it can be said to be so before it has been subjected to trial, and tested by a full supply of water, yet the means of distributing the water has not been provided, and in no sense can it be said that the canal is in full working order.

4. It seems to his Excellency the Governor General in Council that the mere fact of all the distributing channels not being ready, or even of the main canal not having been properly tested, would not in itself have been such a failure on the part of the company as would justify the Government in requiring the surrender of the works. The essence of the stipulations, when viewed in combination, was that the Government had lent the company a certain sum of money, the interest of which was to be paid from the income of the works; and had guaranteed another sum, the interest of which should also be met from the works; and, in giving the fresh loan, the intention of the Government clearly was that, if the works were not in a condition to begin to pay some portion of the interest at least in July 1871, and generally are not in a condition which is described as "perfect working order to the satisfaction of the local Government," thereby meaning that the canals are in fair operation, and earning a reasonable income, from which the Government could look to repayment of its interest, then the Government should have the option of taking over the works, and endeavouring to repay itself. Consequently, his Excellency in Council is of opinion that the most important point to consider at the present time is the power of the company to work and maintain the canals after July 1871, and that the question put by the Madras Government as to how and by whom the money is to be provided for the purpose, is a very pertinent one.

5. While, therefore, the Government of India would not lay much stress on the want of completeness of any part of the project which would not prevent the commencement of irrigation on a moderate and reasonable scale, his Excellency in Council considers that the Government has a right to expect that the works shall *bonâ fide* be in fair operation at the time specified, and managed and maintained at the entire cost of the company, without any assistance from Government. The loan of 600,000 £. was specifically to be applied to new

works chargeable to the capital account of the company, and there was no intention of providing money for the maintenance of the work after completion. Therefore, if the Government of Madras is not satisfied that the canals are thus in working order, it will apparently be justified in expressing an opinion that the condition of the contract has not been fulfilled.

6. I am, however, to point out that, under the contract, it rests with the Government of Madras to give that opinion as to the condition of the works in July next, on which the Secretary of State will act. In this light, it seems necessary that the Government of Madras should lose no time in ascertaining what the intentions and means of the company are, and should place at an early date before the Government of India a specific expression of its opinion as to the propriety of advising the Secretary of State to require the surrender of the works in the event of the company not being able to comply with the conditions on which the loan was granted.

7. I am further to point out that the Madras Government should be in a position to address the Secretary of State on the 1st July 1871, or as soon after as practicable, so that no further time may be lost in bringing the matter to a conclusion, otherwise every day's delay causes sensible waste of money, all of which the Government virtually has to furnish.

8. In conclusion, his Excellency in Council would suggest the propriety of the Advocate General being consulted in any steps which the Government of Madras may see fit to adopt in dealing with the matters adverted to in this letter.

I have, &c.

Colonel, R.A.,
Secretary to the Government of India.

P. S.—Since the above orders were drafted, the accompanying copy of a Despatch from the Secretary of State has been received, confirming, it will be seen, the views of the Government of India, as expressed in para. 4, and pointing out the steps which should be taken by the Madras Government with reference to the prosecution of the distribution channels.

— No. 13. —

The Governor General in Council to the Secretary of State for India.

My Lord Duke,

Simla, 14 June 1871 (No. 73).

WE have the honour to acknowledge the receipt of your Despatch, No. 28, dated 4th April last, communicating copy of a letter from the Secretary to the Madras Irrigation Company, in which an extension of the company's guarantee is solicited for the purpose of completing what is termed by them their "original Toombuddra project." Her Majesty's Government requests to be placed, as early as possible, in possession of the views taken by this Government, as well as by the Government of Madras, of this application, and asks for our opinion on certain points connected therewith.

2. In reply, we would observe that, until we have received a final report from the Madras Government, to whom your Grace's Despatch was forwarded without delay, we are scarcely in a position to submit a reliable opinion on the first four points; but as regards the completion of the project by State agency, we have no hesitation in saying that we are quite prepared to carry it out, in the event of our being satisfied by the Madras Government that its completion will be expedient and desirable.

We have, &c.

Mayo.
Napier of Magdala.
John Strachey.
R. Temple.
B. H. Ellis
J. F. Stephen.
H. W. Norman.

— No. 14. —

The Governor General in Council to the Secretary of State for India.

My Lord Duke,

Simla, 6 July 1871 (No. 78).

SUBSEQUENT to transmitting our Despatch (Public Works), No. 73, of the 14th ultimo, the Government of Madras reported its inability, from unavoidable causes, to furnish the final report on the Madras Irrigation Company's affairs till "some time this month;" and consequently the expression of our views on the points referred to us for opinion by your Grace, in connection with the company's application for an extension of their guarantee to complete the Toombuddra project, must unavoidably be delayed, until after the receipt from Madras of the report, which we have been given to understand that Government purposes addressing to your Grace direct.

We have, &c.

Mayo.
Napier of Magdala.
John Strachey.
R. Temple.
J. F. Stephen.
B. H. Ellis.
H. W. Norman.

— No. 15. —

The Secretary of State for India to the Government of Madras.

My Lord,

13 July 1871 (No. 13).

1. I HAVE received your Excellency's Despatch, No. 9, of 22nd May last, replying to mine on the subject of a claim of the directors of the Madras Irrigation and Canal Company to reimbursement of a sum of about 32,000L., expended by them under directions from your Government, and subsequently to the date of their Supplementary Contract, on operations extra to those contemplated by the contract. These operations were of two kinds; 1st. Search for, and investigation, of sites for reservoirs; 2nd. Construction of a number of additional bridges; and, so far as regards the second item, the fact urged by your Consulting Engineer, that the works to be completed under the contract were to be completed "in accordance with the plans submitted or approved, or to be submitted or approved," seems to be conclusive against the claim of the directors.

2. With respect, however, to the sum of 17,955L. expended in reservoir explorations, I do not perceive the force of the argument that this sum may have been drawn, not from the loan of 600,000L., made to the company expressly for the purposes of their Supplementary Contract, but from the balance of their previously guaranteed capital. The company, when pledging themselves to execute certain works with the aid of the loan, naturally regarded whatever remained to them from their guaranteed capital as equally at their disposal for the same purpose; and it will not, in my opinion, be reasonable to hold them responsible if, by reason of your having caused the diversion of part of those funds to a different purpose, they are found to have been unable to fulfil their pledge.

I have, &c.

Argyll.

— No. 16. —

The Assistant Under Secretary of State for India to the Secretary of the Madras Irrigation Company.

Sir,

India Office, 13 July 1871.

I AM directed by the Duke of Argyll to request you to inform the directors of the Madras Irrigation and Canal Company that, from a Despatch which his Grace has recently received from the Government of Madras, that Government appear to entertain considerable doubt as to the pecuniary ability of the company to carry on operations, now that the time allowed for the operations contemplated by their Supplementary Contract has since 30th ultimo come to a close.

As this is a question in which important public interests are involved, the Duke of Argyll is anxious that all doubt with regard to it should be removed; and I am therefore directed by him to request to be informed of the precise means which the company possess of defraying the cost of the establishments which the Board propose to maintain henceforward in England and India.

I am, &c.

J. C. Melvill.

— No. 17. —

The Government of Madras to the Secretary of State for India.

My Lord Duke,

31 July 1871 (No. 14).

WE have the honour to forward, for the information of your Grace in Council, copy of a Despatch to the Government of India, being a reply to the inquiry made by your Grace, under date the 4th April 1871, No. 28, regarding the present condition and future prospects of the works of the Madras Irrigation and Canal Company, and in reference to the further assistance which the company seek from the State to enable them to extend their operations.

We have, &c.

Napier.

Fredk. Haines, C. in C.

A. J. Arbuthnot.

J. D. Sim.

Enclosure 1, in No. 17.

Order of the Government of Madras, 16th May 1871, No. 1341.

Government Order, No. 1035, 14th April 1871.
 " " " " No. 1089, 18th April 1871.
 " " " " No. 1339, 15th May 1871.
 Madras Irrigation and Canal Company's Agreement, 2nd October 1866.

THE papers as per margin will be communicated to the Government Solicitor, with a request that he will obtain the Advocate General's opinion whether, in reference to the supplementary agreement, and especially to Clause 11 thereof, the said canal and works can be called complete and in working order, so long as the weirs, or works for the discharge of surplus waters, have not been adapted on the principles referred to in Government Order, No. 1089, 18th April 1871, for the safe discharge of floods; and whether, having regard to the Despatch from the Right Honourable the Secretary of State, No. 16, 16th February 1871, printed with Government Order, No. 1035, 14th April 1871, supposing it to be admitted that the main canal and works are completed by the 30th June 1871, the fact of all the distributing channels not being ready, or the main canal not having been proved capable of carrying, without breaching, the full quantity of water for which it was designed, would be such a failure of contract on the part of the company as would justify the Government in requiring a surrender of the works; and whether, in the Advocate General's opinion, if the canal and all its works should be completed by the 30th June 1871, and it should be so admitted by the Government, but the revenue derivable from irrigation in the current year is so trifling as to be inadequate for the payment of maintenance charges, and the company are not only unable to pay anything towards the liquidation of interest due to the State for the loan of 600,000*l.* made to them, but are unable to discharge the cost of the establishment maintained for the conservancy of the

the canal without aid from Government, there will be such a failure on the part of the company as would justify the Government in requiring the surrender of the works, on the ground of their not being in proper working order, as intended by the 11th article of the supplementary contract, inasmuch as the canal would not be in fair operation and earning a reasonable income.

Enclosure 2, in No. 17.

The Acting Government Solicitor at Madras to the Secretary to Government, Public Works Department, dated Madras, 22nd May 1871, No. 209.

I HAVE the honour to acknowledge the receipt of the Order of Government, dated 16th May 1871, No. 1341, Public Works Department, together with its enclosures, requesting the Acting Advocate General's opinion on certain points having reference to the Madras Irrigation and Canal Company, Limited.

2. I submitted the matter for the consideration of the Acting Advocate General; and,

3. I now forward herewith a copy of his opinion, and return the enclosures forwarded with the Order of Government above noted.

Enclosure 3, in No. 17.

Opinion of the Acting Advocate General at Madras, 20th May 1871.

WITH reference to the first of the three questions submitted to me, I understand that Government Order, No. 1089, laid down, first, that the existing works of the canal were so imperfectly constructed that they would be in continual danger of breaching unless certain alterations were effected; and, secondly, pointed out certain principles upon which the alterations should be carried out. Assuming, as seems to be admitted by the chief engineer, that the works are in fact unsafe until altered, and assuming that they continue substantially unaltered until the 1st of July 1871, it is clear that on that date the canal and works will not be "in working order to the satisfaction of the local government," and therefore that it will be open to the Secretary of State to exercise the option of taking over the works, which is given by clause 11 of the Supplementary Agreement.

2. The question in the form in which it is put, however, seems to call for an opinion, whether it would be necessary for the company to show, not only that they had altered their works, but that they had altered them in accordance with the views expressed in Government Order, No. 1089; in other words, whether they are bound to conform to directions on matters of engineering given by the local government. I am of opinion that they are not bound to conform to any such orders, which do not emanate from the Secretary of State. The original Agreement of 1858, recited in the Agreement of 1863, provided "that the various works comprehended in the project selected for the commencement of operations by the company should be constructed conformably to plans approved by the local government." But in the Agreement of 1863 this arrangement was departed from. The right to approve of and alter plans, and to direct works, was expressly given to the Secretary of State (Sections 5, 6, 9, 10, 16), and the province of the local government was limited (Section 19) to compelling the company to construct their works fairly and substantially, in accordance with the plans approved of by the Secretary of State. The Supplementary Agreement (Section 10) preserves all the conditions of the Agreement of 1863. I think, therefore, that the local government, in deciding whether the canal and works are in working order within the meaning of Section 11 of the latter Agreement, would have to consider only the actual fitness or otherwise of the works to carry out the objects of the canal, and that it would be no sufficient ground for dissatisfaction that the fitness, if it existed, had been attained by adopting plans different from those pointed out by the local government.

3. The second question involves two queries: first, whether the fact that all the distributing channels were not ready would be a failure of contract within the meaning of Section 11. I think it would not. As I understand, these distribution channels are only required as the demand for water for irrigation purposes increases, and any expenditure upon them, until they are likely to be required, is pure waste of money. The second query is, whether "the main canal not having been proved capable of carrying, without breaching, the full quantity of water for which it was designed, would be such a failure of contract." Assuming the question to mean "whether it would be a failure of contract if the main canal were proved incapable of carrying the full quantity of water for which it was designed without breaching," I have no doubt that it would. A canal that bursts on receiving full quantity of water for which it is designed, is as complete a failure as a boiler which blows up under the pressure of steam which it was intended to bear. I am asked whether it is incumbent on the company to prove affirmatively that the canal will bear with safety a full supply of water, I answer that it is not. The Government satisfy themselves upon this point in the best way they can; and, if a supply

cient to test the capabilities of the work, does not exist at the time they are making the inquiry, they must form their opinion in some other way.

4. The third question refers to a state of things which seems neither to have been contemplated by, nor provided for in, the contract. I am of opinion that the clause as to the canal being in working order must be interpreted in exactly the same way as if this were an ordinary contract for the performance of certain work. In such a case it is clear the contractor would have delivered over the canal in working order, if it was according to specification, and fit for the purposes for which it was intended, although it might never realise a penny. It seems clear that the whole sum of, first, 1,000,000 £, and then of 600,000 £, was expected to be laid out in the construction of the canal, and it was assumed that the canal, when completed, would at once pay its expenses, and also interest out of its revenue, for the company could not have any other funds in their possession out of which to make such payments. Section 19 of the Agreement of 1863 requires the company to keep their works in repair, and in default of their doing so authorises the Secretary of State to repair, repaying himself out of the guaranteed interest; and, if not so paid, "then the difference shall be forthwith paid by the company to the Secretary of State." But no arrangement is made for the event of the company being unable to pay. Nor does this clause enable the Secretary of State to supply and pay for a working staff. So Sections 7, 8, 9, of the Supplemental Agreement provide for the payment of working expenses, repairs, and interest, but no provision is made for the possible, and apparently impending, contingency of the revenues of the company being unable to satisfy all or any of these charges. The only two cases in which the Secretary of State can take over the works are under Section 24 of the original Agreement, and Section 11 of the Supplemental Agreement, neither of which, in my opinion, applies to the present case. If, as seems probable, the canal, assuming it to be completed and in proper working order on the 1st of July, will prove to be an undertaking which the company has no funds to manage, and the Government has no power to take over, it seems to me that there is no remedy but a new Agreement between both parties, carried into effect by Imperial legislation.

J. D. Mayne, Acting Advocate General.

Enclosure 4, in No. 17.

MEMORANDUM by Colonel J. Carpendale, Chief Engineer, Department Public Works, late Consulting Engineer, Madras Irrigation and Canal Company.

To Government of India, dated 4th April 1871, No. 28.

I HAVE the honour to report as follows, for the consideration of Government, in reference to the Despatch from the Secretary of State noted in the margin.

2. The points which the Secretary of State requires to be reported on are:—

First.—The general character as to design and execution of those of the company's works which are finished or are approaching completion.

3. Setting aside the great radical defect in the general design of the Main Canal, whereby sufficient waterway has not been provided for the passage of flood waters either under the canal or by surplus weirs in its banks for the escape of storm waters entering it when full, I would consider the works generally suitable in design for the joint purpose for which the canal is intended, that is navigation combined with irrigation; but there are some exceptions, and unfortunately they are in the very places where most caution was necessary, namely, in the high walls across valleys which in many places have been substituted for the ordinary canal bank, and which are, in some cases, faulty in design and bad in execution, as shown by the sections laid bare by the breaches of August 1870. The earthen banks also of earlier construction have been proved by breaches to have been thrown up loosely, without any selection of material, or care, and method in formation, and some of the masonry structures of the same period are defective in their construction, and of bad quality as regards material. All work of late years, that is since the date of the supplementary contract, both earthwork and masonry, is much superior in quality, and the masonry especially may be called excellent; the only objection I would raise is that hydraulic mortar has not been used in the masonry works, such as locks, aqueducts, culverts, &c.

Secondly.—The suitability of the works for irrigating the country through which they pass.

4. If this simply means whether a reasonable area of land can be irrigated from the canal, I have to report that more land is commanded than the canal is designed to carry water for, and a very much larger quantity than the canal has yet been proved capable of carrying water for; but the query may be intended to have a much wider meaning, namely, whether the canal, as designed, is the most suitable that could be devised for irrigation in that particular locality; to which I must reply, that the Main Canal was designed for navigation as irrigation, which is one chief cause of the great expense that has been incurred; for the quantity of water might have been carried, and the same extent of wet cultivation expected or hoped for might have been obtained, at a much smaller expenditure, simple works, and with much less risk, if irrigation only had been provided for.

—The probability of much hesitation on the part of the ryots in taking the prescribed rates.

5. The

5. The Collector of Kurnool in a tour through his district, towards the end of last year, made a careful inquiry on this head, with the view of eliciting the general feeling; and, writing on the 28th October 1870 to the Board of Revenue, he said:—

"The general opinion is that the charge of six rupees per acre for the water is excessive, but that it would not be too high if the water was supplied during the whole cultivation season and a crop certainly reaped. But, when it is a risk to attempt wet cultivation, owing to frequent breaches, the rate is too high. For, when a crop is lost or not brought to maturity, the remission of the water and land assessment is, in fact, no compensation for the loss which occurs."

In the same letter he says:—"I think, generally speaking, the ryots look with favour on the canal, and expect hereafter, when it is in good working order and continues for several years, to derive great advantages and profit from wet cultivation, and that the future expectation to a certain extent compensates them for temporary losses, which in all probability they consider as the result of an experiment attended with great risks."

"The canal has, however, breached each year for three years, and the water has been cut off; the ryots have hitherto borne their losses with wonderful equanimity which cannot be expected to last, and should the canal breach again next year, a panic may be caused, the result of which might be serious."

In the above remarks I entirely concur, and I think that much will depend, in regard to the future prospects of irrigation under the canal, on the result of the admission of water to the full depth in the approaching monsoon season.

6. The fourth query is, what force there may be in the company's argument, that the remunerativeness of the works cannot be fairly tested unless they be so extended as to comprehend the whole of their original project.

There is a good deal of truth in one part of this argument, but not exactly as the company put it.

7. The probability of the success of the Main Canal, from Kurnool to Cuddapah, as a line of navigation, would most undoubtedly be greatly improved by the extension of the canal to join the Eastern Coast Canal in the Nellore District, supposing it an established fact that there was any traffic at all on the line from Cuddapah to Kurnool; but as, under existing circumstances, this length of canal will be dry for six months in every year, I very much doubt any system of traffic on it being developed until, by the construction of reservoirs, the natural supply of the Toongabudra is supplemented, and water for the canal all the year round has been furnished. It is also reasonable to conclude that whatever revenue there may be from irrigation from this canal when water for one crop only is available, a greater amount would be realized if water for a second crop was provided by means of reservoirs. It is by no means necessary to this end, however, that any project in Bellary should be simultaneously entered on. It would probably be economical, in constructing one or more reservoirs, that the wants of Bellary should be kept in view as well as those of Kurnool and Cuddapah, as the cost might eventually be rateably divided, but the irrigation projects and interests would be quite distinct. The construction of one or more reservoirs is, in my opinion, the proper step to take next in connection with the Kurnool and Cuddapah Canal; but, in the event of the works coming into possession of Government, I would not advise the Government to incur any large expenditure for this purpose, until it is seen how far the stability of the canal may be depended on for two successive years.

8. Having now answered the several specific queries put by the Secretary of State, I turn to the general question raised by the board of Directors in their letter* to his Grace, that is, their application for an extension to the existing guarantee, sufficient to repay the loan of 600,000 £ and to complete the "Toombuddra project," on the ground that without this extension of their works the experiment will not have had a fair trial, and "because in a financial view the solicited guarantee may be safely granted," this remark being made with reference to the Kurnool section of the project, which, it is stated, is now "about to be completed with great financial advantage." No specific amount of capital is mentioned, but from their letter† to the Secretary of State, which forms one of the appendices, it appears, "that having given their most careful attention to the matter, aided by past experience, the directors believe that 2,500,000 £ would be sufficient to complete the "works contemplated for the Bellary district and for the necessary reservoirs;" and as in round numbers 1,600,000 £ have already been spent, this would leave 900,000 £ for the execution of the Bellary project and for the construction of reservoirs, no mention being made of the extension of the Kurnool and Cuddapah Canal through the Nellore District.

9. A project for a canal from Walapavore on the Toombuddra to the town of Bellary, and which was called by the company a thoroughly digested and well-considered one, was laid before the Government some years ago, and disposed of in Government Order, No. 518, 21st February 1867; the cost of the work was estimated at 1,43,88,000 rupees, or 1,438,800 £.

10. The Upper Bellary project low level line was submitted to Government by the consulting engineer for the company on the 11th January 1870; the estimate amounts to 1,65,24,640 rupees, or 1,652,464 £.

* 7th March 1871.
See No. 5.

† 18th December 1866.

11. The plans and estimates for the Nellore scheme, sometimes called the lower portion of the Toombuddra project, were reviewed by Government in Government Order, No. 1568 of the 30th June 1870. The estimated cost for a canal for navigation and irrigation combined is 53,25,000 rupees, or 532,500 £. This scheme commences at Somaisweram, 13 miles from Cuddapah; the works for this intermediate link have not been estimated, but the line of country is admittedly more difficult than any other that has been investigated, and 50 lacs is as little as could be estimated as the probable amount, say, 500,000 £.

12. From the above figures it will be seen how greatly the company's capital, even if extended to 2,500,000 £, would fall short of what is required to construct the works for the Bellary and Nellore Districts, while nothing has yet been determined as to the further sum that would be necessary for the reservoirs; perhaps another half million for one reservoir; and it is marvellous that, after all the time and money that has been spent on the reservoir investigations, the company have not yet got the project for any one reservoir complete, so that an opinion could be formed as to what the cost would be of sending a suitable supply of water into the Toombuddra in the dry season, to keep up a supply in the Kurnool and Cuddapah Canal.

13. It appears to me that, if the Government wished to deprive the company of their possession, they have ample reason legally, in the circumstance that the canal has not been completed satisfactorily, inasmuch as suitable provision has not been made for the discharge of flood waters, and the canal is consequently in an unsafe condition; and it is also clear to me that the Government have good and sufficient reason legally and morally for declaring that the canal has not been completed to their satisfaction, inasmuch as on each occasion of water being let into it for the purpose for which the canal was designed, it has breached; and there is every reason to fear that it will breach again so soon as it is subjected to the test which is necessary to prove if it is capable of carrying the full depth of water.

14. I do not understand, however, that there ever was any desire on the part of either Government to deprive the company of their possession; rather, there has been every desire shown not to do so, and if there was any reasonable hope that the company could carry on the management of it without further aid from the State, and that the shareholders could derive any profit or advantage from doing so, I would advocate the company being left in undisturbed possession of their property. I do not, however, consider that the history of the construction of this canal, its present condition, or its future prospects, are such as to warrant any special consideration or indulgence being shown to the shareholders; or that they have any ground for expecting that a further sum of public money should be risked to enable them to carry on so costly an experiment. The shareholders now receive 5 per cent. on the capital, their only reason for wishing to retain possession of the canal could be the hope of getting more; they cannot get more until the revenue from the canal has cleared off all arrears of accumulated interest, and until the current revenue, besides covering the cost of maintenance and management, will meet the interest due on the loan of 600,000 £, and on the one million capital. After long and careful consideration of this question in all its bearings, I can hold out no prospect of the canal as it now is, but with all its works of distribution finished, ever paying these charges; and it can consequently be no benefit to the shareholders to retain possession. If they ask what advantage it would be to the Government to relieve them of their property, I answer, none directly. The property is not of a nature to be coveted, but the State has incurred a serious responsibility, in the encouragement it has given to the shareholders, and it is only equitable to relieve them of the bad investment without loss to them, and then for the Government to do the best they can with the property afterwards; and indirectly there would be this advantage, the Government, having its own establishments, can work the canal and maintain it much more economically than the company can; the expense of the home board, the Madras agency, and the chief engineer and his establishment, would be entirely saved. The maintenance or conservancy establishment would be reduced by working in conjunction with the Public Works Establishment of the district through which the canal runs; and there would be a further considerable saving in the interest on any capital that might be required for future projects, as capital is now procurable to any extent at $4\frac{1}{4}$ to $4\frac{1}{2}$ per cent. I would therefore advise the Government to declare, after the 30th June, that the canal and its works have not been completed to their satisfaction, but nevertheless to leave the company in undisturbed possession, if they so desire, and can carry on the management without State aid, which I would positively refuse to further extend; and, if the Company fail to keep the works in repair, as provided in paragraph 21 of the covenant of 3rd June 1863, it would be open to the Government to take possession.

8th June 1871.

J. Carpendale, Colonel, R.E.

Enclosure 5, in No. 17.

MINUTE by the Governor of Madras.

The points which the Secretary of State has specially recommended to the notice of Government are as follows:—

- (1.) The design and construction of the canal.
- (2.) The adaptation of the canal for the purpose of irrigation in the country which it traverses.
- (3.) The probability of water being freely taken up by the ryots at the rates prescribed.
- (4.) The expediency of expanding the scheme of works to the full extent contemplated by the company.
- (5.) The power of the State to complete the system of works, should they be withdrawn from the agency of the company.

1. It will be generally admitted, now, that the design of the canal is not entirely satisfactory, and that the construction of the works is in part extremely defective. The Government are aware, both by competent advice and by actual experience, that sufficient provision has not been made either for the passage of water under the canal, or for the discharge of the maximum amount of water from the canal itself. These are defects of design, but they are defects of design which the Government have failed to discover at the proper time, and which are susceptible of easy remedy. There will be no serious difficulty in effecting additional passages for the water-courses of the country which traverse the line of the canal at a low level. There will be no difficulty whatever in providing additional waste weirs in the banks of the canal. The defects alluded to do not appear to me to be more important or conspicuous than might have been expected in a work of great extent, and of a novel character. Similar imperfections and omissions would probably be discovered at the outset in the construction of any considerable irrigation work in the country, executed by any agency at the disposal of Government. Defects of a corresponding character might, for instance, be indicated in the tank and channel works constructed recently for the increase of irrigation in the vicinity of Madras, and the supply of the city with waterworks, carried on with every advantage of executive and inspecting agency. Another defect in the design of the canal may, perhaps, be the extensive use of perpendicular masonry walls, as the retaining walls of the canal and of the reservoirs into which the canal frequently expands, in lieu of sloping earth walls, after the universal fashion of the country. But here, again, the plan of perpendicular masonry walls has been accepted by Government, and it is undoubtedly warranted by the sanction of high professional authority. As far as the design of the works is concerned, the Government have, I think, at this stage, no equitable right to complain. The design may in some particulars be erroneous, but the errors are as much those of the Government as of the company. The defects of construction or execution are probably more serious than those of design. It is a fact that up to the present time the canal has always breached somewhere when it has been partially filled. Both the masonry walls and the earth-banks of the canal are of indifferent materials, and of faulty execution in the portions of the work first constructed. To what extent these defects prevail it is difficult at present to affirm. The Secretary for the Department of Public Works, who was lately Consulting Engineer for Government, and who is intimately acquainted with the works, takes a most unfavourable view of the capacity of the upper portion of the canal to contain the water for which it is designed with safety. He anticipates repeated disasters and expensive reconstructions. The opinion of Colonel Carpendale is entitled to much consideration, and it is difficult not to share his foreboding views; but here, again, I must admit that the Government may be considered in some measure as participators in the mistakes or neglects of the company. The works of the canal were constantly open to inspection and control. The Government have constantly entertained an officer as consulting engineer for the exercise of this duty. If it be urged that this officer could not always be present during the progress of the works, it may be contended, on the other side, that the Government might have increased their inspecting agency. It is true that the consulting engineers have on various occasions severely criticised the works; but the works were, nevertheless, not pulled down, and they were permitted to be proceeded with. The Government appear to me to have failed to interfere at an earlier period with sufficient energy. I am constrained to admit that the Government are in some degree a party to the grave defects of construction, as well as to the less important errors of design. It seems to me that it is too late now to take serious exception to the execution of works carried out under the eyes of a consulting engineer seven or eight years ago. In a word, the works of the canal are neither in respect to design nor execution completed to the satisfaction of Government, but the Government are in part to blame.

2. The adaptation of the canal for the purpose of irrigating the country which it traverses must be admitted by Government. We may regret that the works have been of a far more expensive character than would have been requisite if the canal had been restricted to the use of irrigation; but the objects of navigation were admitted by Government and the Secretary of State deliberately. The canal is an extravagant one for the purpose of irrigation, but it is well adapted for irrigation in connection with its other use.

3. It may be assumed, I think, that the water would be freely taken up by the ryots at the rates prescribed, if the works should prove of a durable and trustworthy character. The ryots will take the water if they can rely on the supply. We must, however, be prepared, in the first instance, to meet with considerable hesitation, in consequence of the reiterated failure of the works, and that hesitation would be aggravated by any future accidents. Under all the circumstances, we should submit that the expansion of irrigation will be very gradual, and many years must elapse before any return can be expected in the least degree responding to the outlay that has been incurred.

4. It is very difficult to give an unqualified opinion with reference to the expediency of extending the scheme of navigation and irrigation works to the dimensions contemplated by the Secretary of State, the Government, and the company, at an earlier period.

The present canal is a navigation and irrigation canal, which can only, under the most favourable circumstances, do more than half its duty on account of a failure of water during half the year. To give a permanent supply, and to make navigation a reality, it would be necessary to undertake the construction of vast reservoirs on the head waters of the Toongabudra or its affluents. An indispensable feature in the scheme of extension is the construction of these reservoirs. The company have three under survey, known as the Luchavully, the Toonga, and the Masoor tanks. No complete surveys and estimates of any of these three works, embracing all the sources of expenditure, have been prepared up to the present moment; and when framed and presented to Government they could not command an unhesitating confidence, for the execution of these immense storage works would be a novelty in our system of public works. The English Government has not constructed any great tanks up to the present time, and the cost of works by which ancient tanks have been improved and enlarged has, in our recent experience, greatly exceeded the original estimates. I understand, however, that the engineers of the company do not anticipate that they can construct the three reservoirs referred to, excluding indemnity, for less than 1,080,000 £. The storage works referred to would, however, not be requisite for the navigation of the Kurnool and Nellore Canals alone; they would supply water for a second crop over the whole area of wet cultivation contemplated in the complete scheme. Besides the reservoirs alluded to above, the complete scheme of extension contemplates the construction of three systems of irrigation canals, one of which at least must be connected with navigation, inasmuch as it is a development of the existing canal. These are—

1st. The Upper Bellary scheme, under the Walliapuram anicut, which, in the form recently presented by Mr. Gordon, and termed the Hoosoor scheme, is estimated to cost 1,250,000 £.

2nd. The Lower Bellary scheme, of which two projects are entertained, which we may set down at 200,000 £.

3rd. The Nellore extension between Cuddapah and the backwater of the coast, estimated at 1,072,000 £.

The aggregate expenditure for reservoir and canal works, under the scheme contemplated above, would thus be 3,602,000 £, to which must be added the sum for which the company are now indebted to Government, namely, 600,000 £; making a grand total of 4,202,000 £, which it would be incumbent on the company to raise, under a State guarantee, should the general scheme of extension be adopted, and the execution of the works be entrusted to the company. It can hardly be doubted, however, that the expenditure on the works would far exceed these estimates. It is not at all my desire to reproach the company with the appalling errors in the original estimates, under which the existing works were sanctioned and partly constructed. I am willing to believe that mistakes of such unparalleled magnitude could not be made again. The officers of the company have gained experience; they would go in future on much safer ground; and their ability and trustworthiness are guaranteed by the excellence of their later performances. But we have no experience whatever in this country of extensive enterprises of this character, in which unforeseen difficulties are not encountered, and in which unforeseen expenditure is not incurred. I feel confident that I shall not be considered unreasonable if I add 25 per cent. to the general hypothetical estimates indicated above, and assert that the complete scheme of extension works contemplated by the company would cost at least, including the repayment of the loan, 5,000,000 £. The question before us, therefore, is simply this:—Should we be justified in advising the Government of India and the Secretary of State to guarantee the company in raising the sum of 5,000,000 £? I reply, without the slightest hesitation, that we should not be justified.

In my humble judgment, the Government would not be justified in sanctioning an extension of these works, or in incurring any expenditure whatever, until we have ascertained, by actual experience, to what extent the existing works can be rendered remunerative, having in view the character of the works themselves, and the extent to which the people of the country will avail themselves of the benefits placed at their disposal.

5. The last question suggested in the Despatch of the Secretary of State admits, I think, of an easy reply. If the extension works should be prosecuted now or hereafter, the Government can undertake the enterprise by departmental agency with greater advantages than would be at the disposal of any company, for the following reasons:—First, the funds could be procured by the Government of India on loan on easier terms; secondly, the works could

could be executed more economically by existing establishments with the temporary expansion which might be requisite; thirdly, the intervention of a foreign agency in some degree between the Government and their subjects would be avoided.

In conclusion, I beg to submit my opinion that this Government should state, in the most unequivocal terms, that it would be inexpedient to make any further advance to the existing company, or to incur any further obligation in connection with them, and that the Secretary of State should avail himself of any occasion which may offer to negotiate, on reasonable terms, for the surrender to the State of all rights and privileges which the company may possess in the existing works, having due regard to the interests of the shareholders. Taking, however, a liberal and equitable view of the position of the company in reference to the existing works and to this Government, I would not advise any attempt to claim possession of the works on the grounds of a failure on the part of the company to fulfil the conditions of their contract.

Napier.

Madras, 21 June 1871.

Enclosure 6, in No. 17.

MINUTE by the Honourable *A. J. Arbuthnot.*

It appears to me to be clear that the construction of the canal cannot be said to be satisfactory either in respect of execution or design, and that it will be our duty to submit an opinion to this effect to the Secretary of State. It will be for that authority to determine whether or not the company shall be called upon to surrender the canal to the Government under the terms of the contract. This, I conceive, is a point for the decision of the Home Government, and on which we are not required to offer an opinion; but, looking to the present financial position and prospects of the undertaking, it seems to me that, unless the Home Government are prepared to authorise the company to raise additional capital under a guarantee, the surrender of the works to Government is inevitable.

2. I entirely concur in Lord Napier's opinion that it is not expedient to make any further advance to the existing company, or to incur any further obligation in connection with them.

3. I do not agree with his Excellency in regarding the failure of the Government consulting engineers to prevent the errors which have been committed in the designing and execution of the work, as in any way relieving the company from the responsibilities assigned to them under the contract, or as in any way debarring the Government from demanding the surrender of the works under the terms of the contract; but, as I have said, the company will have no alternative but to surrender the work, when they learn that the Government are not prepared to advance, or to enable them to raise, additional capital, the revenues which are likely to be derived from the works for some time to come being utterly inadequate to meet the cost of their maintenance.

A. J. Arbuthnot.

26 June 1871.

Enclosure 7, in No. 17.

MINUTE by the Honourable *J. D. Sim.*

THE first question of the Secretary of State relates to the general character as to design and execution of the company's works. We cannot, I conceive, reply otherwise than that they are faulty, though admitting, at considerable expense, of improvement and rectification. Sufficient water-way for the escape of flood waters has not been provided, and the works are therefore exposed to risk, the embankments are unstable, and, as a fact, the canal has breached every year. The work more recently executed is of a superior description; but, until the older defects are remedied, and for this the company has not the requisite funds, the work, in design and execution, must be held faulty.

2. The second and third questions may, I think, fairly be answered in the affirmative. The canal was designed for irrigation and navigation; the combination was ill conceived and unfortunate, for the expense of irrigation has been greatly enhanced, while the returns from navigation do not, and never can, make good this additional expense; but this union of irrigation with navigation was the original design, and its lamentable results cannot now be made ground of complaint. I see no reason to apprehend that the ryots will decline to take water at the present rate of 12s. per acre, if the supply be really assured, and the company's officers treat them with liberal consideration; but, unfortunately, hitherto the supply has been uncertain, and the ryot, to whom the failure of irrigation is the loss of a year's outlay and labour, naturally holds back. If the canal is placed in such condition that the ryots may be sure of water, the company need be under no apprehension of want of customers.

3. Finally, the argument of the company, that the remunerativeness of their works cannot be fairly tested unless they be so extended as to comprehend the whole of their original project,

project, admits of easy answer. They are perfectly free to carry out this project if they can only raise the necessary funds. But if, as seems to be the case, they cannot do this without a State guarantee of interest on their capital outlay, then other considerations come into play. There cannot be a doubt but that the State can raise the requisite funds as cheaply as, if not more cheaply than, the company, and that the officers of Government can do the work at least as well. If, then, the company desire to have the preference, they surely ought to show that some advantage will result from their employment. Unfortunately the reverse is the case; the work with which they have been entrusted has proved a ruinous failure; a million and a half sterling have been expended on it; it has in eight years since it was commenced yielded only 4,940*l.*, and the sum at its debit for capital and interest is considerably over two millions. And, what is worst of all, there is no probability of its ever proving remunerative. The cost of construction has been so enormous that it will swallow up all the income. 130,000 acres must be irrigated to pay the interest alone on the capital sunk, while the largest extent actually irrigated hitherto has been only 1,877 acres. With such results, surely the claim of the company to be entrusted with works estimated to cost 4½ millions more is, on the face of it, absurd. The company has been tried and has lamentably failed, and, in justice to the people of India, the Government, I submit, cannot and ought not to resort to their agency any further.

4. Nor does this course involve any breach of faith or want of equitable consideration. The agreement with the Government was that the company should execute a single complete work, the cost of which should be about a million sterling. The Kurnool project was selected as answering the description. The company have spent a million and a half on it; it is still unfinished, and it yields nothing. The reasonable construction of the agreement surely is that, if the company succeeded in this work, other works would be entrusted to them; and that, if they failed in this work, others would not be entrusted to them. The company, however, seem to consider that their failure not only does not prejudice their claims, but actually gives them a title to further employment. As an illustration of the manner in which the company has conducted its works, I beg reference to the consulting engineer's report of October 1869, in para. 69 of which he shows that works originally estimated to cost 493,348*l.* actually cost 1,015,552*l.*, or more than double. The estimates of the additional projects which the company desire to undertake with a State guarantee of interest amount to four millions sterling at least, and, with the Kurnool project, would entail a charge for interest of 280,000*l.* annually.

5. Under these circumstances we are, I think, bound to deprecate the grant of any further assistance in the form of loan or guarantee to the company, and to urge that, if it can be done legally, the Government should now buy out the company. The work will for very many years, if not for ever, be a losing concern, whether it belongs to the Government or to the company; but the Government can complete and work it more cheaply, as the entire home establishment and a large portion of the Indian establishment of the company can be dispensed with. It is true, as Lord Napier has remarked, that the company may urge that the Government ought to have intervened while the errors were being committed; and the plea is so far valid that certainly the Government are bound to give the company the full market value of their investment. But it must be remembered that this freedom from constant interposition is one of the advantages expected from the employment of private agency. If Government and its officers are to look after and be responsible for every detail of design and execution, they had better themselves perform the work. I cannot see anything inequitable in the Government buying out the company; the shareholders never can get more than 5 per cent. for their money; and, if the Government gives them that in another equally safe form, they cannot be losers. If there were any chance of the canal yielding more, the case would be different; but of this there is literally none. In the interests therefore of the Indian tax-payers, the Government are, I think, to bring to a conclusion, on fair and just terms, an arrangement which has worked so ill for the country, and now entails on its revenues an annual payment of 80,000*l.* without any return.

J. D. Sim.

July 1871.

Enclosure 8, in No. 17.

The Secretary to the Government of Madras to the Secretary to the Government of India.

Public Works Department, Fort St. George,
26 July 1871.

Sir,

I AM directed to acknowledge the Order of the Government of India, dated Simla, 16th May 1871, No. 1611, communicating a Despatch from the Secretary of State for India regarding the Madras Irrigation and Canal Company.

2. The Despatch was communicated to Colonel J. Carpendale, R.E., late consulting engineer to Government for the company's works, with the view to his specially reporting on the several points on which his Grace required information. Colonel Carpendale's report forms one of the enclosures to this communication, and is accompanied by Minutes by his Excellency the President, and the third and fourth Members of Council.

3. From these papers it will be gathered that the design of the works is not entirely satisfactory, inasmuch as suitable provision has not been made for the escape of flood-waters; but this Government do not desire to press this point, because the works to which exception is now taken, by reason of insufficiency of capacity, were constructed with the knowledge of the Government officers, and under Government sanction, and they were at that time believed to be of ample capacity. The construction of the works is also in part extremely defective, the banks formed in earlier years are not to be depended on, and the masonry works of earlier construction are inferior, and in consequence the canal has breached every year, at one time by common breaches in the banks, at another by the blowing up of a culvert or tunnel, and again by breaches caused by floods, either in the banks, or in the masonry walls which take their place, or in both; and on this ground alone I am to say that this Government do not consider that the work has been satisfactorily completed. In connection with this part of the subject, I am to add that his Excellency in Council, having understood that the canal and its works would, in the opinion of the company's officers, be completed by the 30th June, prescribed in Government Order, No. 1,089, of 18th April 1871, the conditions on which they would be prepared to consider the canal completed in the sense contemplated by Article 11 of the contract, dated the 2nd October 1866; and, for the purpose of ascertaining the exact condition of the works on the 30th June, and how far they would meet the requirements of this Government as above referred to, the Under Secretary to Government in this department was deputed to make an inspection. Captain Scott's report will in due course be communicated to the Government of India; but I am to mention here that, while describing the canal and its works from Soonkasala to Cuddapah as finished in a general sense, excepting the works of distribution, he points out that many small items of work still remain to be done, and he distinctly states his opinion that, if the canal was filled to the full depth it is intended for, it would fail in many places; and in addition to this, I am to say that, on the plea of the full quantity of water not being required for irrigation this year, and that the Government have not pressed the matter (an argument which, in the opinion of this Government, has no cogency), the company's officers are still delaying the admission of the full depth of water into the canal, which would be the only true test of its stability. As regards the suitability of the canal for irrigating the country through which it passes, the Government are ready to admit that it is probably as well adapted as could be expected for the combined purposes of navigation and irrigation, though a much simpler and less expensive design would have answered for irrigation alone; but the quantity of land that is susceptible of irrigation is very large, and the canal having a carrying capacity of 400,000 cubic yards an hour, the advantage to the country would doubtless be very great if the canal were found capable of carrying all the available water for one season without breaching. As regards the water rate, this Government see no reason to apprehend that the ryots would be deterred from freely taking the water at the rate of 12*s.* an acre, if they could have any assurance that there would be no failure in the supply, and that just in the middle of the cultivating season the water would not be entirely cut off, owing to breaches, entailing on them, not simply disappointment or loss of gain, but the loss of a year's outlay and labour.

4. The argument of the company that the value of their works in their remunerative aspect cannot be fairly judged, unless the works are extended so as to comprehend the whole of the original intention, is so far correct, that it is reasonable to suppose that the returns would be greater if there were water all the year round for navigation, and for two crops by irrigation instead of one; but his Excellency in Council is not of opinion that any further encouragement should be given to the company to enable them to extend their operations, or that any further obligations should be incurred by the State in connection with the company; and there certainly is no necessity for doing so on the score of expediency, for, if it should be decided hereafter to extend the work in Bellary and Nellore, the Government could undertake the enterprise by departmental agency with much greater advantage and more economy than could be expected of any company.

5. On the whole, this Government consider it would be most inexpedient to make any further advance to the existing company, and that, without claiming possession of the works on the ground of a failure on the part of the company to fulfil the conditions of their contract, advantage should be taken of any opportunity that may offer for obtaining a surrender by the company on fair and just terms of all their possessions, rights, and privileges.

6. The opinion of the Advocate General on the general question of completion agreeably to the 11th article of the supplementary contract, in reply to a reference made to him by the Government, under date the 16th May 1871, accompanies.

I am, &c.

J. Carpendale, Colonel, R.E.,
Secretary to Government.

— No. 18. —

The Government of Madras to the Secretary of State for India.

My Lord Duke,

11 August 1871 (No. 16).

* See No. 17.
Dated 27th July
1871, No. 1975.

IN continuation of our Despatch, No. 14, dated 31st July 1871,* we have the honour to forward the Report of Captain Scott, Under Secretary in this Department, on the result of the inspection which he has made of the works of the Madras Irrigation and Canal Company, in pursuance of the instruction of this Government, together with a copy of the orders passed by us thereon.

We have, &c.

Napier,

Fredk. Haines, Lieutenant General,
Commander-in-Chief.

A. J. Arbuthnot.

J. D. Sim.

Enclosure 1, in No. 18.

ORDER of the Government of Madras, 26th May 1871, No. 1,443.

THE Government resolve to direct the Chief Engineer for Irrigation to proceed to Kurnool at an early date, for the purpose of making a thorough inspection of the Madras Irrigation and Canal Company's main canal and works from Soonkasala to the Cuddapah terminus, in order to his reporting whether or not they are in such a condition that they may be considered complete, with reference to the sanctioned plans, by the 30th of June.

2. For the purpose of this Report, Major Ryves may assume that the canal is of the sanctioned width and depth, and that the masonry works in their general design are in conformity with the sanctioned plans. His attention should be more particularly directed to the present condition of the banks; whether they are in proper section, properly consolidated, and suitable for use as tow-paths; whether the high walls, which in many portions take the place of banks, present an uninjured and stable appearance; if the breaches of 1870 have all been repaired as provided in the sanctioned plans; whether the masonry works have all been finished, the lock gates and sluice valves fitted, and are in working order, so far as an opinion can be formed without actually working them. In the event of water being anywhere available, the locks should be fitted and tested; whether the bridges are completed, including the approaches, and the roadways formed, and if the parapets of the third-class bridges have been lowered to allow of the yokes of ploughs clearing them when the plough reversed is being drawn across the bridge. Major Ryves will be further instructed to report whether any and what steps have been taken towards improving the surplus discharge works in conformity with Government Order, No. 1,089, dated 18th April 1871, and to what extent, in general terms, the distribution works have so far approached completion as to be available for use this season.

3. His Excellency in Council will also be glad to have Major Ryves's report as to the area to be irrigated this season, and for which water has been applied for, and can be supplied, and the revenue that may be expected in the current year, supposing the canal to be found capable of carrying water throughout the season without breaching; and he will also report on the arrangement intended by the company's officers for testing the canal agreeably to paragraph 3, Government Order, 18th April 1871, No. 1,039, so soon as a full supply of water from the Toongabudra is available.

Enclosure 2, in No. 18.

ORDER of the Government of Madras; 26th May 1871, No. 1,444.

MAJOR Ryves being unable to proceed to Kurnool for the purpose of making the inspection of the works of the Madras Irrigation and Canal Company ordered in Government Order, No. 1,443, dated 26th May 1871, His Excellency the Governor in Council resolves to depute Captain Scott, Under Secretary to Government in this department, for the duty.

Enclosure 3, in No. 18.

The Under Secretary to Government, Public Works Department, to the Secretary to Government, Public Works Department, dated Fort St. George, 6th July 1871.

I HAVE the honour to inform you that, in obedience to the orders of Government quoted in the margin, I inspected the main canal and works of the Madras Irrigation and Canal Company from Soonkasala to Cuddapah between the 7th and 27th June, and I beg to report as follows on the questions referred to me in my instructions.

2. An examination of the mileage notes and general remarks* on each section appended hereto will show in detail the state of the canal at every point. It will be gathered that the earthwork in the first three sections, that is from the 1st to the 45th mile, is not altogether satisfactorily formed, and that some labour is still required to bring the banks and towpath into fair order. In the 4th and 5th sections, or up to the 75th mile, a considerable improvement is noted; while in the remaining portions of the canal, but especially in the 7th and 8th sections, so far as external appearance is concerned, there is generally nothing further to be desired. The bed of the canal is clear of obstructions, the side slopes are neatly trimmed, and the embankments are of the regulated height, of full section, with towpath formed to a proper width. Unfortunately there is almost universal absence of consolidation in the embankments throughout the whole length of the canal, so that their satisfactory appearance is to a great extent delusive. Great exertions have been made by the engineers in charge in laying fresh soil and trimming the slopes, and a very great amount of work has been done, but the banks are generally formed in bad soil, and they have been thrown up loosely and at random, and are for the most part bare of grass. When water is brought into the canal they will settle very considerably, and they will be guttered by rain, and the cost of maintaining and making them up annually will necessarily, for several seasons, be very great. In their present condition it will be necessary to use great caution, and to admit water very gradually and only to a small height during this year. It seems certain that with a full canal they would breach at many points. The walls used principally in the 2nd section as substitutes for earthen embankments have been raised to a height of 3½ feet above water level, and they appear to be in good repair. In some cases a puddle bank has been laid at the toe where especially leaky, and the rubble backing has been added to. Water passes more or less through all, and nothing but the test of a full supply in the canal can determine the question of their safety. There is no doubt that there are now many weak points, and that, until the natural process of silting up in the hollows when they are built has gone on for a long time, there will always be danger of failures taking place.

3. All the breaches which were made in the banks or walls last year have been repaired in accordance with the sanctioned plans, but the earthwork backing to the new wall closing the Hindry breach has slightly slipped since it was laid. The general unsatisfactory state of the canal at that particular point has been noted in the mileage observations appended.

4. The masonry works are, it may be said, completed, as the trifling amount of building remaining to be done in two or three instances could be finished in a very few days. The character of the work is generally rough, and some portions recently completed very much so, and, though it usually appears to be in a sound state, it is probable that frequent repairs will be necessary and the cost of maintenance considerable. All the lock gates have been hung, and the valves for the sluices are in their places, but this is not always the case with the lifting gear, and at almost every lock some small additional fittings are required, and some further adjustments are necessary to place them in proper working order. As at the time of inspection there was no water in the canal where the locks are placed, there was no means of actually filling and testing them, and no decided opinion can be pronounced as to their stability under working conditions until this has been done.

5. The approaches to the bridges and the roadways are all made up, and, except in one single instance, the parapet walls of the third-class bridges have been lowered to allow of the yokes of ploughs being drawn across them. In the case alluded to, the order for the alteration was given by the chief engineer, and accidentally overlooked.

6. Notwithstanding that throughout the length of the canal there are not a few points where there is still something to be done to bring the works even in their outward aspect to a finished state, still on the whole, and in a general sense, the canal with its appurtenances may be considered to be completed in reference to the sanctioned plans; for it is excavated throughout to its full dimensions, the banks and walls are raised to full height and section, and the masonry works are constructed and in a state to deal with the water when it is admitted.

7. The question of improving the surplus discharge works in the first four sections of the canal is reported on in the consulting engineer's letter to Government, No. 131, dated 6th March 1871, and Order thereon No. 1,089, of the 8th April 1871, approves of the reconstruction.

* These will be found later on, with Enclosure to No. 23.

struction of calingulah No. 13 in the 2nd section, and gives discretionary power to the Company's officers to decide how improvements in the other calingulahs should be carried out. In accordance with the sanction thus given, calingulah No. 13 has been rebuilt, its crest being placed at a level 5 feet above the normal bed of the canal, and planks are provided to close each bay for a further height of 3 feet. With this exception, all the surplus discharge works remain in the same condition they were in before the floods of August 1870, which demonstrated the insufficiency of the means of escape provided for flood water, having in view the insecure state of the canal walls and embankments.

The chief engineer of the Company has, however, taken certain measures tending to prevent the water from rising to an excessive height, and to ensure that breaches should occur in the most favourable localities if breaching is really inevitable. He has raised or removed the shutters at the sluices in the calingulahs, and has laid in front of the vents earthen banks to a height 6 feet above canal bed level, and at intervals (generally where the canal is in cutting to a depth of 4 feet) he has lowered the earth bank to a height of 10 feet above bed level, the intention being that, when the water rises to a height greater than 6 feet, the calingulah sluices should be opened by the breaching of the bank in front of them, and that, if any further and dangerous rising of the water should occur, the banks at the selected places should be cut and allowed to breach, while the ground would act as a natural calingulah, and retain a supply of water for irrigation. In their order above quoted Government have observed that such measures as have just been described are only admissible in the case of an incomplete canal, but not otherwise; and the fact that the Chief Engineer has considered it necessary, for the safety of the work, to adopt them, is evidence that this is in an incomplete state in respect of one of its most important parts.

8. The distribution works sanctioned by Government for the land under each section of the canal are in a more or less advanced state. All the sluices in the main canal have been built, and, though a number of them were not provided with shutters and some were without lifting gear when inspected, these deficiencies will shortly be made good. The following abstract statement shows the length of the irrigation channels sanctioned and executed in each section, with the acreage commanded, and which can, therefore, be readily supplied with water on a demand being made by the ryots:—

Number of Sections.	Irrigation Channels.		Amount of Land now Commanded.
	Sanctioned.	Executed.	
	Miles.	Miles.	Acres.
1st - - - - -	14.00	14.00	1,386
2nd - - - - -	14.00	14.00	1,956
3rd - - - - -	26.14	26.14	9,837
4th - - - - -	63.44	63.44	25,000
5th - - - - -	26.16	23.04	9,000
6th - - - - -	93.56	26.00	20,000
7th - - - - -	28.41	27.00	12,600
8th - - - - -	64.00		
9th - - - - -	37.60	14.60	8,600
10th - - - - -	10.00	7.87	3,788
TOTAL - - -	377.31	216.09	91,667

As a rule, it is the main distributing channels which have been excavated, and the heads of the subsidiary channels are not marked out or provided with masonry outlets, but temporary arrangements can easily be made to regulate the supply. The excavation of such channels has been checked, in accordance with the recommendation of the Consulting Engineer in his letter, No. 129, of the 17th November 1870, approved by Government, until formal application has been made by the village people.

9. I have found it impossible to obtain such definite information on the subject of the area which will probably be irrigated this year, as would enable any very reliable estimate to be made of the revenue which will be collected. The ryots are, as a rule, exceedingly unwilling to make formal application for water, and appear to be under the impression that they will commit themselves to payment if they do so, even if the supply should fail; and it is a fact that applications are not made. In some places they request the Company's Engineers to give them water, but do not apparently understand how to make their applications through the proper channel. Such a change as is involved in the habits of the people, by the introduction through a large tract of wet in lieu of dry cultivation, will only take place gradually. Special measures of encouragement will be necessary, and they must acquire that confidence in the permanence of the supply of water, which only its presence in the canal for two or three seasons without disaster can give them, before they will make to any great extent those changes in their agricultural plant and processes which will be necessary. In order to obtain some data on which to found an estimate of the area of irrigated land and prospective revenue from the canal during this season just commencing, and

in default of the receipt of regular applications for water, the Collectors of the Kurnool and Cuddapah Districts have caused inquiries to be made in the villages under the canal, as to the intentions of the landholders and the extent to which they propose to irrigate. This is the only way in which any estimate can be made, and it is necessarily a very vague one. I questioned the Deputy Collectors of each district as to the result of their inquiries, and these officers admitted that any returns made must be considered mere approximations, and that the ryots are not at present very ready to come forward with their demands for water. I also obtained from them such statements as they had been able to compile of the probable extent of land which would be taken up in the event of the canal holding water for a complete season. An abstract of these is given below, and an estimate of revenue based thereon.

District.	Talook.	Mileage on Canal.		Probable Cultivation.	TOTALS.
		From Mile.	To Mile.		
Kurnool - -	Ramalakottah - -	1st -	22nd -	Acres. 940	Acres. —
Ditto - -	Nundikotkur - -	23rd -	86th -	3,725	—
Ditto - -	Nundial - -	87th -	109th -	624	—
Ditto - -	Sirwell - -	110th -	123rd -	1,913	—
Ditto - -	Koilkootla - -	124th -	130th -	681	7,883
*Cuddapah - -	- -	148th -	180th -	1,000	1,000
Grand Total - -		- -	- -	- -	8,883

Revenue.		Rs.
8,863 Acres, 1st crop, at 4 rupees	- - -	35,532
2,221 Acres, 2nd crop, at 2 rupees	- - -	4,442
Kurnool water supply	- - -	4,000
Total Estimated Revenue for 1871-72	- -	43,974

The area irrigated last season was 1,516 acres. The increase calculated on this season is, therefore, 7,367 acres, and it is not probable that it will exceed the estimate; in fact, it is more likely to fall short of it.

10. On my arrival in Kurnool, I addressed a letter to the Company's Chief Engineer, directing his attention to the Government Order (quoted in the margin), approving of the testing of the canal, and detailing the nature of the test which should be deemed sufficient to establish the fact of its being in working order; and I requested him to inform me what arrangements he had made for carrying the wishes of Government into effect. Government Order No. 1089, 18th April 1871.

From Mr. Latham's reply, appended to this Report (in original), it would appear as if in certain respects he had made or was making preparations to enable him to test the canal if required; while, on the other hand, other portions of his letter would lead to an inference directly the contrary.

He states, in paragraph 2, that "arrangements have been made for passing water down the canal as rapidly as possible," and in paragraph 3 that "arrangements will be complete, by the time the water is down the canal, for putting the necessary sluice-keepers and watchers for testing it to any height required;" but in the same paragraph the Chief Engineer proceeds to say that "the temporary arrangements described in paragraph 11 of the Consulting Engineer's letter attached to Government Order, No. 1089, of the 18th April 1871, have been made," i. e., that the sluice-shutters in the calingulahs had been removed, and the earthen banks, described in paragraph 7 of this Report, thrown up, so as to breach if the water in the canal rose to a greater depth than 6 feet above bed-level (the maximum test-level being 9 feet), and he concludes his answer to the question proposed to him with the information that, "in the absence of any instructions or positive order of Government or the Board to test the canal, he had not retained the staff necessary to do so." I must further remark that the admission of water into the canal on the occasion of the first fresh in the Toongabudra was by no means made with rapidity; quite the contrary. Probably Mr. Latham intended that it should always be understood that the degree of rapidity was to be only so great as was consistent with the safety of the banks, and accordingly, when there was a discharge of 1 foot of water over the Toongabudra anicut, and the depth of water in the canal could have been maintained at 8 feet, only 2 feet was allowed to flow in; increased after my arrival to 3 feet 9 inches. I consider that this caution was necessary, because of the generally unsafe condition of the embankments and walls; but it hardly seems

* The villages are not given in the original statement, and the mileage is only approximative.

seems to me to be consistent with readiness to test the canal in the manner desired by Government.

The Chief Engineer further deprecates the applications of the test, apparently on the ground that it would alarm the ryots and injuriously affect the prospects of irrigation, and he appears to suggest that it should be postponed till the end of the season.

A careful inspection of the embankments and walls of the canal has convinced me that they would fail at many points, if subjected now to the test proposed, which is, that the canal should be kept running for 24 hours with 9 feet of water in it, or 1 foot above the present calingulah crests, and that it should carry for 30 days consecutively a full irrigation supply.

Under these circumstances, and seeing that, in the event of any disasters to the works, the loss must eventually fall on Government, but for no other reason, I think it would be advisable to postpone the testing, provided the Company's agents are willing to admit, without qualification, that the canal cannot retain the water which it was designed to carry.

11. In conclusion, I beg to state that I have received from the engineers of the Company every assistance in carrying out my inspection, and in obtaining all necessary information.

Fort St. George,
6 July 1871.

A. de C. Scott, Captain, R.E.,
Under Secretary to Government, P. W. D.

(For the mileage notes, see page 51.)

Enclosure 4, in No. 18.

The Chief Engineer of the Madras Irrigation and Canal Company to Captain A. de C. Scott, R.E., Under Secretary to Government; dated Lockonsula, 16th June 1871.

Testing Canal.

I HAVE the honour to acknowledge receipt of your letter, Kurnool, the 11th instant, and beg to reply as follows:—

2. Arrangements have been made for passing water down the canal as rapidly as possible after the admission of water at Soonkasoola, which, owing to my illness, took place on the 3rd of June, instead of the authorised date, which is the 1st June.

3. Arrangements have been made, or are making, and will be complete by the time the water is down the canal, for putting the requisite sluice-keepers and watchers for testing the canal to any height required. Further, the temporary arrangements described in the first part of paragraph 11 of Colonel Carpendale's letter, attached to Government Order, 1089, of 18th April 1871, have been made; also the banks, where they are low, and may be breached without emptying the canal, have in convenient places been lowered to the lowest safe level, or are being so lowered, that is (see paragraph 11 of Consulting Engineer's letter, attached to Government Order, 3195, of 15th October 1867), they are being formed with a revetment to a height of 3 feet 6 inches above full water level, and the revetment is backed by an earth bank up to the same level, while the bulk of the bank in rear is reduced to 1 foot above water level. A hut is built close by, so that the bankers will see to the bank and will keep it secure. It will only be breached when it is breached by the bankers.

4. I may add that the calingulah question will be put into the hands of Mr. Browning, I hope within a month, in order that he may form working plans and estimates for calingulahs for the whole canal, on the patterns approved in Government Order, 1089, of 18th April last, and on the principles approved in Government Order, 1505, of 2nd instant (unless these be modified as I have proposed in a recent letter, written for submission to Captain Ryves before I read the last Order). These plans and estimates will be submitted to the Government and the Board this autumn as early as possible.

5. In the absence of any instructions or positive Order of Government or the Board to test the canal, I have not retained the staff necessary for testing the canal. In reply to your last paragraph, I beg to submit the following remarks on the subject of testing:—

The advantages of testing seem to me to be—

(1.) To detect any weak places or cracks, burrows, &c., and so get them mended at once.

(2.) To detect any errors or omissions of the engineers in the levels or measurements by which they have constructed the works.

(3.) When testing were completed and all necessary omissions made good, it may be that the ryots would be penetrated by confidence in the canal for the future.

It appears to me that these advantages are not of much value, considering the known completeness of the works as a whole, and the loss of revenue which the experiments would probably cause, and the cost of the experiments.

7. Any errors of level or omissions in the banks are known to be such as the staff of bankers

bankers alone may easily correct, and they may also very well repair any cracks, leaks, &c., which occur in the banks while in ordinary use. The banks and many of the masonry works get stronger every year they are used, since the silt makes the earth in the banks, and at the junctions of banks with masonry, tighter and more secure yearly. Moreover, the canal was at first intended to be secure for current demand, but not to be water-tight until it had been some time in use.

8. A more important question is that of how much calingulah power is advisable. But this is not a matter to be tried by filling the canal full. Government have (Government Order, 1505, of 2nd instant) ruled that the calingulahs and sluices should suffice to discharge an inch of rain an hour. They do suffice for little over a quarter of this, but the deficiency may easily be made good before this time next year. It is manifestly prudent to wait till the calingulahs are complete, to whatever extent is agreed on, before filling the canal needlessly full.

9. The most important considerations are, however, those of staff and revenue.

10. The present conservancy staff will have full occupation on the canal, until the water is down the whole length to a depth of 5 feet or so, required for probable demands. Every available man will then need to be put on distribution for clearing out old channels, arranging field channels, seeing that the water actually flows in all directions over the country, and repairing or preventing petty damage to the distributing works. I find that the engineers will be engaged in July very much with examining and making over stores, office records of the state of the works and the finances, and such work, requiring great care and time. In August they will have to be incessantly in the field away from the canal, if there is to be any irrigation worth speaking of. All their men have to be taught and trained, and the wishes of the villagers have to be ascertained and consulted as to every field and village requiring channels; any channels not complete by the 1st September will be too late. All has to be done with a staff completely new to the work, if we except the practice got in July and the first week in August last year. As I have before said, I think caution as appropriate as for a railway first opened under a staff strange to their work; the skill required and risk run is at least as great in the case of a banker or sluice-keeper as in that of a pointsman or platelayer or crossing keeper.

11. The knowledge that the canal is under test would cause all ryots, unless they possessed wells, to wait till the test is over before they commenced sowing wet crop, and would cause all who were doubtful of the result to sow dry crop at once, before the sowing time for the first dry crop is over.

12. To wait until after the sowing and test in October would hardly be fair, unless the ryots were authoritatively forewarned that their crops would be submitted to that risk.

13. These most important objections do not apply, if the testing be carried out after the 31st December. There is generally ample water during the month of January, and there is always enough at that time for testing all the portions of canal constructed for navigation only.

14. I am not disposed to object to any test which is within the means possessed by the company, and does not in any way touch the security or interests of the ryots in irrigation.

Enclosure 5, in No. 18.

Order of the Government of Madras, 27th July 1871, No. 1975.

THE above Report confirms the opinion which the Government have for some time held, as to what would probably be the condition of the Madras Irrigation and Canal Company's works on the 30th June 1871, namely, that, although a good deal remains to be done to bring the works in even their outward aspect to a finished state, yet, in a general sense, the main canal and works, excepting those of distribution, may be considered finished in accordance with the sanctioned plans. But the state of completion falls far short of that contemplated by the 11th Article of the supplemental agreement, dated 2nd October 1866, and of what would be understood by the expressions satisfactorily completed and placed in working order.

2. It appears that in some portions of the main canal the earthen banks have not been satisfactorily formed; that there is a general absence of consolidation throughout; and that their satisfactory appearance from neat superficial trimming and finish is delusive; that in other portions the banks are formed of bad soil, and, being loosely thrown up and at random, are further deficient in the protection that a covering of grass would afford; and that it seems certain that with a full canal the banks would breach at many points.

3. It is also observed that water in larger or smaller quantity passes through all the walls which take the place of earthen banks in certain places, and that nothing short of a full supply of water could determine the question of their stability.

4. It also appears that the chief engineer has taken measures to prevent the water in the canal rising beyond a fixed height, that height being much below the level of the canal when full, and to ensure that, if the canal should breach, it will do so in the most favourable localities. These precautions are precisely what the Government, in Government Order, No. 1089, dated 18th April 1871, prescribed as admissible only in the case of an incomplete canal, and altogether unsuitable in connection with a work that is supposed to be complete in itself; and the fact of the company's chief engineer considering it necessary to adopt such measures is, in the opinion of the Government, the strongest evidence that the company deem the undertaking deficient in its most essential particulars.

5. No definite information appears to have been obtainable as to the area that will be irrigated this year; but, from inquiries made by the collectors of Cuddapah and Kurnool, it is gathered that, in the event of the main canal carrying water throughout the season without breaching, it is possible that an extent of 8,883 acres might be irrigated, in which case the total revenue for the year would be 43,974 rupees. The Government cannot say that they have any confident expectation that this hope will be realised; and the amount is so insignificant as a return for an expenditure of capital and interest thereon aggregating more than two millions sterling, besides being less than half what is required for annual outlay on maintenance or conservancy, that they cannot acquiesce in the propriety of the company's proceedings in deferring, or, more correctly speaking, dispensing with, that test which the Government in the strongest terms prescribed the necessity for, and which has been dispensed with on the pretext that it would alarm the ryots and injuriously affect the prospects of irrigation.

6. The test which the Government approved of, and which is nothing more than the canal was designed for, and was expected to be capable of sustaining, was that a depth of nine feet of water above bed should be maintained for 24 hours, and that for 30 days consecutively the canal should carry a full irrigation supply. In Captain Scott's opinion the embankments and walls would fail at many points if subjected to such a trial, and, as the company's engineers have made provision for the canal breaching in the event of the water rising more than six feet, it must be presumed that they share the apprehensions of the Government officers who have reported on the subject.

7. Captain Scott's Report will be communicated to the Secretary of State and to the Government of India, who will at the same time be informed that the canal has not been properly completed and placed in working order to the satisfaction of this Government.

— No. 19. —

The Governor General in Council to the Secretary of State for India.

My Lord Duke,

Simla, 23 August 1871 (No. 101).

WE have been furnished by the Government of Madras with a copy of its Despatch to your Grace, No. 14, dated the 31st ultimo,* and accompaniments, on the subject of the present condition and future prospects of the Madras Irrigation and Canal Company, and desire at present to express our concurrence with that Government in considering it impossible to contemplate any relation with the Company in regard to further works. We purpose, however, addressing your Grace further on the whole question, after ascertaining and fully considering the precise nature of the present relations between the Company and the State.

We have, &c.

Mayo.

Napier of Magdala.

John Strachey.

R. Temple.

J. F. Stephen.

B. H. Ellis.

H. W. Norman.

— No. 20. —

The Governor General in Council to the Secretary of State for India.

My Lord Duke,

Simla, 15 September 1871 (No. 119).

IN continuation of our Despatch, Public Works, No. 101,* of the 23rd ultimo, we desire to lay before your Grace a short review of the facts connected with the Madras Irrigation Company's operations. Those operations began in 1859, or nearly 12 years ago. The result has been an outlay of more than one and a half millions

millions sterling, and up to the present time an income of only 4,740 £, while the works themselves are considered by the engineers who know most of them, to be still very defective. The immediate causes of these results seem to have been due partly to want of skill in design, but more to faults in construction. The original project, it was supposed, would probably cost about one million sterling; and this sum was, as your Grace is aware, guaranteed by Her Majesty's Government, after a long discussion on various points of the contract, which was not finally signed until 1863.

2. After the guaranteed million had been spent, and the first part of the scheme was still incomplete, the Company applied for an extension of the guarantee; but the Government refused, offering instead to buy the undertaking. This offer the shareholders declined; and ultimately a loan of 600,000 £. was granted to the Company by the then Secretary of State for India, for which interest at 5 per cent. was to be paid from the profits of the canal; and on the condition that, if the works were not completed and placed in *perfect working order*, to the satisfaction of the local government, by the 1st July 1871, the Company should, if the Secretary of State so desired, surrender the whole of the works to the Government, which would pay the capital laid out on them. A further advance is now sought for by the Company to enable them to complete their original scheme.

3. It seems very doubtful whether, in their present state, the works can prove remunerative, for 130,000 acres must be irrigated to pay the interest alone on the capital expended, while the largest extent of land actually irrigated hitherto by the works has only been 1,887 acres. Works which were originally estimated to cost 493,348 £. are said to have actually cost 1,015,552 £. According to the consulting engineer's reports, serious mistakes appear to have been made in the designs; insufficient passages have been constructed for the water-courses of the canal; perpendicular masonry walls have been adopted as retaining walls, in lieu of the usual sloping earthen banks, and contrary to the universal practice of the country. But the defects of construction appear to be more serious than those of design. Up to this time the canal has never been filled, notwithstanding which it has always been breached somewhere when partial attempts have been made to fill it. The masonry walls are of indifferent materials and faulty construction, and the water supply is so uncertain that the ryots appear unwilling, even in a country where the value of irrigation is thoroughly appreciated, to take the water. The instability of the embanked portion seems to be a source of constant apprehension to the cultivators, who thus cannot help looking on these works constructed for their good with feelings of fear, if not aversion.

4. With regard to the Minutes of his Excellency the Governor of Madras and his colleagues, we hesitate to accept the view taken by his Excellency, that the Government should be considered participators in the mistakes and negligence of the Company; although we quite agree with him in the blame cast upon his Government when he says that, "though the Consulting Engineers on various occasions severely criticised the works," they nevertheless were "not pulled down, but were permitted to be proceeded with." It is true that this admits fault on the part of the Madras Government and its officers, but it in no way excuses the Company and its officers, who are primarily responsible for the proper execution of the work, and the fulfilment of their obligations. It is possible that a greater degree of responsibility devolves on Government in respect to design than to construction in these matters; but we cannot admit that the presence and supervision of Government engineers exonerates a guaranteed company, or a contractor of any kind, from responsibility with regard to the due construction of any of their works. In the case of failure we may dismiss our consulting engineers, but we must also hold the Company or the contractor fully to their engagements. This opinion is so well expressed by Mr. Arbuthnot, in the 3rd paragraph of his Minute of the 26th June last, that we need not refer to it further than to say that, although his expressions are very clear, he might have put the case even more strongly than he has done.

5. For the objects with which the works were originally designed, they are practically useless. We consider that in strict equity the Company has no right to expect a further sum from the Government than the value of the works in
197, E their

See Enclosures to
No. 17.

their present state, having regard to the liability of 600,000 *l.* to the Government, and the return which, after the necessary outlay in reconstruction and repairs, the Government is likely to obtain from it. It seems unlikely that the works in their present state would be anything like security for even the 600,000 *l.* which the Government have advanced. We apprehend there can be no difference of opinion as to the inexpediency of making any further advance to the existing Company, or incurring any further obligation with regard to them, and we fully agree in Colonel Carpendale's remark, that neither "the history of this canal, its present condition, or future prospects, are such as warrant consideration or indulgence being shown to the shareholders." It is but fair to say that Colonel Rundall, our Officiating Inspector General of Irrigation Works, from his knowledge of the country and its requirements, takes a more hopeful view of the prospects of returns than either Colonel Carpendale or Captain Scott; but it seems doubtful whether the canal, in its present state, can be used for the objects for which it was constructed. We have, however, caused inquiry to be made as to what it will cost to place the works in a state of usefulness; and until that point is known it is impossible for us to form any opinion, or to make any recommendations regarding an extension of the works.

6. Since writing our former Despatch, we have examined the original and supplementary contracts made with the Company, and, after consulting our colleague, the Honourable Mr. Stephen, we regret to say that we cannot discover that the State has any remedy for the loss to which it has been subjected by the mismanagement of the undertaking by the Company, but must continue to pay to the Company the guaranteed interest of 5 per cent. annually on their original capital of 1,000,000 *l.* until such time as the works are surrendered to Government. It appears from the wording of the contracts that Government cannot claim possession of the works on the ground of a breach of contract, and it would consequently be unadvisable to press the assumption of the works; but, as it is most inexpedient to make any further advances to the Company, advantage should be taken, as recommended by the Government of Madras, of any opportunity that may offer for negotiating for the surrender of the works to the State on the best terms that can be obtained.

We have, &c.

Mayo.

Napier of Magdala.

John Strachey.

R. Temple.

J. F. Stephen.

B. H. Ellis.

H. W. Norman.

— No. 21. —

The Government of Madras to the Secretary of State for India.

My Lord Duke,

11 October 1871 (No. 22).

See No. 18.
Dated 11th August
1871, No. 16.

IN continuation of our Despatch, as per margin,* we have the honour to forward the accompanying letter from the Agent of the Madras Irrigation and Canal Company, commenting on Captain Scott's Report on his inspection of the works of the Madras Irrigation and Canal Company, together with the latter officer's remarks and the Proceedings of this Government thereon.

We have, &c.

Fredk. Haines, Major General,
Commander in Chief.

A. J. Arbuthnot.

J. D. Sim.

Enclosure 1, in No. 21.

The Agent and Manager of the Madras Irrigation and Canal Company to the Acting Chief Engineer for Irrigation and Under Secretary to Government; dated Madras, 4th August 1871, No. 340.

THE Order of Government, No. 1975, of the 27th July, having been communicated to me, I have the honour to request that you will do me the favour to submit to the Right Honourable the Governor in Council the following representations:—

2. It is said that the Government cannot acquiesce in the propriety of the "Company's proceedings, in deferring, or, more correctly speaking, dispensing with, that test which the Government in the strongest terms prescribed the necessity for, and which has been dispensed with on the pretext that it would alarm the ryots and injuriously affect the prospects of irrigation."

3. I beg most respectfully to assure his Excellency in Council that, on behalf of the Company, I have taken no proceedings whatever; in other words, the Company has taken no proceedings whatever.

4. It will, I imagine, be conceded that a work cannot be tried, or tested, until it is executed; and the company was required by the supplementary contract to execute the Kurnool-Cuddapah Canal by the 1st July 1871.

5. Before that day Captain Scott, by order of Government, inspected the works and reported that, even in the middle of June, "the canal and its appurtenances might be considered to be completed in reference to the sanctioned plans."

6. As explained in another communication,* I never did, nor do I now, believe it to be my duty on behalf of the Company to take the initiative in any proceedings for offering to Government proofs of the completion of the canal. I think you will find that it has always been customary upon the passing of any order by the Government which required the Agent to take any action or to afford information, it has, I think, been the invariable custom, for the Consulting Engineer to communicate to me by letter the directions or queries of the Government, and although I have in some cases anticipated such communication, yet I have never been expected to act until so advised. As an illustration, permit me to refer to your No. 107 of the 1st instant.

* No. 321 of 22nd July.

7. The test "which the Government prescribed the necessity for" is a process of a purely professional character, and one which, I imagine, demands a certain amount of care and professional skill to carry out, and I submit that I was fully justified by the nature of the case in assuming that the Government would intimate to me the time when the prescribed test should be applied, and in assuming also that they would make arrangements for being represented by some officers who would, on their behalf, watch the process.

8. I have never, on behalf of the Company, been called upon to direct the application of the test "which the Government prescribed the necessity for," and I trust that his Excellency in Council will perceive that the Company is guiltless of having knowingly or willingly taken any proceedings at variance with the views expressed by Government, much less has it been the intention of the Company to seek a "pretext" for evading any of its liabilities. I have read the correspondence which took place between Captain Scott and Mr. Latham, and I can detect in the letter written by the latter nothing but an honest, straightforward and *bonâ fide* desire that the ryots (although they are the special charge of the Government, not the Company), should run no risk of damage, and a perfect readiness to test the canal whenever, upon a due consideration of the attendant circumstances and of the various interests at stake, the Government should see fit to direct the operation.

9. His Excellency in Council will, I trust, concede to me that, the action (or, to speak more correctly, inaction) of the Company having been misunderstood and called in question, it is my duty, without delay, to offer such explanations as will, I hope, place the matter in its true light.

10. But there is another point in which I respectfully submit the Government have been misled. It is stated in the same paragraph 5, that because "the amount of 43,974 rupees is so insignificant," therefore "they cannot acquiesce in the propriety of the Company's proceedings in deferring that test which the Government prescribed the necessity for."

11. It will, I presume, be admitted that, if the premise is shown to be erroneous, the sequence of necessity falls to the ground. But, in arriving at the sum which forms the basis of this syllogism, a serious error has been fallen into; the water rate fixed by the Government is 6 rupees, not 4 rupees, nor 2 rupees. The amount therefore, instead of being only 43,974 rupees, should be 70,630 rupees, taking the estimates of the Revenue Officer of the Government, as shown in paragraph 9 of Captain Scott's report.

12. It does not come within my province to offer any remarks upon the professional points upon which objections are raised, but there are one or two observations, in reference to the state of the works reported on, upon which, without trenching upon professional ground, I feel it my duty to comment.

13. In paragraph 2 it is said that—

- (1.) "The earthen banks have not been satisfactorily formed;
- (2.) "That there is a general absence of consolidation; and,
- (3.) "That their satisfactory appearance from neat trimming is delusive.
- (4.) "That in other portions the banks are formed of bad soil,
- (5.) "And being loosely thrown up and at random are
- (6.) "Further deficient in the protection that a covering of grass would afford."

14. With regard to (2) consolidation, I submit that banks contracted to be *finished* by the 1st July could hardly be expected to be *consolidated* early in June, consolidation being only attainable by time. But the nearest approach to instantaneous consolidation is obtained by (3) *trimming* which, I infer from the language used by Captain Scott in paragraph 2 of his report, would tend to prevent the "guttering by rain" to which (5) banks loosely thrown up are liable. But, while the latter are condemned without qualification, the former are condemned as "delusive."

15. With regard to (4) *bad soil*, I presume that the only reason for using it was that nature had refused good soil on the spot, and that the estimates sanctioned by Government did not admit of the costly alternative of sending to a distance for that which would have been better. (6.)—The absence of grass, I imagine, is to be accounted for in a somewhat similar manner. I know that the encouragement of vegetation on the canal banks is a subject that has always been kept in view; but it will be remembered that climate and the vicissitudes of the seasons have to be contended with, and, when the peculiarly severe conditions of the supplemental contract are considered, and the extraordinarily short period allowed to the Company to complete a gigantic work, it is obvious that but little time could have been left for the engineers to devote to this secondary work.

16. I trust, therefore, that his Excellency in Council will bear with me if I venture to submit that, whatever may be the force and purview of the contract read in its strict liberal sense, its *spirit* can surely never have contemplated instantaneous consolidation and vegetation as indispensable or essential conditions of completion.

17. It scarcely falls within my province to go further into the essential questions raised by the order of Government. Those will be fully discussed by his Grace the Secretary of State with the directors of the Company; but it has seemed to me imperative that I should, without delay, enter on behalf of the Company this preliminary protest on minor but salient points, and I trust, to the candour of his Excellency in Council to accept with indulgence and favour what I have ventured to submit.

Enclosure 2, in No. 21.

MEMORANDUM by Captain Scott.

Submitted to Government.

THE remarks made by the agent relative to the action of the Company's officers on the question of testing the canal do not appear to call for any remark from me.

2. The rates taken in my report as leviable for the water supplied from the canal were derived from the letter of the consulting engineer to Government, dated 21st April 1871, No. 13, which gives a statement of probable revenue for 1871-72 very similar to my own. Under the orders quoted in the margin* this statement was forwarded to the Government of India.

The latest decision of Government,† however, on the question of the water-rate to be credited to the Company, rules that 6 rupees per acre per crop should be charged to the cultivators, and unquestionably that rate should be adopted in each estimate of revenue for the current year. I therefore lose no time in bringing to the notice of Government the correction in the amount of *possible* revenue entered in my statement, which is thereby necessitated; but it will be admitted that, in framing an estimate of this kind, the probable remissions should be taken into consideration; now this was not done in the account objected to by the agent, and as I find that, while the full demand since the season of 1865 has been 41,078 rupees, the net demand, or demand less remissions, was only 31,515 rupees, it is obvious that about one-fourth of the full assessment is generally lost. I have made the necessary deduction, and the account as corrected will stand thus:—

	Rs.
8,883 acres, 1st crop, at 6 rupees - - - - -	53,298
2,221 acres, 2nd crop, at 6 rupees - - - - -	13,326
	66,624
Deduct average remissions, 25 per cent. - - - - -	16,656
Probable net demand - - - - -	49,968
Add Kurnool town supply - - - - -	4,000
Probable revenue, 1871-72 - - - - -	53,968

This

This amount is less than one-third per cent. on the expenditure incurred of capital and interest thereon, and Government will probably not agree with the agent that there is now ground for modifying the terms used in the G. O. on my report, which describes the calculated revenue as an insignificant return on that expenditure.

Moreover, it must be borne in mind that the abstract of acreage to be irrigated during the present season is simply based on verbal statements made by curnums and ryots. The villagers assert in each case that if water is available they will bring into wet cultivation certain fields, but as they do not make formal applications for water there is no guarantee whatever that they will act up to their present declared intentions; and, taking into consideration a number of facts conveying concurrent testimony, I shall be much surprised if more than from one-half to two-thirds of the areas supplied by the deputy collectors is taken up for irrigation.

3. Government will no doubt at once perceive that the agent of the company misconceives the deductions which my remarks on the general condition of the canal embankments should lead to. I should hardly have imagined that the subject was so technically alluded to as to be at all unintelligible to a non-professional reader, but perhaps I had better explain that the great defect in the earthwork, at least so far as regards the great mass of it, is an entire want of method in laying it; a disregard, in fact, of the ordinary rules acknowledged by engineers as necessary to be observed in the formation of embankments to resist the pressure of water.

7. The ground on which the bank was to rest should have been cleared of vegetation and broken up and the earth laid in even layers. It was thrown at random.

8. The layers should be tamped or watered, and the better soil selected and placed next to the water. The earth was not compressed at all or watered, and there was no arrangement of soil. The outside of the banks has in most cases been sloped and trimmed and patted down neatly enough, but it can hardly be necessary to point out to anyone that that kind of thing cannot be safely substituted for the method of formation, layer by layer, under a rammer. In short, the care and precautions necessary in forming embankments in all soils, but especially necessary in soil of bad quality, have been admittedly neglected, and it will require time and the thorough saturation of the banks by water cautiously admitted into the canal, as well as large additions of earth to compensate for their sinking, to bring them into anything approaching a satisfactory state.

A. de C. Scott, Captain, R.E.,

Under Secretary to Government,

In charge of Office of the Chief Engineer for Irrigation.

Enclosure 3, in No. 21.

The Agent and Manager of the Madras Irrigation and Canal Company to the Acting Chief Engineer for Irrigation and Under Secretary to Government; dated Madras, 29th August 1871, No. 369.

I HAVE the honour to forward the Chief Engineer's Report for the month of July 1871.

Chief Engineer's Report to accompany Divisional Reports for July 1871.

The rainfall in July, and so far in August (24th), has been below the average, and the crops, which were got in unusually early in the light showers, suffering from drought, yet the Toombuddra, and especially the Kistna, have not been unusually low.

2. By about the middle of July the Conservancy Engineers had fully taken over charge, and began to carry out channels wherever there was reasonable hope of the water being taken up this or next season. In a great number of cases, probably the majority, the ryots seem to have decided against waiting for water, and took advantage of the fine cloudy weather for getting in dry crops. They are suffering for this, and, in some cases, doubtless regretting it. No doubt reports tending to produce doubt and uncertainty as to the working of the canal under uniform management during the whole season have existed; and I do not see how they should not decide ryots in favour of postponing the experiment of irrigation, until the supply should have been proved trustworthy. Notwithstanding a few trials of flooding* which have been successfully tried by ryots, I anticipate a smaller extent of irrigation than has been estimated. It is difficult yet even to estimate the probable extent of wet cultivation. It is daily increasing, and may double.

*About 500 odd acres.

3. I have urgently impressed on all engineers the immense importance of keeping a constant flow through all channels. A decrease of flow alarms a ryot, lest it fail altogether; whereas an increase of flow is apt to breach his little banks, and cause him trouble, if not loss. The work to be done is very extensive, each of the four engineers has an area of about half the size of Oxfordshire or Berkshire. His length of 50 miles of canal is the full length of those counties, and has irrigating channels of a few miles in length, only, until it gets near the watershed of the country, and it then irrigates right and left for a breadth of 7 to 12 miles. Hence the shape of the country in the engineer's charge is very much as if one

*15th May 1871,
No. 1339.

†1st June 1866,
No. 1348.

of those counties were reduced to half its actual breadth at every point, but the length left unaltered. Within this area the engineer is to be prepared to supply water on any field that requires it, and not only that, but if he is to get any water taken he must convince the ryots that they may rely upon his supplying the water.

4. The progress made in supplying water since the middle of July has, I consider, been very creditable, but the ryots need experience; and I was painfully amused to see the profound, as well as joyful, surprise with which they found the water actually reach their fields. Their belief that it would ever do so seems to have been very low, and their offers to irrigate may have been often rather made in bravado. Large meetings of ryots were being held near the 115th mile, on the question whether to irrigate or no. The way on which a whole village turns out to see the first field or two flooded also shows the stir and interest awakened by the presence of water in their villages.

5. No accidents have occurred; the canal banks seems to have stood well. In some straight reaches in the 9th section the wind has been blowing very strong for days in the direction of the reach, but I saw no banks cut up to an extent of more than about one-twelfth of a cubic yard per yard run, washed down half a yard. The small works by which drainage is to cross channels are being made so capacious as to prevent the breaching of channels by floods, but the process is tentative, and, in some places, works are omitted for this season.

6. It has been impossible to get returns of the number of acres actually irrigated, under 2,000, I fear.

J. H. Latham,
Chief Engineer.

Kurnool, 24 August 1871.

Enclosure 4, in No. 21.

MEMORANDUM by Captain Scott.

WITH the above letter the Agent and Manager forwards a copy of the Chief Engineer's Report for the month of July.

2. It will be observed that that officer now estimates that the extent of land actually irrigated from the canal is under 2,000 acres, and it is to be feared that at this advanced period of the season but little more will be taken up.

3. The fact that the water has been so far retained by the works would be more satisfactory, if the announcement could be accompanied by information that the depth of water admitted was anything approaching that which represents the full supply, but there is no information whatever on this point.

A. de C. Scott, Captain, R.E.,
Officiating Chief Engineer for Irrigation.

Enclosure 5, in No. 21.

ORDER of the Government of Madras, 25th September 1871, No. 2442.

THE Agent of the Madras Irrigation and Canal Company will be referred to the report of the Company's Chief Engineer for May, printed with General Order, No. 1897, 18th July 1871, and to that gentleman's letter to Captain Scott, dated 16th June 1871, printed with General Order, No. 1975, dated 27th idem. The error in the rates on which the calculation of possible revenue for the current year is based, and which were adopted by Captain Scott from a report by the late Consulting Engineer, is to be regretted, but the Government are not of opinion that the amount of revenue that will be realised this year will prove greater than the sum already estimated.

2. These proceedings will be communicated to the Secretary of State and to the Government of India.

Enclosure 6, in No. 21.

The Agent and Manager of the Madras Irrigation and Canal Company to the Chief Engineer for Irrigation; dated Madras, 23rd June 1871, No. 275.

I HAVE the honour to furnish you with copy of the last report I have received from the Company's Chief Engineer.

2. In paragraph 5, Mr. Latham mentions that "the screws and racks now being made to replace broken ones had not all reached" their destinations. These have all been finished and dispatched from Madras.

3. With reference to the hesitation to cultivate created among the ryots by rumours of "testing," the Government will doubtless be disposed, both in the interests of the ryots, and also with a view to revenue, to postpone any extra filling, until the crops shall have been gathered.

Chief Engineer's Report to accompany Divisional Reports for May 1871.

I AM happy to inform the Board that the divisional reports show that the canal was complete on the 1st instant, with some exceptions not worth mention, except as illustrating the state of completion.

1. No. 13 Calingulah, 24th mile, the repair of which was recently sanctioned, required three weeks' work to finish it. Its progress since the 1st has been satisfactory, and it is complete, except parts of the tow-path and water-cushion and the clearing away of rubbish.

2. No. 8 Culvert (about 98th mile)—Some repairs to the masonry had been postponed so long, in order for the water to dry up in the culvert, that the unusually early rains surprised it before it was finished, leaving about a fortnight's work, which will be soon done.

3. Some repairs to Bayupgoodoor Bridge in 102nd mile had been left until the Government should decide whether the bridge should be widened. It will now be put in order. The repairs merely affect a few yards of parapet.

4. One hundred cubic yards of stone require removal from the head sluice channel at Rajoli in the 143rd mile.

5. The screws and racks now being made to replace broken ones had not all reached the sites for which they are required.

6. The distributing channels are only being completed so far as it is expected they may be used next year, and the construction of these will not be carried on until the demand is finally ascertained by experience.

There is no reason to suppose that the estimate made by the deputy collector in October last, of the probable irrigation this year, will prove excessive. On this I hope to report more fully after visiting the villages this month.

I notice that in the village of Moochmurri the ryots profess to be preparing 1,000 acres, against under 500 entered in the deputy collector's estimate; and I do not know of any village in which his estimate is over the present expectation.

The water was admitted on the 3rd instant, and passed over Hindry Aqueduct on the 5th. It was then checked to allow the 24th mile tank (in which the breach occurred) to fill slowly. Next morning an old leak was running under the south abutment of Hindry Aqueduct; but a careful examination has shown that the water issues perfectly clear, and without any sand. It is due to the percolation through the bed and masonry revetment of the canal below the aqueduct, and will decrease as the silt deposits on them and on the newly placed earth on the canal bed. I am taking means to hasten the process by throwing down a yard depth of earth over the whole breadth of canal for a distance (proposed) of 150 feet from the abutment.

I was prepared to go on with the filling of the canal to full water line, so soon as the water should have passed down the whole length of the canal, had Government pressed the matter. I am very glad that this was not pressed on many accounts; and I have been able to arrange for the dismissal of all the staff engaged on construction, except such as are required to wind matters up, and subordinates actually engaged on construction of sanctioned distributing channels.

The objections to filling the canal at once, without any economical reason, seemed to me to be the following:—

(1.) The conservancy staff are all new to their work. The bankers hardly know their stations, nor the overseers the conditions of their work, and the sluice-keepers are nervous. When the water passed over the Hindry Aqueduct, the overseer had taken all his bankers three miles away, and there was no one but a lascar watching the banks. The tindal at No. 9 calingulah had meanwhile shut all his sluices, having quite lost his head, his orders being to keep them all open; and the signaller at Soonkasala cannot yet be trusted to answer at all the hours of day and night, as he ought to do. On the whole, however, the staff is doing very well, and this is very much due to the patience and activity of Mr. Crawford.

(2.) The consolidation of the banks and decrease of leakage improves yearly. The above reasons apply similarly to the first opening of a railway. The Government have, I believe, been very prudently content with running trains at about 18 miles an hour for the first year after opening each length; and so may a portion be content to have the canal worked at less than its full capability; for the traffic on a railway may suffer from a slow speed, but the irrigation under the canal has all the advantages the canal can possibly afford if the canal merely carry the water the land under irrigation requires.

(3.) Unmistakable indications came to my knowledge that the rumour of an expected testing of the canal was creating hesitation in the preparation of land for irrigation: the ryots complaining that they were not inclined to have unnecessary risks run with their crops, and threatening that they would sow dry crop for this year. This was at Moochmurri.

Since my last Report the services of two more engineers have been dispensed with, namely, Messrs. Gordon and Higginson, both engineers whose permanent loss would be much to be regretted. Mr. Gordon has contributed greatly to the economical and punctual completion

completion of the three lower sections; and at the same time has so far completed the reservoir plans that the only plans not yet submitted, those for the Toonga site, are complete, as well as the estimates, and only require fair copying. Nothing but the distressing domestic calamity which has so recently shocked all who know him, has prevented the completion of this. Mr. Higginson deserves all the credit which the completion of his work implies; he was thoroughly master of the situation, and saw to all the details of the works and machinery.

On the 1st July the conservancy staff will be fully appointed, and will take up their charge and duties as rapidly as possible.

Kurnool, 10 June 1871.

J. H. Latham,
Chief Engineer.

Enclosure 7, in No. 21.

MEMORANDUM by the Chief Engineer.

Submitted to Government.

2. The Chief Engineer observes that Government have not insisted upon the test of filling the canal. I am not aware that Government have modified the requirements stated in Government Order, No. 1089, 18th April 1871.

3. Mr. Latham's objections to testing the canal appear to me to be reasons for that measure, even as a rehearsal and training for the new conservancy staff—the bankers who do not know their stations, and the nervous sluice-keepers—in order that they may have some notion of what will be required of them when the next natural flood fills the canal.

J. G. Ryves, Major, R. E.,
Acting Chief Engineer for Irrigation.

Enclosure 8, in No. 21.

ORDER of the Government of Madras, 18th July 1871, No. 1897.

THE Government are scarcely surprised at the disinclination of the company's officers to allow the full depth of water to enter the canal, if they anticipate that such a course would result in breaches; but they did not expect to be told that "the Chief Engineer was prepared to go on with the filling of the canal to full water line had Government pressed the matter, which he is very glad is not the case," for there is no authority whatever for this statement, or for the course adopted by the company's officers in consequence of this assumption. As correctly observed by the Chief Engineer to Government for Irrigation, the Government have not modified the requirements stated in G. O., 1089, 18th April 1871, nor has the subject been in any way brought under their consideration since that date. The Government can only attribute this continued disinclination of the company's officers to subject the canal to the only true test of its stability, to an apprehension that the works are not in all respects suited to the purposes for which they have been designed; and this reluctance on the part of the officers of the company, to encounter the risk alluded to, cannot be without weight with the Government, in passing their opinion as to the condition in which the works have been delivered at the close of the contract period.

— No. 22. —

(Extract.)

The Secretary of the Madras Irrigation and Canal Company to the Under Secretary of State for India.

8 & 9, Queen-street Place, London,
2 November 1871 (No. 5).

Sir,

By the desire of the Directors, I forward, for the information of his Grace the Secretary of State for India in Council, a printed copy of a Memorandum written by the Chief Engineer of the Company, in reply to, and in explanation of, the statements contained in the Report made by Captain A. de C. Scott, on the 6th July 1871, and the Order of the Government of Madras, dated 27th July 1871, No. 1975.

I have &c.

J. Westwood, Secretary.

— No. 23. —

The Secretary of the Madras Irrigation and Canal Company to the Under Secretary of State for India.

8 and 9, Queen-street Place,
London, 8 November 1871 (No. 6).

Sir,

I HAVE the honour to enclose with this, for the information of his Grace the Secretary of State for India, a duplicate of the printed paper which accompanied my letter No. 5, to you, of the 2nd instant, upon which there has been added memoranda written by Mr. George Gordon, lately deputy chief engineer to the company.

See No. 22.

I have, &c.

J. Westwood.

MADRAS IRRIGATION AND CANAL COMPANY.

NOTES by Mr. Gordon, late Deputy Chief Engineer of the Company, are printed in the margin; also a Memorandum at the end (page 76.)

PROCEEDINGS of the Madras Government, Public Works Department, 27th July 1871.

READ the following letter from the Under Secretary to Government, Public Works Department, to the Secretary to Government, Public Works Department, dated Fort St. George, 6th July 1871:

I have the honour to inform you that, in obedience to the Orders of Government quoted in the margin, I inspected the main canal and works of the Madras Irrigation and Canal Company, from Soonkasala to Cuddapah, between the 7th and 27th of June; and I beg to report as follows on the questions referred to me in my instructions:—

2. An examination of the mileage notes and general remarks on each section appended hereto will show in detail the state of the canal at every point. It will be gathered that the earthwork in the first three sections, that is, from the 1st to the 45th mile, is not altogether satisfactorily formed, and that some labour is still required to bring the banks and towpath into fair order. In the 4th and 5th sections, or up to the 75th mile, a considerable improvement is noted; while in the remaining portions of the canal, and especially in the 7th and 8th sections, so far as external appearance is concerned, there is generally nothing further to be desired. The bed of the canal is clear of obstructions, the side slopes are neatly trimmed, and the embankments are of the regulated height, of full section, with towpath formed to a proper width. Unfortunately there is almost universal absence of consolidation in the embankments throughout the whole length of the canal, so that their satisfactory appearance is to a great extent delusive. Great exertions have been made by the engineers in charge in laying fresh soil and trimming the slopes, and a very great amount of work has been done; but the banks are generally formed in bad soil, and they have been thrown up loosely and at random, and are for the most part bare of grass. When water is brought into the canal they will settle very considerably, and they will be guttered by rain, and the cost of maintaining and making them up annually will necessarily, for several seasons, be very great. In their present condition it will be necessary to use great caution,† and to admit water very gradually, and only to a small height during this year. It seems certain that with a full canal they would breach at many points. The walls used principally in the 2nd section as substitutes for earthen embankments have been raised to a height of 3½ feet above water level, and they appear to be in good repair. In some cases a puddle-bank has been laid at the toe where especially leaky, and the rubble backing has been added to. Water passes more or less through all, and nothing but the test of a full supply in the canal can determine the question of their safety. There is no doubt that there are now many weak points, and that until the natural process of silting up in the hollows when (sic) they are built has gone on for a long time, there will always be danger of failures taking place.

3. All the breaches which were made in the banks or walls last year have been repaired in accordance with the sanctioned plans, but the earthwork backing to the new wall closing the Hindry breach has slightly slipped since it was laid. The general unsatisfactory state of the canal at that particular point has been noted in the mileage observations appended.

4. The masonry works are, it may be said, completed, and the trifling amount of building remaining to be done in two or three instances could be finished in a very few days. The character of the work is generally rough, and some portions recently completed very much so; and, though it usually appears to be in a sound state, it is probable that frequent repairs will be necessary, and the cost of maintenance considerable. All the lock gates have been

* This is the case with all earthwork, and is no proof of incompleteness. All earthworks require maintenance.—G. Gordon.

† This is the intention.

hung, and the valves for the sluices are in their places; but this is not always the case with the lifting gear, and at almost every lock some small additional fittings are required, and some further adjustments are necessary to place them in proper working order. As at the time of inspection there was no water in the canal where the locks are placed, there was no means of actually filling and testing them, and no decided opinion can be pronounced as to their stability under working conditions until this has been done.

5. The approaches to the bridges and the roadways are all made up, and, except in one single instance, the parapet walls of the third-class bridges have been lowered to allow of the yokes of ploughs being drawn across them. In the case alluded to, the order for the alteration was given by the chief engineer, and accidentally overlooked.

6. Notwithstanding that throughout the length of the canal there are not a few points where there is still something to be done to bring the works, even in their outward aspect, to a finished state, still on the whole, and in a general sense, the canal with its appurtenances may be considered to be completed in reference to the sanctioned plans; for it is excavated throughout to its full dimension, the banks and walls are raised to full height and section, and the masonry works are constructed and in a state to deal with the water when it is admitted.

* An afterthought.

7. The question of *improving the surplus discharge works in the first four sections of the canal is reported on in the consulting engineer's letter to Government, No. 131, dated 6th March 1871, and Order thereon, No. 1089, of the 8th April 1871, approves of the re-construction of calingulah No. 13, in the 2nd section, and gives discretionary power to the company's officers to decide how improvements in the other calingulahs should be carried out. In accordance with the sanction thus given, calingulah No. 13 has been rebuilt, its crest being placed at a level 5 feet above the normal bed of the canal, and planks are provided to close each bay for a further height of 3 feet. With this exception, all the surplus discharge works remain in the same condition they were in before the floods of August 1870, which demonstrated the insufficiency of the means of escape provided for flood water, having in view the insecure state of the canal walls and embankments.

The chief engineer of the company has, however, taken certain measures tending to prevent the water from rising to an excessive height, and to ensure that breaches should occur in the most favourable localities if breaching is really inevitable. He has raised or removed the shutters at the sluices in the calingulahs, and has laid in front of the vents earthen banks to a height 6 feet above canal bed level, and at intervals (generally where the canal is in cutting to a depth of 4 feet) he has lowered the earth bank to a height of 10 feet above bed level, the intention being that, when the water rises to a height greater than 6 feet, the calingulah sluices should be opened by the breaching of the bank in front of them, and that, if any further and † dangerous rising of the water should occur, the banks at the selected places should be cut and allowed to breach, while the ground would not be injured, and a supply of water for irrigation. In their Order above quoted, Government have observed that such measures as have just been described are only admissible in the case of an incomplete canal, but not otherwise; and the fact that the chief engineer has considered it necessary, for the safety of the work, to adopt them, is evidence that this is in an incomplete state in respect of some of its most important parts.

† i.e., above the full height.

8. The distribution works sanctioned by Government for the land under each section of the canal are in a more or less advanced state. All the sluices in the main canal have been built, and, though a number of them were not provided with shutters, and some were without lifting gear when inspected, these deficiencies will shortly be made good. The following abstract statement shows the length of the irrigation channels sanctioned and executed in each section, with the acreage commanded, and which can, therefore, be readily supplied with water on a demand being made by the ryots:—

Number of Sections.	Irrigation Channels		Amount of Land now commanded.
	Sanctioned.	Executed.	
	Miles.	Miles.	Acres.
1st	14.00	14.00	1,386
2nd	14.00	14.00	1,056
3rd	26.14	26.14	9,837
4th	63.44	63.44	26,000
5th	26.16	23.04	9,000
6th	93.56	26.00	20,000
7th	28.41	27.00	12,000
8th	64.00	14.00	8,600
9th	37.80	7.87	3,783
10th	10.00		
TOTAL	377.31	216.09	91,567

As a rule it is the main distributing channels which have been excavated, and the heads of the subsidiary channels are not marked out or provided with masonry outlets, but temporary arrangements can easily be made to regulate the supply. The excavation of such channels has been checked in accordance with the recommendation of the consulting engineer in his letter, No. 129, of the 17th November 1870, approved by Government, until formal application has been made by the village people.

9. I have found it impossible to obtain such definite information on the subject of the area which will probably be irrigated this year as would enable any very reliable estimate to be made of the revenue which will be collected. The ryots are, as a rule, exceedingly unwilling to make formal application for water, and appear to be under the impression that they will commit themselves to payment if they do so, even if the supply should fail, and it is a fact that applications are not made. In some places they request the company's engineers to give them water, but do not apparently understand how to make their applications through the proper channel. Such a change as is involved in the habits of the people, by the introduction, through a large tract, of wet in lieu of dry cultivation, will only take place gradually. Special measures of encouragement will be necessary, and they must acquire that confidence in the permanence of the supply of water, which only its presence in the canal for two or three seasons without disaster can give them, before they will make to any great extent those changes in their agricultural plant and processes which will be necessary. In order to obtain some data on which to found an estimate of the area of irrigated land and prospective revenue from the canal during this season just commencing, and in default of the receipt of regular applications for water, the collectors of the Kurnool and Cuddapah districts have caused inquiries to be made in the villages under the canal as to the intentions of the landholders, and the extent to which they propose to irrigate. This is the only way in which any estimate can be made, and it is necessarily a very vague one. I questioned the deputy collectors of each district as to the result of their inquiries, and these officers admitted that any returns made must be considered mere approximations, and that the ryots are not at present very ready to come forward with their demands for water. I also obtained from them such statements as they had been able to compile of the probable extent of land which would be taken up in the event of the canal holding water for a complete season. An abstract of these is given below, and an estimate of revenue based thereon.

This difficulty arises from the company's officers not being allowed to deal directly with the ryots in the matter of applications.—G. G.

District.	Talook.	Mileage on Canal.		Probable Cultivation.	TOTALS.
		From Mile.	To Mile.		
Kurnool	Ramalakottah	1st	22nd	Acres.	Acres.
Ditto	Nundikotkur	23rd	86th	940	—
Ditto	Nundial	87th	109th	3,725	—
Ditto	Sirwell	110th	123rd	624	—
Ditto	Koilkootla	124th	130th	1,913	—
*Cuddapah		148th	189th	681	7,883
				1,000	1,000
Grand Total					8,883

REVENUE.		Rs.
8,883 acres, 1st crop, at 4 rupees		35,532
2,221 „ 2nd „ at 2 „		4,442
Kurnool water supply		4,000

Total estimated Revenue for 1871-72 - - - Rs. 43,974

The area irrigated last season was 1,516 acres. The increase calculated on this season is therefore 7,367 acres, and it is not probable that it will exceed the estimate; in fact, it is more likely to fall short of it.

10. On my arrival in Kurnool I addressed a letter to the company's chief engineer, directing his attention to the Government Order (quoted in the margin) approving of the testing of the canal, and detailing the nature of the test which should be deemed sufficient to establish the fact of its being in working order; and I requested him to inform me what arrangements he had made for carrying the wishes of Government into effect.

G. O. No. 1089, 18th April 1871.

From Mr. Latham's reply, appended to this report (in original), it would appear as if, in certain respects, he had made, or was making, preparations to enable him to test the canal if required; while, on the other hand, other portions of his letter would lead to an inference directly to the contrary.

He states, in paragraph 2, that "arrangements have been made for passing water down the

* The villages are not given in the original statement, and the mileage is only approximative.

the canal as rapidly as possible," and, in paragraph 3, that "arrangements will be complete by the time the water is down the canal, for putting the necessary sluice-keepers and watchers for testing it to any height required;" but in the same paragraph the chief engineer proceeds to say, that "the temporary arrangements described in paragraph 11 of the consulting engineer's letter attached to G. O., No. 1089, of the 18th April 1871, have been made," i.e., that the sluice-shutters in the calingulahs had been removed, and the earthen banks, described in paragraph 7 of this report, thrown up so as to breach if the water in the canal rose to a greater depth than 6 feet above bed-level (the maximum test level being 9 feet); and he concludes his answer to the question proposed to him, with the information that, "in the absence of any instructions or positive order of Government or the board to test the canal, he had not retained the staff necessary to do so." I must further remark that the admission of water into the canal on the occasion of the first fresh in the Toongabudra was by no means made with rapidity; quite the contrary. Probably Mr. Latham intended that it should always be understood that the degree of rapidity was to be only so great as was consistent with the safety of the banks, and accordingly, when there was a discharge of one foot of water over the Toongabudra anicut, and the depth of water in the canal could have been maintained at 8 feet, only 2 feet was allowed to flow in; increased, after my arrival, to 3 feet 9 inches. I consider that this caution was necessary, because of the generally unsafe condition of the embankments and walls; but it hardly seems to me to be consistent with readiness to test the canal in the manner desired by Government.

The chief engineer further deprecates the applications of the test, apparently on the ground that it would alarm the ryots and injuriously affect the prospects of irrigation, and he appears to suggest that it should be postponed till the end of the season.

A careful inspection of the embankments and walls of the canal has convinced me that they would fail at many points if subjected now to the test proposed, which is, that the canal should be kept running for 24 hours with 9 feet of water in it, or one foot above the present calingulah crests, and that it should carry for 30 days consecutively a full irrigation supply.

Under these circumstances, and seeing that, in the event of any disasters to the works, the loss must eventually fall on Government, but for no other reason, I think it would be advisable to postpone the testing, provided the company's agents are willing to admit without qualification that the canal cannot retain the water which it was designed to carry.

11. In conclusion, I beg to state that I have received from the engineers of the company every assistance in carrying out my inspection and in obtaining all necessary information.

Captain Scott then p. with "mileage and general remarks," but for convenience it has been thought better to pass over these for the moment, and continue the proceedings as printed by the Order of the Madras Government made on that Report, following the latter by "explanatory memoranda and general remarks" made thereon by the chief engineer of the company, and then to add the "mileage and general remarks" of Captain Scott, with the "replies" of the company's chief engineer placed in juxtaposition.

Continuation of printed "Proceedings of the Madras Government."

From the Chief Engineer of the Madras Irrigation and Canal Company, to Captain A. de C. Scott, R.E., Under Secretary to Government, dated Lockinsula, 16th June 1871.

Testing Canal.

I HAVE the honour to acknowledge the receipt of your letter, Kurnool, the 11th instant, and beg to reply as follows:—

2. Arrangements have been made for passing water down the canal as rapidly as possible after the admission of water at Soonkasoola, which, owing to my illness, took place on the 3rd of June, instead of the authorised date, which is the 1st June.

3. Arrangements have been made, or are making, and will be completed by the time the water is down the canal, for putting the requisite sluice-keepers and watchers for testing the canal to any height required. Further, the temporary arrangements described in the first part of paragraph 11 of Colonel Carpendale's letter, attached to G. O., 1089, of 18th April 1871, have been made; also the banks where they are low, and may be breached without emptying the canal, have, in convenient places, been lowered to the lowest safe level, or are being so lowered, that is (see paragraph 11 of consulting engineer's letter attached to G. O., 3195, of 15th October 1867), they are being formed with a revetment to a height of 3 feet 6 inches above the full water level; and the revetment is backed by an earth bank up to the same level; while the bulk of the bank in rear is reduced to 1 foot above water level. A hut is built close by, so that the bankers will see to the bank and will keep it secure. It will only be breached when it is breached by the bankers.

4. I may add that the calingulah question will be put into the hands of Mr. Browning, I hope, within a month, in order that he may form working plans and estimates for calingulahs for the whole canal on the patterns approved in G. O., 1089, of 18th April last, and on the principles approved in G. O., 1505, of 2nd instant (unless these be modified as I have proposed in a recent letter written for submission to Captain Ryves before I read the last order).

If the water was admitted so rapidly as to rise to 8 feet at the head, the surface slope would be so great that the banks would be exposed to injury by the great velocity of the current, which would never need to occur in working the canal.—G. G.

These plans and estimates will be submitted to the Government and the board this autumn as early as possible.

5. In the absence of any instructions or positive order of Government or the board to test the canal, I have not retained the staff necessary for testing the canal. In reply to your last paragraph I beg to submit the following remarks on the subject of testing:—

6. The advantages of testing seem to me to be—

(1.) To detect any weak places or cracks, burrows, &c., and so get them mended at once.

(2.) To detect any errors or omissions of the engineers in the levels or measurements by which they have constructed the works.

(3.) When testing were completed and all necessary omissions made good, it may be that the ryots would be penetrated by confidence in the canal for the future.

It appears to me that these advantages are not of much value, considering the known completeness of the works as a whole, and the loss of revenue which the experiments would probably cause, and the cost of the experiments.

7. Any errors of level or omissions in the banks are known to be such as the staff of bankers alone may easily correct; and they may also very well repair any cracks, leaks, &c., which occur in the banks while in ordinary use. The banks and many of the masonry works get stronger every year they are used, since the silt makes the earth in the banks, and at the junction of banks with masonry, tighter and more secure yearly. Moreover, the canal was at first intended to be secure for current demand; but not to be watertight until it had been some time in use.

8. A more important question is that of how much calingulah power is advisable. But this is not a matter to be tried by filling the canal full. Government have (G. O., 1505 of 2nd instant) ruled that the calingulahs and sluices should suffice to discharge an inch of rain an hour. They do suffice for a little over a quarter of this, but the deficiency may easily be made good before this time next year. It is manifestly prudent to wait till the calingulahs are complete, to whatever extent is agreed on, before filling the canal needlessly full.

9. The most important considerations are, however, those of staff and revenue.

10. The present conservancy staff will have full occupation on the canal until the water is down the whole length to a depth of 5 feet or so, required for probable demands. Every available man will then need to be put on distribution for clearing out old channels, arranging field channels, seeing that the water actually flows in all directions over the country, and repairing or preventing petty damage to the distributing works. I find that the engineers will be engaged in July very much with examining and making over stores, office records of the state of the works and the finances, and such work, requiring great care and time. In August they will have to be incessantly in the field away from the canal, if there is to be any irrigation worth speaking of; all their men have to be taught and trained, and the wishes of the villagers have to be ascertained and consulted as to every field and village requiring channels; any channels not complete by the 1st September will be too late. All has to be done with a staff completely new to the work, if we except the practice got in July and the first week in August last year. As I have before said, I think caution as appropriate as for a railway first opened under a staff strange to their work; the skill required and risk run is at least as great in the case of a banker or sluice-keeper as in that of a pointsman or platelayer or crossing keeper.

11. The knowledge that the canal is under test would cause all ryots, unless they possessed wells, to wait till the test is over, before they commenced sowing wet crop, and would cause all who were doubtful of the result to sow dry crop at once before the sowing time for the first dry crop is over.

12. To wait until after the sowing and test in October would hardly be fair, unless the ryots were authoritatively forewarned that their crops would be submitted to that risk.

13. These most important objections do not apply if the testing be carried out after the 31st December. There is generally ample water during the month of January, and there is always enough at that time for testing all the portions of canal constructed for navigation only.

14. I am not disposed to object to any test, which is within the means possessed by the company, and does not in any way touch the security or interests of the ryots in irrigation.

ORDER THEREON, 27th July 1871, No. 1975.

Capt. Scott says the canal is finished, and the masonry works in a state to deal with the water when it is admitted.—G. G.

THE above Report confirms the opinion which the Government have for some time held as to what would probably be the condition of the Madras Irrigation and Canal Company's works on the 30th June 1871, namely, that, although a good deal remains to be done to bring the works in even their outward aspect to a finished state, yet, in a general sense, the main canal and works, excepting those of distribution, may be considered finished in accordance with the sanctioned plans. But the state of completion falls far short of that contemplated by the 11th article of the supplemental agreement, dated 2nd October 1866, and of what would be understood by the expression satisfactorily completed and placed in working order.

* As sanctioned.

2. It appears that in some portions of the main canal the earthen banks have not been satisfactorily formed; that there is a general absence of consolidation throughout; and that their satisfactory appearance from neat superficial trimming and finish is delusive; that in other portions the banks are *formed of bad soil, and, being loosely thrown up and at random, are further deficient in the protection that a covering of grass would afford; and that it seems certain that with a full canal the banks would breach at many points.

3. It is also observed that water in larger or smaller quantity passes through all the walls which take the place of earthen banks in certain places, and that nothing short of a full supply of water could determine the question of their stability.

It is ready for all present demands, and will be consolidated by the time the full supply is needed, or long before.—G. G.

4. It also appears that the chief engineer has taken measures to prevent the water in the canal rising beyond a fixed height, that height being much below the level of the canal when full, and to ensure that, if the canal should breach, it will do so in the most favourable localities. These precautions are precisely what the Government in G.O., No. 1039, dated 18th April 1871, prescribed as admissible only in the case of an incomplete canal, and altogether unsuitable in connection with a work that is supposed to be complete in itself; and the fact of the company's chief engineer considering it necessary to adopt such measures is, in the opinion of the Government, the strongest evidence that the Company deem the undertaking deficient in its most essential particulars.

5. No definite information appears to have been obtainable as to the area that will be irrigated this year; but, from inquiries made by the collectors of Cuddapah and Kurnool, it is gathered that, in the event of the main canal carrying water throughout the season without breaching, it is possible that an extent of 8,883 acres might be irrigated, in which case the total revenue for the year would be 43,974 rupees. The Government cannot say that they have any confident expectation that this hope will be realised, and the amount is so insignificant as a return for an expenditure of capital and interest thereon aggregating more than two millions sterling, besides being less than half what is required for annual outlay on maintenance or conservancy, that they cannot acquiesce in the propriety of the company's proceedings in deferring, or, more correctly speaking, dispensing with, that test which the Government in the strongest terms prescribed the necessity for, and which has been dispensed with on the pretext that it would alarm the ryots, and injuriously affect the prospects of irrigation.

6. The test which the Government approved of, and which is nothing more than the canal was designed for and was expected to be capable of sustaining, was that a depth of 9 feet of water above bed should be maintained for 24 hours, and that for 30 days consecutively the canal should carry a full irrigation supply. In Captain Scott's opinion the embankments and walls would fail at many points if subjected to such a trial, and as the company's engineers have made provision for the canal †breaching in the event of the water rising more than 6 feet, it must be presumed that they share the apprehensions of the Government officers who have reported on the subject.

The canal is in working order, for it is capable of carrying more water than will be required for some time.—G. G.

7. Captain Scott's Report will be communicated to the Secretary of State, and to the Government of India, who will at the same time be informed that the canal has not been properly completed and placed in working order to the satisfaction of this Government.

EXPLANATORY MEMORANDA by the Chief Engineer of the Madras Irrigation and Canal Company regarding the Inspection Report of Captain A. de C. Scott, and the Order made upon the latter by the Madras Government, on the 27th July 1871.

12 October 1871.

BEFORE I review the mileage notes and the general remarks on each section of the canal, made by Captain Scott in his report, it is expedient that I should recall to mind several special matters which, I think, must regulate any consideration of his statements and of the Order, No. 1975, passed by the Government of Madras and founded upon them.

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† Not for the canal breaching, but only for the opening of the sluices, which could be closed again when the water fell, without interruption of the supply. See Capt. Scott's para. 7.—G. G.

2. When the supplemental contract was agreed to in October 1866, the design of the whole line of canal and the system of construction had been for a long time finally determined. The company had submitted to the Government plans and estimates of the earth-work along the entire extent of the canal, and these had been approved, and the greater portion of the total quantity of the work itself had been performed under the supervision of succeeding consulting engineers specially appointed by Government for watching and controlling the company's proceedings and expenditure.

3. The task, therefore, which the company took upon itself when it agreed to the second contract was, the completion of works according to designs and a system of construction which had been already established and acted upon to an extent which would not permit of the substitution of another system, except at an enormous increase of cost (making the total, say, 780,000 £. or 800,000 £. instead of 600,000 £.), and accordingly that system has been worked out, and under it completion has been effected; the Government during the whole time exercising the most absolute control over plans, estimates, staff, expenditure, and construction.

4. The numerous reports embodying the various opinions of the consulting engineers, and the directions given by the Madras Government to the company, form a volume of proofs of the minute and careful manner in which supervision has been exercised without intermission, and show that the soil used in the embankments and the mode in which all the works have been constructed have been thoroughly understood and intelligently reported upon by the authorised officers from 1859 to the present time, and likewise that soil, without specially selected puddle, was used before the date of the supplementary agreement.

5. As the chief engineer of the company, I have always acted upon the belief that the essential feature of the established system of construction was, that the consolidation of all embankments should be the work of time in lieu of the much more costly plan of inserting a puddle clay core. Such a core, whether in the centre or in the slopes of the banks, had in no instance been adopted in the first approved estimates, nor did an instance of the use of such a core exist, I believe, in the Madras Presidency. Had the coring principle been intended, it would have been shown in the original estimates, but, as it was not shown, to have introduced that principle under the new contract at a necessary cost of at least 1,000 £. a mile, a loan of 800,000 £. instead of 600,000 £. would have been required, and the large extent of embankment then already executed would have had to be almost reconstructed. I may add to this, that, where small portions of the embankment were found on trial to be weak on account of the badness of the soil, I submitted estimates for clay puddle cores, but these were clearly exceptions adopted where safety could not be otherwise secured,—as, where the soil was mere gravel, or the bank stood upon gravel.

6. The authorised practice has been to form the embankments by the deposit of earth in excess (to an extent agreed upon with the consulting engineer) of the section approved by Government sufficient to allow for consolidation, and then to watch subsidence as it took place, making up and strengthening where necessary, and, as I said before, in one section of canal it was found essential that several clay cores and face walls should be inserted.

7. This was a process that could only go on with the knowledge and sanction of the consulting engineer, who periodically examined the works and reported progress to Government, at least every three months. Permanent consolidation on the 1st of July, 1871, that is, immediately upon the termination of construction, was never considered necessary to the fulfilment of the new contract, such a state of things being impossible under the authorised system. One need go no further than the reports of the consulting engineers to show this.

8. As part of the established system, water has during the present year been admitted into the canal* in quantity enough to effect the public object for which that work was constructed, that is to irrigate every acre of land which it was believed would be prepared for irrigation. As a fact, the supply has, I am sorry to say, greatly exceeded the demand.

9. It will be in the remembrance of the board that the Madras Government, in view of the *gradual* extension of irrigation, wisely directed that the construction of irrigating channels should keep pace with local requirements.

10. The system of constructing the embankments of a canal, so as to leave to time and conservancy their perfect and final consolidation, is not only supported by the precedent furnished by the Krishna, Godavery, and Cauvery Canals, but is consistent with a prudent economy and the progress of demand for the water to be conveyed by the canal. The conditions of a canal are essentially different from those of a tank intended when once full to retain water through all the dry season. The canal need never be filled more than enough to supply current demands. The tank must be filled enough to supply the greatest estimated demand during the whole season. The flowing water in the canal carries a constant supply of silt along the face of the banks, and so rapidly furnishes, to a certain and very appreciable extent, a substitute for puddle where the soil of the banks is, to start with, moderately impervious. As is known in England, a coat of mud the thickness of a piece of

* According to reports lately received by the Directors, the depth of water in the canal had reached to 6 feet, that is within 2 feet of the full depth intended to be conveyed.

of paper will often stop the action of a filter bed, and requires to be skimmed off in order to keep the filter in action.

11. From the recent failure of the Red Hill Tank near Madras, owing to the percolation of the water through the banks, although puddled, no conclusion can be drawn as to what kind of bank will work best in a canal.

12. The duties of the conservancy staff (engineers, bankers, &c.) lately appointed with the sanction of Government, will be to watch the consolidation of all earthwork which the inflow of water, regulated by the demand for irrigation, may effect, to maintain the requisite height of embankment, and to remedy weakness and leakage if discovered, so as to ensure safety. This process will continue until the canal shall be called upon to give the full supply for which it was designed, and the most effective and permanent consolidation of all earthwork shall have taken place, as well as all percolation stopped, by the deposit of silt, and the addition of shingle made where experience shall show it to be necessary.

13. The absence of consolidation in the embankments remarked upon by Captain Scott, admits of the doubts expressed by him that, if the full amount of water were admitted, breaches would take place. His remarks and fears form the foundation of the Order made by the Government. But an initial absence of perfect consolidation is the natural state of things which must belong to the economical and safe system adopted. Water is not required to the full extent, and is therefore admitted gradually; and during this process, all weak points are found out and strengthened in regular course, and at the smallest amount of cost, without any undue risk either of breaches or the stoppage of irrigation.

14. To admit into our canal, constructed under this system, immediately upon its completion according to the plans and designs upon which it has been constructed, the total quantity of water it is intended to supply ultimately, would plainly be an innovation and altogether unnecessary, as being beyond the certain fulfilment of all public wants and purposes. Such a course has not been followed, nor even suggested on the Godavery, Nellore, and Cauvery Canals, so far as I have been informed by the engineers engaged on them. But I have such confidence in the solidity of the embankments, and the condition of all the masonry works, that I do not hesitate to recommend the board to direct that during the next season the following test shall be made, and more than this the present staff cannot wisely attempt at once. The upper 75 miles of canal, and the 22 miles forming the seventh section, are liable to be filled by excessive rain. Once in the 10 or 11 years over which our experience extends, a storm has occurred which would raise the water in this half (97 miles) of canal to the highest flood level, viz., a foot above the calingulah crest, in spite of the safety sluices and weirs. All the rest of the canal is completely under control, and there is no reason whatever for filling it quicker or fuller than is needed for current demands. No test is justified for this portion; but for the former portion of 97 miles, a test is desirable, and I recommend that arrangements be made for filling it at the first opportunity, and maintaining it full for a month. To suddenly fill it would, of course, be a waton risk; but ample time for this test may be found during any working season. It is impossible to do more than fill any portion of canal; nor is there need to do so in order to show its sufficiency.

15. Captain Scott reports that, "on the whole, and in a general sense, the canal with its appurtenances may be considered to be completed in reference to the sanctioned plans; for it is excavated throughout to its full dimensions, the banks and walls are raised to the full height and section, and the masonry works are constructed and in a state to deal with the water when it is admitted;" and the Government in their Order use in effect the same language. This should be conclusive as to the performance by the company of its task, bearing in mind the system under which that task was to be performed; but I will add that, after Captain Scott's inspection, and previously to the 1st of July last, much work was finished off, and there really remained unexecuted on that day no portion of the contract work, unless the screwing on of some racks deserve noticing as an exception. Maintenance and conservancy alone were then required to operate. Many of the trifling matters put forth by Captain Scott, as being requisite to perfect completion, have been attended to and supplied, as I shall show when dealing with details.

16. The 4th paragraph of the Order of Government (No. 1975) has a very serious aspect, and would seem to convey the idea that the company had not, on the 30th June last, performed its part of the agreement. It is stated that the fact of my considering it necessary to adopt precautions against danger from the recurrence of such a flood as occurred in August 1870, was (in their opinion) the strongest evidence that the company deemed the undertaking deficient in its most essential particulars. This has reference to the temporary plan proposed by me, which the Government lately sanctioned, to carry off exceptionally excessive rainfalls, until a general plan for permanently improving the existing masonry calingulahs should be agreed upon between the Government and the company. The facts entirely exonerate the company from blame, and show that, so far as the construction of the present calingulahs is concerned, the contract has been completely, both in word and spirit, exhausted. The masonry calingulahs or escapes were constructed in conformity with plans approved by the Government, and were at the time considered to provide an amply sufficient means of escape. They provided for an average discharge equal to that provided by the calingulahs on the Godavery Canals and other works of the Government itself. This was the view and belief of all parties when, in August 1870, an unprecedented fall

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of rain took place, much in excess of the discharge accommodation, and the canal consequently breached. The preparation of plans and estimates for an enlarged system of calingulahs required careful consideration, both on the part of the company and of the Government, and there was not time even for this before the 1st of July last, on which account I submitted a temporary plan, and this was approved by Government, as a means of protection against the recurrence of such a rainfall until the permanent should be substituted. With the sanction of Government the executive engineer has since been engaged upon the preparation of plans and estimates for enlarging the calingulahs, and these will be placed before the company's agent almost immediately, and when they shall have received approval, the construction of the works themselves will proceed, out of the company's capital.

17. The Order of Government of the 18th April last, paragraph 2, is a confirmation of what I have just stated; it says,—

"His Excellency the Governor in Council is of opinion that there is no room for doubt as to the propriety of debiting to capital the cost of altering the surplus weirs, so as to enable them to act efficiently in relieving the canal of flood-waters. It appears to be altogether immaterial that the consulting engineer concurred with the company's officers in considering the capacity of the works as designed and carried out sufficient, and that the Government approved of the estimates."

"Since the designs were prepared and approved, the data on which they were based have been shown to be erroneous, and consequently the Government and the company's officers are both agreed as to the necessity for making further provision for the discharge of surplus water, or, in other words, for doing now what was necessary in the first instance, though not then known to be requisite. It appears to be clear that the company are bound to place the canal and works in working order to the satisfaction of the Local Government, and that this requirement must be determined with reference to the known circumstances of the canal and of the country through which it runs, so far as these are understood at any time prior to the 1st of July 1871. Whatever radical alterations of existing works may be necessary to place the canal in working order must therefore be deemed a part of the construction, as distinguished from repair and maintenance, and, as such, must be a charge against capital."

And, without entering into the question of the fund from which the expense should be taken, I admit that the Company are bound under their original contract to make the necessary escape enlargements from time to time to the satisfaction of the Government of Madras, but this is not a duty put upon them by the Supplementary Contract. Indeed, between the discovery of the necessity for these additional means of safety and the 1st July last, there was not even time to prepare the plans and estimates, indeed barely time to obtain an assent to the fundamental basis of the new designs, which was not settled when Government passed their Order, No. 1505, of 2nd June last, on the subject.

18. Far too much prominence has been given by Captain Scott to the condition of the tow-path along the canal. The matter in itself is of a very trivial character and hardly worth notice. All such irregularities as may be found to exist may easily be remedied and will naturally be a part of the duties of the Conservancy Staff. Perfection can only be attained when ultimate consolidation shall have taken place. At present it forms a good bridle path, better in its worst parts than the only road at Kurnool, viz., that between Kurnool and Gooty, and it is nowhere worse than a newly metalled road. As a bridle path it is upon the whole better than the road.

19. The inspection made by Captain Scott occupied from the 8th to near the end of June last; that is, it begun three weeks before the termination of the contract, and ended before the contract time expired, and the deficiencies and points of non-completion mentioned by him were most of them made good before the 1st of July, or shortly after, and others are now being prosecuted. The total amount of the cost of meeting every one of his requirements, after the 1st of July last, will not exceed 1,500 £; and of these the majority, if not the whole, can hardly be said to be required by the Supplementary Contract. Those which have actually been supplied are struck out in red ink in the accompanying print of his Report.

20. I need not notice those portions of Captain Scott's Report or the Order of Government which touch upon the probable spread of irrigation; they have no connexion with the question whether the canal has been brought to a state of completion under the contract, and are also beyond my province.

21. I will now turn to the details of Captain Scott's Report as to the state of the works when inspected by him, which Report I think bears every evidence of having been carefully and impartially made.

22. First, I must, however, remark upon the statements Captain Scott has made in connexion with various portions of the works, viz., that the masonry is generally inferior, the banks unconsolidated, the soil inferior and liable to cut up, the canal likely to breach if suddenly filled, and that the lock gates and gear and all the shutters require in the aggregate a good deal of work to make them fit and to adjust them. The Company were bound by their contract to make all works thoroughly efficient and satisfactory to Government. But it must be considered that their contract was not to provide an efficient canal for a lump

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* This merely refers to the heads to which the cost should be debited. It is an admission that the works were constructed as intended, and sufficient as far as was known.—G. G.

sum furnished by themselves, and at their own cost. Economy was as desirable for the interests of Government as of the Company. Hence, if the Madras Government or their engineers expressed distinct approval of any class of work, it became my object not to incur expense in obtaining a finish in excess of what was approved. But I have endeavoured, by making full use of the staff, to improve, first, the soundness, and, secondly, the finish of all classes of work, without paying an extra price beyond what has been necessary to secure the results already examined and approved by the engineers of the Government. Government Order, No. 3045, of 19th of December 1862, paragraph 9, seems to endorse the opinion of Colonel Ludlow, Consulting Engineer, quoted in his letter, No. 76, of 29th of October 1862, to the Secretary to Government Public Works Department, paragraph 59, viz., "This large Work (the Hindry Aqueduct), as far as it is completed, appears to be well and solidly built." I accordingly ordered that masonry work should in all cases be built at least as good as that of the Hindry Aqueduct, and this condition was inserted in the most important contracts, as in that with Runganatha Mood, contractor for the 9th section; Major Mullins, consulting engineer, and Colonel Orr, secretary to Government, Public Works Department, approved of the work in the Hindry Aqueduct when they visited it. The only question raised was the expediency of using an asphaltic lining. Again, Colonel Orr particularly called the attention of his Excellency the Governor to the No. 5 Bridge in the 15th mile as being a specimen of very suitable masonry. In the piers of the Hindry Aqueduct the courses are very variable; numerous "pinners" appear on the face. The regular stones vary from 2 inches thick, or even less, upwards; and the thickness of a course, including joints, seems to average 3 inches. In four cases tried in the piers first built, the following results were observed, neglecting pinners and stones under 1½ inches thick.

18 courses in 5' 1" over all.	
17 " 4' 1" "	
20 " 4' 6" "	
20 " 5' 5" "	
Total - - - 75	19' 1"

Showing an average breadth of courses of 3 inches. No. 5 Bridge is of a similar class of work, with joints occasionally 1 inch thick; but care has been taken to secure larger stones, and avoid small ones, and the courses average 4 inches thick, and the joints perhaps ½ inches. Good random masonry may no doubt be called "inferior masonry;" but I do not think that much of the masonry on the canal, certainly not on important works, is inferior to this, and many of the important works are, I believe, very good samples of *random rubble masonry*, which is all they profess to be, as described in the sanctioned estimates.

23. The banks thrown up in the last six years have not been rammed so thoroughly as would have been managed had the subordinate supervision been better; but it is a mistake to suppose that selection and ramming were neglected. Where earthwork is being carried on rapidly, I believe English inspectors are necessary to ensure a thorough selection and ramming of banks. Even if the banks be thoroughly rammed, a settlement of about 1 in 6 will take place as water is admitted into the canal. When complete, therefore, the bank is not so solid as it will be after the admission of water, and the slopes are a sixth steeper, owing to the allowance of 1 in 6 made for this settlement. Hence, unless the final slopes are to be excessive, the looser and steeper slopes of the bank when first made up are certain to be furrowed by the water, and so puddled and reduced to a final form. Suppose the water to cut into a bank to the extent of half a yard, the quantity of earth removed is very trifling, although it looks considerable on the bank. Probably only about 1-12th of a cube yard will be moved for every yard run of bank in ordinary cases, and will be washed down to make the final slope. When the banks have settled and turf has grown, it may be found that no shingling is required, as is the case already in the 7th section, and other places where there is no revetment, and meantime the repairs are quite within the command of the bankers. Still, where banks prove expensive to repair, it will be well to widen and shingle them, as is being done for a mile and a half above the Vaikal air aqueduct, and as has been done above the Pankal Wunkah. I should say 500 l. would suffice for all such places where discovered.

24. As regards the lock gates, I anticipate that the timber will permanently shrink when seasoned by alternations of dry and wet; and it seemed likely that, even before the canal was opened, a sensible shrinking would have occurred, owing to the exposure uncovered to the heat of a dry season. They have been generally fitted to shut close against the sill, and when wet they expand, and water enters between the gate and sill. It will be easy to trim them (if they do not meantime shrink, as I expect they will) to meet within half an inch along the mitre posts, when closed against the sill at the end of next hot season. Meantime the leakage can be readily stopped, if desirable, by a rope of grass or paddy-straw, if it be required to use them. The tightness with which some few opened is generally due to their having been adjusted in the dry weather, in which case the moist weather swells the heel posts, and makes them too tight until the keys are readjusted, as I have ordered them to be.

MILEAGE NOTES on the Works of the Madras Irrigation and Canal Company, 7th to 27th June 1871, being the concluding Portion of Captain A. de C. Scott's Report.

EXPLANATIONS OF MEMORANDA by the Company's Chief Engineer regarding Captain A. de C. Scott's Mileage Notes.

I WILL take the works in order, as they are reported upon by Captain Scott.

1ST SECTION (1st to 17½ Miles).

Head Works.—The river was flowing over the crest of the Soonkasala anicut to a depth of 9 inches at the time the head-works were inspected, and the condition of the masonry could not be ascertained. It is stated by the engineer in charge to be in perfectly good repair, all defects having been made good during the preceding dry season. The under-slucices were open, and the stonework appeared to be in good order. The shutters, which are balanced on a vertical pivot, are rather roughly fitted, and they are consequently liable to get jammed, and are generally difficult to work. The water was flowing through the head-slucice into the canal, in which it stood at a depth of 3½ feet. The shutters of this work are raised by tackle, and the only means of lowering them is by driving them down with blows of a plank or beam. They should therefore be ringed with iron. The apron and side walls of the sluice on the canal side have been repaired, and a water cushion has been formed by building a low wall across the canal between the side walls, at a distance of about 70 feet from the cutwaters of the sluice, the intermediate space being floored with rough stone and concrete. The wall, for a length of about 10 feet on each side, where it abuts against the side walls, is raised somewhat higher than the middle portion, diminishing the outflow at the sides, and protecting the walls from scour. The arrangement appears to be effectual. The front of the sluice is tolerably free from silt.

1st Mile.—The spoil banks are roughly formed, and the tow-path is, in many places, not well defined. The engineer in charge states that the work-people have been engaged in trimming the earth-work in the next mile, and have not yet taken up the part referred to.

2nd Mile.—The self-acting shutters in the calingulah are badly fitted, and would admit floodwaters from the river into the canal. This defect was noticed in the Consulting Engineer's Inspection Report of the 17th November 1870. A culvert at 1 mile 72 chains has been abandoned and blocked up, the drainage-water being admitted into the canal instead. The earth-work and tow-path are in the same condition as in the 1st mile.

3rd Mile.—Culverts Nos. 7 and 8 and a drain beyond in this mile have been abandoned, and the canal-water is permitted to stand back on the upper side. At 2 miles 30 chains is a 2nd-class bridge, of which the approaches have been fairly formed. The earth-work generally is irregularly made up; the tow-path has been recently cut and trimmed; but for a considerable distance it is placed too low, and will be flooded when the canal is full. The side-long slopes to the path are roughly cut and at too steep an angle. There is a "masked calingulah" at 2 miles 76 chains, i.e., a wall built in the line of embankment and covered with earth formed to the ordinary section. The crest of the wall is at the level of the bed of the canal, which would therefore empty itself if the earth-works were breached or cut designedly. There would therefore be little advantage gained.

1st Mile.—The spoil banks form no portion of the works themselves. When Captain Scott inspected this mile, the bankers were working out from the 3rd mile, and before the end of June they had put the tow-path in the 2nd and 1st miles in a proper state.

2nd Mile.—On the 3rd of June I inspected this calingulah, and gave instructions for the improvement of the shutters, which were followed out before the 30th of the same month. The necessary alterations would occupy a couple of carpenters one day. The culvert referred to was some years since abandoned, and blocked up with several others, and the admission of water into the canal substituted with the sanction of Government. This has been found to be an improvement.

3rd Mile.—Culverts Nos. 7 and 8 and the drain referred to were abandoned, if I recollect right, for they are trifling works, before the date of the supplemental contract, and their place is supplied by the new calingulah sanctioned by Government in the 2nd mile. The tow-path, which is on the edge of heavy cutting, can be easily increased in height by the bankers raking down upon it some of the adjacent soil. The cost will be the merest trifle, and will form a portion of the outlay upon conservancy. Any alteration of the masked calingulah is involved in the general question of calingulahs, to which I have already alluded as being under consideration.

The wall should be raised to 4 feet above bed-level, so as to retain some moderate supply of water.

4th Mile.—No. 1 breach made in the banks last year by flood has been efficiently repaired, the earth-work being brought up to the regular section. No. 9 culvert having been found quite insufficient to carry off the drainage-water, an inlet wall has been built across the upper end to admit the surplus into the canal. There are some irregularities in the form of the canal; for a distance of 30 chains the embankment has been thrown back from the edge of the cutting from 40 to 50 feet, leaving a berm two or three feet below the level of the canal-water when it is full, and the tow-path is led on the tops of the embankments. Traction under these circumstances would be difficult. The earth-work in this mile is better formed than it is above, and appears tolerably solid; but the tow-path requires flattening.

5th Mile.—At 4 miles 40 chains a rocky point has been left, which projects across the general alignment of the canal and embankments for a distance of 60 to 70 feet, and forms a complete obstruction to towing. The embankment, for a length of 50 feet, has been lowered to a height of 10 feet above canal bed-level, at a selected point, to breach in the event of heavy floods. The earth-work is in fair condition, and the tow-path clear.

6th Mile.—The sluice shutters of No. 1 calingulah, at 5 miles 3 chains, have been removed, and an earthen bank has been laid in front of the vents to a height of 6 feet above the bed-level, with a view to its breaching and leaving the vents open should a flood occur. A similar arrangement has been made, or is in progress, at all the calingulahs in this section, except No. 9. The water in the canal stands at present 2.85 feet deep at this point. The revetment of the canal embankment at the Yedoor tank will be raised to the level of the top of the earth-work; it is at present four feet below it. The breaches Nos. 2 and 3 of last year in the bund of this tank at 5.45 and 5.62 have been made good. At 5.67 stands a 2nd-class bridge. The approaches are completed. The embankment of the canal is, generally, fairly consolidated, as far as can be judged from its outside appearance. There were a few leaky places, but they have recently been puddled. The tow-path is in serviceable condition.

7th Mile.—At 2 miles 27 chains, with 2 feet 9 inches of water in the canal, it was noticed that a small leak had commenced; it will receive immediate attention. At 2 miles 64 chains the embankment has been lowered, as in the 5th mile. The banks and tow-path are in the same condition as in the previous mile.

8th Mile.—The banks are in good form, and the tops in a condition for use as a tow-path.

9th Mile.—At 8 miles 17 chains the embankment has been lowered for a length of 100 feet, as described above. At 8 miles 49 chains a supplementary irrigation sluice has been built, as sanctioned in Government Order No. 3468, dated 28th October 1869. At 8 miles 60 chains there is an inlet with self-acting shutters, and, underneath, a culvert and sub-way combined, all of which are in a very leaky condition. Streams of discoloured water are gushing out of the abutment walls of the tunnel. It appears that the canal-bed

4th Mile.—Culvert No. 9 was built in the manner stated by Captain Scott with an inlet wall, and has never since been found insufficient nor altered in design. It was complete before the new contract was made. The small patch of ground temporarily flooded whilst this culvert is overflooded is poor and stony. I believe the inlet to be as old as the culvert, certainly it was constructed long before 1866, the year of the new contract. The tow-path (hardly worth referring to) is constructed according to plans sanctioned by Government, with a broad berm of 40 or 50 feet. It was so constructed several years before 1866. Inconvenience would, no doubt, be experienced with a tow-rope less than 150 feet long. I have, however, directed an estimate to be made for improving this; the total should not exceed 150 l.

5th Mile.—I have also directed an estimate to be made for carrying the tow-path round the rock at 4th mile 40 chains, although a bargee could easily keep his rope clear. The cost should not exceed 50 l. This rocky point has existed for years, and has been inspected by a succession of consulting engineers, and I believe never objected to; certainly never required to be corrected by the company.

6th Mile.—The revetment referred to was raised before the 30th June.

7th Mile.—The leak referred to was stopped before the 30th June.

9th Mile.—The leakage here referred to is not so bad as it was last year, and the bankers have directions to render the tunnel tight immediately they can do so. It is reported not to be dangerous, and cattle and passengers pass through its centre arch. The cost of this additional requirement will be about 10 l.

bed above was scoured away last year, and the hole at the back of the tunnel wall was filled up with dry rubble stone instead of puddled clay. The water is thus led down to the back of the wall. Immediate remedial measures are necessary. The banks and tow-path are in fair condition.

10th and 11th Miles.—At 9 miles 1 chain and 9 miles 50 chains the banks breached last year have been substantially repaired, and they are throughout these miles in generally good form, as also the tow-path.

12th Mile.—At calingulahs Nos. 5 and 6 the apron of rough stone laid dry has been partly carried away. It will be repaired. At 11 miles 20 chains is a third class bridge, the parapet walls of which have been lowered in accordance with the orders of Government. They stand at 2 feet 3 inches above the roadway. The approaches at the upper part are at a slope of 1 in 4, and probably impracticable for bullocks with a plough. The banks are generally fairly made up, and appear to be solid outside. The tow-path is led on the top, and is in tolerably good order.

13th Mile.—The apron of calingulah No. 7 is partly washed away; a third-class bridge at 13 miles 36 chains has had its parapet walls lowered, but the approaches at the upper part are very steep (1 in 6). The embankments and tow-path are in fair condition.

14th and 15th Miles.—The banks are generally in good order; the tow-path in some places requires making up.

16th Mile.—The third-class bridge at 15 miles 21 chains has been altered in regard to its parapet walls. The approaches at the upper part are steep.

17th Mile.—The canal is in rocky cutting in this mile, and the tow-path is led along the edge; it requires clearing in some places.

General Remarks.—The banks and tow-path in the 1st mile require re-forming, and at many places in the section it will be found necessary, in order to insure easy towage, to trim and remove portions of the canal sides, which are irregular. The culverts for the drainage of the land on the upper side have, in several instances, been built too small, and it has been necessary to abandon them, and to admit the drainage-water into the canal. All the irrigation sluices which have been sanctioned have been constructed, but the shutters for the most part have not been provided or have been lost. It is stated, however, that they will be supplied at once. The aprons to the calingulahs are not of a nature to withstand any considerable discharge over the crests of the works, and they have given way in several instances, and notably at No. 8. Lately, instead of packing the stone protection to the banks, and pitching it at right angles to the slope, it has been thrown loosely down, and in some cases in excessive quantity. Except in the 1st and 17th mile, where the canal is for the most part in cutting, the banks are in fair form and consolidated on the outside; but, as it is admitted that the earth was originally thrown up at haphazard, without ramming or laying in layers, and as it is generally of very bad quality, little confidence can be placed in them.

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12th Mile.—The calingulah aprons have been made upon the principle of allowing for gradual subsidence; as the stones put in sink, others are thrown on the top, and so a really permanent condition is reached. This process is going on at these two calingulahs, and also at one in the next mile. It is useless to pitch the face of such aprons (as was done at these calingulahs, according to plans approved by Government), until the rough mass has worked into a final condition. This is a mere matter of conservancy, and is provided for accordingly. The bridge and its approaches are in accordance with approved plans, and have now stood for about three years. The whole question of bridges has been most carefully at various times investigated and regulated by the Government.

13th Mile.—The remarks made in connection with the 12th mile apply to the calingulah apron and the bridge approaches in this mile.

14th and 15th Miles.—The tow-path was made up before the 30th June, and will be maintained by the bankers.

16th Mile.—The bridge and its approaches were constructed in accordance with plans approved by Government three years ago.

17th Mile.—The tow-path was cleared before the 1st of July last, except a few stones requiring breaking in order to form a smooth surface. This will cost under 10s. Roughness will continually appear after wet weather, but it will be easily corrected by the bankers.

General Remarks on the 1st Section, that is to say the 18th Mile.—The state of the tow-path and culverts, as also the calingulah aprons, I have already referred to. All the irrigation sluices were supplied before the 30th June. I do not know who made the admission referred to, that the earth was originally thrown up at haphazard, &c., but the embankments were designed, and mostly constructed, long before the supplemental contract was made, and every requisition of the Government in respect to them has been since complied with, so far as their consolidation admits. The bad quality of the earth in some miles, and the impossibility of getting better except at largely increased cost, has been a matter of notoriety from the very commencement of the works, and the banks have been so constructed as to receive their consolidation from time; their state and condition has been known for years to the Government. The berm objected to by Captain Scott was ordered by Colonel Rundall when consulting engineer, over nine years since, to be at least 10 feet. It has been, however, reduced to 5 feet below the Mittacondal Cutting; and I may mention that, in addition to the discontinuities in the towing-path caused by this berm, there are others which have been sanctioned by Government, as in the 26th and 28th miles, where two adjacent water-spreads are connected

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All the irrigation channels and the works sanctioned for the 1st section have been completed. They command about 1,386 acres of land.

connected by a cut through a low place in the dividing ridge between them, and the tow-path becomes merely a path along the margin of the tank for a short distance. In these cases, in practice the towing cattle would walk along the gravelly edge of the water at whatever elevation it might be, and the boat, if kept off in 5 feet water by the rudder or poles, would be about 70 or 80 feet from the cattle. I really do not see any serious inconvenience in this, nor should I call such towing path for a short distance otherwise than "easy." The tow-path might, however, be readily taken round the rocky protuberance in the 5th mile at a small expense, so as to be kept close to the sanctioned channel. The only culvert for draining land in the first three miles, which was found too small, was the 6th, for which a calingulah was sanctioned. Mr. Lowe, the divisional engineer, stopped all the small ones up in 1864, and provided for their being permanently closed. The irrigation sluices in the upper sections are small ones with openings 7" x 5" and upwards, and are treated just as open sluices in channel sides will be, i.e., they have a shutter put into them by hand for use whilst the water is in the canal.

Shingling, i.e., rubble thrown unpacked on to the slopes, is the only pitching which follows any slipping or settlement, and is therefore least likely to leave earth exposed just above a slight slip; it is also the only pitching which lies wholly on the bank, and does not accumulate weight on the toe, as it is raised higher and higher.

2ND SECTION (18th to 32nd Mile).

18th Mile.—(*Hindry Aqueduct*).—The side walls of the aqueduct have now been raised to a height of 9½ feet above the floor, or 18 inches above the level of the water when the canal is full; the wings and the face-walls to the embankments in continuation of the wings to 3½ feet above water-level. The earth backing has, however, not been raised, and stands at 2 feet below the tops of the wall. The abutments of the aqueduct stand at the foot of the long slope of the river bank, and the space between the back of the abutment and the tops of the banks, inclosed at the sides by face-walls and embankments, has not been filled at all. The depth of the water, when the canal is full, will vary from 8 feet at the summit of the bank to something like 25 feet behind the abutment, and even now it is considerable. Under this pressure three leaks exhibit themselves; one at the toe of the south abutment at the level of the bed of the Hindry river*; one at the face of the west wing wall, on the same side of the river,† and the third (only observed a few days ago) at the foot of the embankment, on the west side‡. The chief engineer has commenced throwing in earth at the back of the abutment, and in front of the face-wall opposite the leak last mentioned. The silting up of the hollow now existing, by the canal-water, will eventually, no doubt, stop all leakage, and the process should be encouraged if possible. A large breach§ on the lower side of the canal, just below the aqueduct, has been repaired, as far as could be ascertained, in accordance with the design sanctioned by Government. The foundation of all the face-walls at this point rests on sand, which also underlies the embankments as far as the top of the river bank. There has been a slight slip in the earth recently placed against the wall built to close the breach,

18th Mile.—(*Hindry Aqueduct*).—The leakage referred to will, as suggested by Captain Scott, be effectually remedied by silt. I have directed that the process shall be encouraged as much as possible. The new bank in rear of the new wall close to the breach has not settled more than was expected, and the height has been made up. I am not aware of any slip in it, and I believe the work to be sound and sufficient for its purpose.

2ND SECTION.

breach, and until the space within the embankments has silted up considerably all this work will give cause for anxiety. Beyond the breach* the face-wall had slipped forward for a length of 300 feet. This has been rebuilt, and the foundation is on hard soil.

19th Mile.—At 18 miles 14 chains the tow-path leaves the summit of the banks, and descends to a berm, the canal being in cutting, and up to the 1st-class bridge; at 18 miles 34 chains, the spoil encroaches on the berm, which is too narrow and encumbered with stones. The approaches of the bridge are completed. At 18 miles 79 chains stands No. 10 calingulah. A berm, 100 feet in width, is left here in front of the work; towage would be interrupted.

20th Mile.—At 19 miles 17 chains in front of No. 11 calingulah, the towage is broken as at No. 10. Again, at 19 miles 41 chains, a berm of great width is left, the tow-path being in the bank above. The spoil is thrown irregularly. At 19 miles 30 chains a core-wall extends for about 6 chains; it has not been improved as have similar walls at other places, and requires attention.

21st Mile.—The banks and tow-path are fairly formed. At 20 miles 25 chains there is a leak with about 2 feet 9 inches of water in the canal above normal bed-level. At 20 miles 72 chains there is also a small leak.

22nd Mile.—At 21 miles 23 chains the bank is leaky; at 21 miles 41 chains in front of No. 12 calingulah the towage is broken as there is rocky ground up to the crest-level for a width of at least 100 feet. The banks and tow-path are in other respects in fair order.

23rd Mile.—The banks are fairly formed and rivetted, but soft. From 22 miles 19½ chains to 22 miles 47½ chains is a wall in lieu of bank with 8 vents and shutters worked with screws. The shutters do not fit well.

24th Mile.—At the Kadrabagh Aqueduct (23 miles 12 chains) all necessary repairs have been executed except the rough stone protection in the bed of the vagoo at the lower side. The stone has been collected. A breach† in the retaining wall at 23 miles 60 chains at its junction with the canal embankment has been repaired. The bank has been lowered in this mile at a favourable site for a breach, in the event of an excessive flood, a precaution noticed in observations on the 1st section. The interior of the earthen bank as exposed shows very unfavourably; it is exceedingly loose and dry and formed of heaps of earth promiscuously thrown. The banks generally are trimmed to a fair section, and the tow-path is clear of obstruction.

25th Mile.—No. 13 calingulah, carried away by the flood of August 1870, has been newly reconstructed; the piers between the openings have been completed, and 20 out of 58 arches turned. It may be completed by the end of this month. The masonry is of inferior quality; the crest is at a height of 5 feet above bed-level of canal.

26th Mile.—The banks are loosely thrown up and appear to be still soft. They are fairly trimmed and tow-path formed. The walls which extend for a considerable distance, where the canal alignment crosses ravines and forms deep reservoir (*sic.*), appear to be in good repair. All that required it have recently been raised to a height of 3½ feet above

19th and 20th Miles.—Although the canal in these miles has been constructed in accordance with designs approved by Government, and I do not think the state of the tow-paths will be found inconvenient, nevertheless, to meet Captain Scott's requirements, I have ordered estimates to be prepared for remedying the alleged defects. The total cannot well exceed 70 l. I do not notice the statements regarding spoil, because, as I said before, that forms no part of the Company's Works, and can at any moment be remedied at a very trifling cost.

21st Mile.—The two small leaks referred to have received attention. Such leaks may be treated as matters of course, to be dealt with by the Conservancy Staff. They are quite harmless.

22nd Mile.—The leak at 21st mile 23 chains has been in like manner attended to; it was trifling.

23rd Mile.—The shutters will be easily made to fit at the cost of a rupee or two, after the present season.

24th Mile.—The rough stone for the apron, which was stacked for measurement by the vagoo's side when Captain Scott passed Kadrabagh Aqueduct, was all thrown in before the 30th of June.

Where the top of the bank had been removed to a level a foot above full water level, the bank and tow-path metal might look loose, promiscuous, and dry, but below water level the bank here has been found so tight as not to need puddling. The mass of it was constructed before 1865.

25th Mile.—The calingulah No. 13, was completed before the 30th June.

Captain Scott's observation regarding the masonry has been met by my earlier remarks. It is as good as that of the Hindry Aqueduct, and received the sanction of Government during construction.

26th Mile.—Captain Scott says the banks are loosely thrown up, and appear to be still soft. I do not know that these are more so than others, but they are of a height to allow for subsidence. Their construction was commenced in 1862, and they have been inspected frequently by the consulting engineer.

Captain

* Has nearly ceased.

† Has ceased.

‡ Was readily stopped.—J. H. L.

§ Of August 1870.—J. H. L.

° Of August 1870.—J. H. L.

† Of August 1870.—J. H. L.

above the canal water when full. They are backed with earth or dry rubble stone, and occasionally puddled and plastered in front where leaky. The backing or filling for tow-path is left 2 feet below the top.

27th Mile.—The lower side of the canal is formed partly by wall and partly by banks of earth. The former have been dealt with as in the previous two miles; the latter have been puddled in front when high.

28th Mile.—The canal at the Poodoor bungalow cuts through a saddle, and the tow-path has, for a short distance, not been properly formed. At 27 miles 50 chains a breach* in a high wall has been efficiently repaired, a puddle bank with a layer of shingle being laid in front and a rubble packing behind the wall which has been rebuilt. The old wall has been left at its original height of 2 feet above full canal water-level; the new portion has been raised to 3½ feet above. The puddling and shingling have been continued along the old wall. The banks and tow-path in this mile are in tolerably good condition.

29th Mile.—Banks and tow-path as in last mile.

30th, 31st, and 32nd Miles.—At 30 miles 28 chains is a 2nd class bridge very well built, the approaches also formed. The banks are in good repair, but appear loosely laid; the tow-path is in serviceable condition, and also the revetment. The banks where high have been generally puddled in front, and are protected throughout up to 2 feet above water-line with rough stone pitched and packed or loosely thrown.

General Remarks.—The general impression made by an inspection of the works of the 2nd section is not a favourable one. From the peculiar manner in which the canal has been laid so as to cross ravines where the ground is frequently many feet below the normal bed-level, the embankments or walls must be subjected to the pressure of bodies of water of considerable depth when the canal is running even half full, and there is much ground for believing that the work throughout is not of particularly good quality. Where an opportunity has been afforded of examining the interior of the earth-work, as where it has been lowered to breach in case of necessity, it has been found loose and dry, and was evidently thrown up at random, nor, as a rule, are the higher embankments of such thickness as to give a margin of stability which would compensate for the bad manner in which they seem to have been formed. In general also the soil is inferior. Again, in regard to the walls, it may be said that they have given way under a charge which could hardly be considered excessive if we remember for what they were designed, and the work where exposed to view by a breach has been, it is believed, generally found of inferior quality; neither have they been strengthened to any material extent since their disastrous failure last year, seeing that the only alterations carried out have been the raising of the masonry to 3½ feet above the full water-level of the canal, and a trifling addition in some cases to the rubble backing behind, with puddling at the toe where the leakage had been excessive. All the

None built since 1865 have given way.

Captain Scott has misunderstood with regard to the walls. The new faced walls were raised to 3½ feet above water level, but none of them have been plastered or puddled in front. The old walls have not been raised except at the epds, but some of them have been plastered and puddled.

28th Mile.—This tow-path has been referred to under 1st Section, General Remarks. The old wall here, where 20 feet high, has recently had a puddle foreshore 10 feet high, and the dry rubble backing raised to 16 feet.

30th, 31st, and 32nd Miles.—I do not know how these banks appear loosely laid. There is no excessive leakage to indicate this. They were constructed some time prior to the supplementary contract, and have since been simply increased to maintain section, and have been frequently inspected by the Government consulting engineer.

General Remarks on 2nd Section.—In his general remarks Captain Scott argues that there is much ground for believing that the work throughout the 2nd Section is not of particularly good quality. He bases this belief on the loose and dry appearance of filling up of one bank above the highest flood water-line. As to which part of his argument I have already explained that, although the summit of the bank and tow-path metal might look promiscuous and dry, yet below water-level the banks have been found so tight as not to need puddling. Both the bank and the tow-path were constructed to near completion before the supplementary contract came into existence, and have been since strengthened according to designs approved by Government. All requirements made before the 1st of July last have been complied with.

Captain Scott also argues on the general inferiority of the soil, as to which I can only reply that the soil is certainly not good, but better could not be procured; it was used with the knowledge and sanction of Government, the commencement of that use dating so far back as 1860. Also as to the breaching of two old walls of defective design, I must remark that these have since been thoroughly repaired according to designs sanctioned by Government.

Captain Scott then proceeds to argue that the thickness of the higher embankments must be increased; that is, made of larger section than that which has been approved by the consulting engineer and sanctioned by Government; and that the walls, which in their weaker state stood the recent

the walls leak more or less; additions have been made to them where the leakage was greatest; still it is probable that the stability of many under a full head of water is very doubtful.

The other masonry works, such as bridges, calingulahs, culverts, &c., are completed, and in good repair; but the masonry built is in many cases of an inferior kind, and, even if failures do not occur, repairs will be frequently necessary.

All the breaches made last year have been repaired. The bridges and approaches have been completed, the parapet walls of the third class bridges being lowered in accordance with the orders of Government. No steps have been taken to improve the surplus discharge works beyond lowering the thirteenth calingulah. The towpath is generally fairly formed, but there are various obstructions along the side of the canal, noticed in the mileage observations, which must be removed.

All the irrigation sluices sanctioned for this section have been completed, and also the irrigation channels comprising a length of 14 miles; these command 1,956 acres of ground.

3RD SECTION (33rd to 60th Mile).

33rd Mile.—The embankments in this portion are high and somewhat slight. They are now receiving a backing of earth. They are puddled along the front face.

34th Mile.—At 33 miles 20 chains a second class bridge, sanctioned in lieu of the Sultanpore Tunnel which was destroyed by flood, has been completed with its approaches, but these are not connected with the road which passed through the tunnel a quarter of a mile distant. The embankment and towpath are in fair order and of considerably stronger section than those in the previous mile. No. 15 calingulah is banked with earth in front of the sluices, the shutters being removed.

35th and 36th Miles.—The canal is for the most part in cutting. The spoil is somewhat roughly formed, but the towpath is clear. A berm is left between the banks on which is the path and the canal cutting; this is unnecessary and, in fact, an impediment, as it is generally below full water level. At the Ulloor aqueduct the repairs necessary in consequence of last year's flood have been completed. Beyond the aqueduct the bank is lowered for 200 feet to breach, if required.

37th Mile.—The towpath in some places is not made up on the summit of the bank which is very soft. The sides of the embankment and the shingling are left in a very rough state.

38th and 39th Miles.—From 37 miles 26 chains to 37 miles 33 chains is a corewall of the old pattern; that is to say, not puddled in front. At 27 miles 33 chains a calingulah has been built. The banks are formed of good soil, and are of strong section; but the stone revetment is pitched at too great a slope, and has fallen out in places.

trial satisfactorily, and subsequently to that trial were materially improved and strengthened (the face walls, by being raised to 3½ feet above full water level, and the solid walls, by being furnished with a foreshore puddle along the front and supported in the rear by a dry rubble slope, the surface slope of which cuts the outer face of the wall above full water level), which additions in strength have been approved by Government, will even now prove quite insufficient for security. I differ with him.

All the walls, except face walls, were completed long before the date of the supplementary contract.

3RD SECTION.

33rd Mile.—The backing of earth and puddling, mentioned by Captain Scott, were completed before the 30th June.

34th Mile.—I assume that, by using the word "remove," Captain Scott desired to notify that the shutters of No. 15 calingulah were open; that being the fact here and elsewhere. There was no passable cartroad leading from the tunnel before it breached.

35th and 36th Miles.—The spoil may be somewhat roughly formed, but I have yet to learn that trimming spoil was a portion of the contract, or is necessary to the due construction of the canal in any way. However, to regulate its surface may form occupation to the bankers.

The berm complained of exists under an order made by the consulting engineer in 1861-62,* and has never before been objected to.

37th Mile.—A towpath must, at any rate at first, be either "dry and loose," as of gravel, or "soft" and liable to be very moist in the rains; and that in this mile is the latter. It is very old, much older than the supplementary contract, and thoroughly consolidated. The roughness of the sides of the embankment and shingling arises from no defect, but from the fact that the old upright revetment sanctioned by Government is, as it gives way, being gradually changed to shingling.

38th and 39th Miles.—The core wall referred to is in cutting, and therefore has no foreshore. When the plans were submitted and approved by Government, none was suggested, as none was needed. The same remark applies to the revetment as that on the 37th mile.

* Excepting in small works in India, I have never seen a berm omitted between a bank and its cutting; it would be bad engineering.—G. G.

40th Mile.—At 39 miles 37 chains is a 3rd class bridge; the width is 7 feet in the clear, the parapet walls have been lowered, and the approaches are completed. It is passable for loaded bandies. At 39 miles 59 chains is a retaining wall No. 11. The top is $3\frac{1}{2}$ feet above full water level, the earth backing 2 feet lower.

41st Mile.—At 40 miles 16 chains is a masonry wall with rubble backing. The towpath in the wall is 1 foot 2 inches above full water level. A parapet wall 2 feet 4 inches high with protecting coping is built at the side of the towpath. This arrangement is objectionable as the coping would probably cut the towrope. At 40 miles 47 chains is a calingulah No. 10. The embankments are made of good soil, and are, with the towpath generally, in good form.

42nd Mile.—At 41 miles 31 chains to 41 miles 48 chains there is a wall in lieu of bank without backing, for half its length coped as in last mile; the level of the top is not accurately known, and it may require raising. In the wall is a sluice of 5 vents, the shutters are removed, and an earthen bank thrown up in front to breach when the water rises to 6 feet above bed level. The southern half of the wall is leaky, and has been backed with rubble. At 41 miles 57 chains to 41 miles 62 chains is another wall backed with rubble, it is also leaky. The banks and towpath are generally in good condition.

43rd Mile.—At 42 miles 14 chains, Mulliala village and 2nd class bridge. The approaches of the bridge are finished. The banks here are protected by stone thrown loosely down, giving a rough unfinished appearance. At 42 miles 28 chains an irrigation sluice has been built of 4 vents, closed by shutters worked by differential pulleys, and arranged with a down-haul to close them. The gear is not perfectly in order, and is under repair. The banks and towpath are in good repair.

44th Mile.—At 43 miles 34 chains is a 3rd class bridge; the approaches are completed and parapet walls lowered. The canal water stands back and forms a tank. The embankment is of bad soil and leaky, and the ryots of Madigatla, which village lies immediately under it, have, on their petition, been allotted a new site for this village. There has, however, been as yet no slip or yielding in the embankment. It is protected on the inner side with large slabs of schistose rock loosely thrown. This seems insecure, and would probably be displaced by the wash of the water in windy weather.

45th Mile.—At 44 miles 17 chains is a scouring sluice of 5 vents, the shutters worked with screws. There is an earthen bank in front to 6 feet above bed level, and it is proposed to keep the shutters up and allow the bank to breach as at other places. At 44 miles 26 chains the embankment is lowered to a level of 10 feet above the canal normal bed. The interior of the earthwork as seen in this cutting is not consolidated; it is formed of fragments of shale mixed with earth, loose, and full of interstices. At 44 miles 29 chains is a calingulah; the outfall is bad, and leads along the outer toe of the embankment. The Nagatore tank ends in this mile. It is of considerable depth; the bank seems solid and of fair soil, but it is badly protected in parts by shingling as it is called, with pieces of slatey stone thrown at random so as to cover the slope. The canal banks and towpaths are neatly made up.

41st Mile.—These parapet copings were put on as an experiment without my instructions, and I disapproved of them. They consist of stones of some value, which protect the wall, and are safest as they lie. They could all be removed in a day, to be used elsewhere.

42nd Mile.—This wall, built on fissured quartzite, according to an approved plan and section, leaks below, but does not indicate any danger. This leakage would be stopped by a small puddle-foreshore, which would cost about 10 L., and I have directed an estimate to be procured and laid before the Company's agent, that the work may be done.

43rd Mile.—This sluice now works well, with the exception perhaps of one shutter, which perhaps does not quite close, but will in time be made to do so by the Conservancy Staff.

44th Mile.—This bank was formed by raising an old Tank Bund, which leaked, but has shown no signs of insecurity. The leakage formerly was large enough to form a supply for irrigation and was so used, but it has since decreased, and is now quite insufficient for that purpose. The plan was approved by the Government, and the bank constructed under their supervision.

45th Mile.—I was assured by the assistant engineer in charge of their construction, that every care was taken to keep the best earth of the locality in the centre of the banks. They have stood very well, and are tight so far as they have been tried. I do not know how Captain Scott ascertained that the interior is bad soil.

General Remarks.—The earthwork of this section of the canal presents generally a better appearance than that in the second section. The embankments in the first portion, from the thirty-third to the thirty-fifth mile, where the canal skirts the hill side, which slopes rapidly, are exceptionally high, and appear to have been originally loosely thrown up; their section is slight, and the additional earth now being laid on them is simply thrown from the top without benching the old work or removing grass. It is probable that they will require considerable additions to render them safe. The lower portions of the canal in the section are frequently in cutting, and the soil is of fair quality. At certain points the banks have a rather unfinished appearance, but generally they have been trimmed, and there is a fair way on the top. Whenever the interior of the earthwork is exposed by cuttings, it seems, however, to be loose and dry, and, until they have been thoroughly saturated by the water standing against them, and have fully settled, their stability under pressure is doubtful. The revetment or stone protection to the banks varies in quality. The system adopted of shingling or spreading stones loosely on the slopes may answer in the portions of the canal where the water does not spread, but where tanks are formed it is believed to be insufficient. There are but few walls in this part of the canal, and where they have been constructed the depth of water against them will not be considerable; nevertheless they are generally leaky.

All the sanctioned masonry works have been completed; the quality of the work is the same as in the other sections; that is to say, rough and of a low class. The parapet walls of the third-class bridges have been lowered, and the approaches of all completed. The breaches in the upper banks at the Ulloor aqueduct have been repaired. The waterway of the under tunnel is insufficient, and it is proposed to lower the side-wall of the aqueducts on the upper side and to admit the water in excess of that passed through the tunnel into the canal.

The surplus discharge works of the section remain in the same condition as they were in last year; the shutters of the sluices will, however, be removed, and their place supplied by earthen banks raised to six feet above bed level, as in the other sections. All the shutters and lifting gear to the sluices in the first, second, and third sections are roughly made and fitted. The pitch of the screw for lifting the shutters of the calingulah sluices is very small, and it takes two men from 25 minutes to half an hour to raise each.

The irrigation sluices in the third section have been completed, and all the irrigation channels sanctioned.

4TH SECTION (45 Miles 33 Chains to 61 Miles 70 Chains).

46th and 47th Miles.—At 46 miles 43 chains' Nagatoor first-class bridge. The approaches are completed. The banks and towpath are in good condition.

48th and 49th Miles.—The banks appear to be solid outside and are well formed, but too much rounded at the top for a towpath. There are some bushes on the inside slope which require removal. The inner slope is shingled.

General Remarks on Section 3.—The section of the embankments is in accordance with the approved plans, with earth added to meet consolidation. Stone is plentiful all along this section, and shingling can be readily added to the banks if the present is found not to stand. Hitherto it has given no trouble, which cannot be said of packed pitching. The masonry is not so rough as that of the first section or of the Hindry Aqueduct. Ulloor Aqueduct and Sultanpoor Bridge are of good coursed rubble; but to this I have already referred.

No shutters are removed further than to raise them. The lowered banks are 3 ft. 6 in. above full-water level. The side wall of the aqueducts on the upper side will be lowered, to admit the water here mentioned, so soon as the approval of Government, long since asked for, is received. The shutters of the sluices of the calingulah are country-made, but efficient.

4TH SECTION.

48th and 49th Miles.—The bankers will, as a part of their duty, level the top of the towpath, and remove the bushes which have here frequently grown to the size of a large cabbage on the inner slope of the banks. The subject is too immaterial to notice further. The towpath was convenient enough

50th Mile.—The canal forms a water-spread. The embankment is formed of good soil and is in good form. The slope is protected by shingling. At 49 miles 68 chains stands calingulah No. 1. The apron is excellent, and has stood for six years without repair. 49 miles 48 chains, bridge No. 1-A, 2nd class. Approaches completed.

51st to 54th Miles.—The banks are generally in good shape, and appear never to have shown signs of weakness. The soil is of good quality. The cutting of the canal neatly executed.

54th Mile.—The canal forms a waterspread (Puggadial tank): the embankment is generally in good order, but has sunk in the line of a vagoo in the hollow.

55th Mile.—A subway and drainage under-tunnel, 14 feet wide, at Puggadial village. Banks in good repair.

56th and 57th Miles.—The canal spreads; the tank bank is revetted at the lower part and shingled above, the lower at a slope of $1\frac{1}{2}$ to 1, the upper 2 to 1. The embankment has had water against it to within two feet of full supply level.

58th and 59th Miles.—Canal banks in good order. At 58 miles 4 chains is a calingulah. The shutter and gear of the sluice are badly fitted; the former flimsy. An earthen bank is thrown up in front of them.

60th and 61st Miles.—At 59 miles 13 chains is a third-class bridge. The approaches are completed; but the parapet walls have not been lowered, in accordance with the orders of Government. The canal at the end of this mile forms the Tangadanchia tank. The embankment is of full section and in good order, revetted on the slope. It breached in 1869, under, it was supposed, a full head of water, but has not given way since. About 20 chains from the termination of the spread at the lower side is a calingulah, which forms the only outlet for the surplus water of this tank. The approach is narrowed to the width of the canal. The question of widening or lowering the crest of the calingulah and improving the approaches has to be considered. At the end of sixty-first mile is a culvert and subway eight feet wide.

62nd Mile.—The canal bank in some parts is leaky and the soil indifferent. At 61 miles 70 chains the fourth section ends.

General Remarks.—In the fourth section generally there is a considerable improvement in the appearance of the canal embankments, partly owing to the fact that the soil is of better quality; where, however, the canal crosses valleys and depressions, and forms reservoirs, some of them of considerable depth, which is the case occasionally in the section, it is not unlikely that failures will occur. The embankments to these tanks are generally of full dimensions, and they have been kept in good repair; but there is reason to suppose that here, as at other places, they have not been carefully thrown up: they are for the most part of full width at the top, and are formed into a fair path six feet wide. The masonry works are all completed, but the lifting gear of the sluice

enough for Captain Scott to canter upon at every point.

50th to 61st Mile, inclusive.—Captain Scott's remarks upon these miles, being favourable, require no notice from me.

62nd Mile.—The leakiness spoken of is noticeably becoming smaller. The soil is the best in the locality, and was used with the sanction of Government.

General Remarks.—Captain Scott's general remarks upon the fourth section are upon the whole very satisfactory. The banks supposed to have not been carefully thrown up were constructed in accordance with the system adopted, and will in due course attain perfect consolidation, being in the meantime maintained to their proper height by the conservancy staff. The lifting gear and shutters are being attended to and maintained from time to time to fit and work satisfactorily. I do not know how a bank carefully thrown up "to full dimensions and kept in good repair" would look different from these. The top of the bank is nowhere lowered to less than 12 ft. 6 in. above the proper bed of canal. It is nowhere 10 feet above the bed.

shutters is sometimes very roughly put together. The shutters themselves, where of wood, are of slight construction, and the same defect in the screws of the calingulah sluice shutters is noticed in this as in the third section. The approaches of all the bridges have been completed, but the parapet wall of the third-class bridge has not been lowered.

The surplus discharge works remain in the same condition as they were in last year, but the chief engineer has taken the precaution in this and in the upper sections of raising or removing all the shutters of the calingulah sluices, and has thrown up earthen banks in front of the vents calculated to breach when the canal water rises above six feet in depth. The banks of the canal are also lowered at intervals to a level of 10 feet above that of the proper bed, with the intention of allowing it to breach at selected places, should an excessive flood occur.

All the irrigation sluices sanctioned for this section have been completed, and most of them are fitted with shutters and lifting gear. In certain cases, however, these are still in the workshop.

Sanction has been obtained for the execution of 63 miles of irrigation channels; of these, 62 miles have been completed, commanding 24,000 acres of irrigable land.

5TH SECTION (61 Miles 70 Chains to 74 Miles 57 Chains).

63rd Mile.—The top of the bank in this mile is often too narrow, rounded and unsuitable for traffic; guttered also on the back slope. At the end of this mile is a 14-foot culvert in good masonry.

64th and 65th Miles.—The banks vary in condition and soil. At many places they are too narrow at the top, but are generally trimmed to a fair slope. In the 65th mile is a 6-foot culvert and an irrigation sluice, of which latter the gear has not been fitted. The Terrogopillay second-class bridge has been completed, with its approaches.

66th Mile.—The Terrogopillay aqueduct is in this mile. The masonry seems to be sound, and there are no cracks or settlement. As there was no water in this part of the canal, it could not be determined whether the work was water-tight or not; but nothing has been done to stop the leaks noticed in the inspection report of the consulting engineer, dated 17th November 1870. The double banks from the village of Terrogopillay to and beyond the aqueduct are in a hollow, formed of very bad treacherous soil, and altogether untrustworthy. The depth of water against them will be considerable, and they appear to be low. There has been a slight slip inwards, near the aqueduct on the upper side. The chief engineer will have the heights ascertained, and raise them where required. Beyond the valley crossed by the aqueduct the embankment is very narrow, and only 4 feet above the water line.

67th Mile.—The embankments are in much the same condition as in the previous mile, but the soil is better. An irrigation sluice of six vents has been built, but the gear is not fitted.

68th and 69th Miles.—The canal is partly in cutting in red gravelly soil, the sides are considerably guttered, the towpath has not been formed, and the banks are in a rough state; bushes

5TH SECTION.

63rd to 65th Miles.—The tops of these want trimming, which will be done as soon as the bankers are free from irrigating fields. It is a trivial matter, and will not occupy much of their time.

66th Mile.—The double banks referred to are made with the best soil of the locality, as sanctioned by Government. No slips have lately occurred, and the widening of the banks is complete.

67th Mile.—The necessary shutters and gear complete have been fixed and properly furnished in the irrigating sluice.

68th and 69th Miles.—Although a very trifling matter, and scarcely worth referring to, I regret to say that the towpath in this cutting was not completely trimmed when the bankers were taken off

growing on the inside slope and top, and the summit very narrow and rounded, unfit for traffic.

70th Mile.—For some distance the banks are formed of bad soil, and have cracked considerably; they are overgrown with bushes, and the top is narrow. There is a culvert of three arches of 10 feet span. In this mile there was a gang of coolies making good the earthwork, and a conservancy staff has been engaged on the miles generally.

71st Mile.—The banks have been cleared of bushes, and the towpath has been formed for a small distance. There is an irrigation sluice, of which the gear is not fitted. The bank generally requires forming at the top.

72nd, 73rd, and 74th Miles.—The Pamulpad 2nd class bridge is completed, with its approaches. The banks and towpath are in fair order. Cumbalpallai sluices for surplus water are completed; the masonry is sound, but not of high quality. The shutters and lifting gear are very roughly put together, and the pitch of the screws very small. It would probably take two men three hours to open all the vents, of which there are six.

75th Mile.—A 1st class bridge stands in the heavy cutting in rock in this mile, which takes the canal through the watershed separating the drainage basin of the Kistna river from that of the Pennair. The bridge has been completed for some years, and is in good repair. The cutting is completed, and the bed and towpath of the canal are cleared of rocks. The 5th section ends at 74 miles 57 chains.

General Remarks.—Throughout a considerable portion of this section of the canal the soil is of good quality, and it is partly in cutting, so that the stability of the banks is beyond suspicion; but they are often overgrown with bushes, occasionally cut and guttered by rain, or cracked by the sun, and for a great part of their length narrow at the top, which is unfit for use as a towpath. At certain places noticed in the mileage observations, and especially near the Terrogopillay aqueduct, the earth of which they are formed is of a very bad kind, and it is doubtful whether they would stand at the latter place under a full supply of water. The masonry works sanctioned are all completed; and, though it cannot be said that the class of work is high, still it appears sound, and there are no signs of failure.

The approaches to the bridges have been made up, and are in good order. The surplus discharge works are in the same condition as in the other sections already noticed, and earthen banks have also been laid in front of the calingulah sluices.

All the masonry works of the irrigation sluices have been completed, but most of them have not been supplied with lifting gear for the shutters.

Government have sanctioned for this section the execution of 26 miles of irrigation channels, of which 23 miles have been completed, commanding 9,000 acres of land.

6TH SECTION (74 Miles 57 Chains to 93 Miles 25 Chains).

75th Mile.—The first lock in the canal stands at the end of this mile. It regulates the level of the water in the upper and lower reaches, the depth in the latter being reduced from 9 to 6 feet. The masonry is of fair quality, but the sills to the

for distribution works. It is, however, not correct to say that it is unfit for traffic, for it is convenient enough for riding and towing.

70th Mile.—The earthwork was made good before the 30th June.

71st Mile.—The irrigating sluice and gear here and elsewhere are completely finished.

72nd, 73rd, and 74th Miles.—The shutters and gear are receiving every attention, and all inconvenience is remedied as discovered. This is the usual and obvious course.

General Remarks on 5th Section.—These being favourable where clear and strong, and only unfavourable where doubtful, require no remark from me.

All earthbanks will gutter with rain and crack with the sun, and the banks of this canal will in addition yearly, until a constant supply is provided, be liable to damage and breaches, occasioned by the burrows of animals. The repairs of these are the maintenance.—G. Gordon.

6TH SECTION.

75th Mile.—Gates, sluices, valves, and shutters always, at first, require attention, and can only be gradually brought into close fit and perfect working order. They may all now be said to be complete.

gates are somewhat roughly built. The gates are not very well fitted, and require caulking. The sluices and valves for filling and emptying the lock chamber are in working order; the latter are of wood, revolving pattern. Below the lock the canal is reduced in width from 90 feet to 50 feet at the bed, and a sluice above the lock discharges surplus water coming down the upper reach into the Caulee. There is also a head-sluice for regulating the supply passing down the canal. The shutters of all these are worked by screws with cut thread, giving about 1 inch rise to a revolution, and they are far superior to those in the upper sections, which render the openings and closing of vents a very tedious operation.

76th, 77th, and 78th Miles.—The canal is carried over rocky ground, principally shale, the bed level generally coinciding with that of the ground. The banks are fairly trimmed, but overgrown with bushes for the first two miles. They have generally been formed with a core of rammed earth, supported on either side by shale and soil mixed; and, though reported leaky in some places, they ought to stand the moderate quantity of water which will be required to fill the canal to the proposed depth of 6 feet. Doubtless, however, there will be considerable loss of water from subsoil leakage through fissures in the rock. The towpath is in fair order, but the earth on it is soft and loose. Two 10-foot culverts, a double culvert with two 10-foot spans, and a 1st class bridge, have been completed. The latter requires re-plastering.

79th and 80th Miles.—The canal is free from bushes, and the banks otherwise in the same state as in the previous three miles. There is a 10-foot culvert in the 80th mile, used also as a sub-way.

81st Mile.—A sluice of three vents stands at the head of the Toorcherla Irrigation Channel, which takes off in this mile. The shutters and lifting gear have not been fitted. The channel is $5\frac{1}{2}$ miles in length with $2\frac{1}{2}$ feet fall per mile, and at its head is 24 feet wide at the bottom, with $3\frac{1}{2}$ feet depth of water at full supply-level. No land has yet been irrigated from it. Lock No. 2, at 80 miles 53 chains, has two 10-foot drops and an over-bridge; it is completed. The masonry appears to be of fair quality; the foundations are on rock, as also the floor of the lock chamber. The valves of the filling sluices are of iron, revolving pattern, and are in good working order. Those of the emptying sluices are also of iron, working vertically on friction rollers, the gear consisting of a double rack and pinion with a counterpoise attached to one rack. This is the pattern adopted for all emptying sluices in the locks below, and as at present fitted it is not without defects. The gear requires re-arrangement, as there are at present no stops to prevent the rack with the counterpoise working through and ungearing itself. The alteration is a trifling one, and will readily be made. It has been noted by the chief engineer. The shutter works in angle iron guides, and is not properly kept in its place. The rollers, therefore, are apt to ride on the top of the flange instead of inside it. Some additional fittings are required, and will, it is understood, be supplied. The method of attaching the guides to the masonry is a weak one. The gates are rather roughly adjusted, and require caulking.

76th to 78th Mile.—All bushes will, as a matter of course, be removed by the Conservancy Staff at least twice each year, that being specially their work. The bridge mentioned does not need re-plastering, but if so it will be a matter connected with necessary repairs, and not construction. The cutwaters never were plastered, and certainly do not need it.

In these miles (only) Captain Scott, I am glad to find, frees himself from doubts, and seems confident that the banks are not only "fairly trimmed," but of earth properly arranged and rammed. My orders, written and printed, to select and ram the earth for all banks were clear and frequently repeated, and, I venture to hope, have been carried out in other miles besides these. I never ordered the best earth to be put on the slopes, nor on the top above watermark, and these are the places where Captain Scott seems to have generally looked for it.

81st Mile.—The shutters and lifting gear have since been fitted, but are kept open, there being no need for them at present.

At 80 miles 70 chains, Lock No. 2A., one 10-foot drop. The filling sluices are worked with iron shutters, raised or lowered by rack and pinion without counterpoise. The shutters have rollers, and the arrangement has the defects noticed in regard to the guides of the lock above.

The emptying sluices have shutters and gear of the same pattern as No. 2, and the same remarks apply. The gates are hung, but require caulking. The masonry is of the same class as No. 2. The banks and towpath in this mile are fairly trimmed, but appear to be loose and soft.

82nd Mile.—At 81 miles 28 chains, Lock No. 3, of one 7-foot drop and 12-foot culvert for drainage, used also as subway. The shutters and gear at the emptying and filling sluices are of the same pattern as those at similar parts of Lock No. 2A., and the same observations are applicable. The masonry is of fair quality. The gates are not caulked, and work rather stiffly; they may require some adjustment. The canal banks beyond the locks are somewhat unfinished, and grass and weeds are growing in the bed.*

83rd Mile.—The canal banks are formed in bad soil, but are of strong section, and trimmed neatly. At 82 miles 14 chains, No. 4 lock, two 10-ft. 10-in. drops and two 12-foot culverts for drainage and 2nd class passage under. The masonry is apparently of fair quality; the pointed sills are superior to those in locks above. The arrangements for working the sluices are the same as in the locks above, and require adjustment as before noted. The lock-gates are hung, and shut with a fair degree of closeness. The foundations and bottom of the lock chamber are on rock.

84th Mile.—The banks of the canal are trimmed, and the towpath formed. At 83 miles 30 chains, a double lock, with two 10-foot drops. The chamber has a concrete floor. The masonry is of fair quality, and the sills well cut. The shutters and lifting gear are the same as above, and require adjustment. The gates require caulking. They appear to be well hung.

85th Mile.—At 84 miles 44 chains, Lock No. 6, with one 13-foot drop. The foundations are on rock, which also forms the floor of the lock chamber. The machinery, &c., for the sluices and the gates is in the same condition as in the last lock. The masonry appears to be sound; the sills are well built, though the stones are rather thin. The gates are well hung, and work easily. Under the lock are three 15-foot culverts for drainage, and a passage of the 2nd class of 12 feet span.

The canal banks are formed of indifferent soil, but are fairly trimmed and of proper section.

86th and 87th Miles.—At 85 miles 34 chains, Lock No. 7, two 9-foot drops. The lock and its arrangements are in the same condition generally as in the previous one. One sill requires dressing, as it is not true. The gates should be caulked.

There is a 2nd class passage of 12-foot span under the lock.

At 85 miles 72 chains is an aqueduct with seven spans of 12 feet completed and in good order. The canal banks are trimmed and the towpath formed, but the soil is very loose.

88th and 89th Miles.—At 87 miles 12 chains is a 2nd class bridge, with two spans of 20 feet and one of 40 feet. The approaches are com-

82nd Mile.—The conservancy work referred to has been attended to.

General Observations as to Gates.—The mitre posts of gates should not come together by half an inch when the gates are dry. All gates will have to be similarly adjusted. All gates which fit well dry, swell so when wet as to open a gap *one inch* broad near the point of the sill between the pointing sill and the gate. The little caulking still required is being done by the bankers who watch the locks. These observations apply to all portions of the canal. Stops were fixed sufficient to prevent the counterpoise weights working through if properly hung, and the alteration required is indeed trifling. Additional fittings, so far as I know, are not absolutely required; and there are practical objections to them upon which experience alone can decide. They are being tried and will be adopted if found convenient.

pleted. At 87 miles 62 chains, a culvert of two 12-foot spans. The canal banks are in tolerably good order, and were thrown up a considerable time ago.

90th Mile.—At 89 miles 37 chains, lock No. 8, with 2-foot drops and 2nd class over-bridge. The masonry has been completed. The gates are hung, and the valves and gear are fixed. The sill of the lower chamber at the tail-end requires a little dressing to fit the gates. The masonry is of rough quality, but appears outwardly sound. The lifting gear is precisely similar to that of the locks above, and requires adjustment and additional fittings of the same kind as noticed already. The canal banks above and below are trimmed to proper section. The approaches of the bridge have been completed. In this mile is a culvert recently built with two vents of 10 feet on inverts.

91st Mile.—At 90 miles 3 chains, No. 9 lock, two 8-foot drops. This work is completed. The upper chamber floor is in an invert, and half the lower floor is of the same construction, the other being on natural rock. The sill at the tail-end of the upper chamber requires dressing. The gates have not yet been caulked; they are hung, and swing easily. The valves and gear are in the same condition as those in the locks above. The canal banks are fairly trimmed, and the soil of average quality. At 90 miles 48 chains, lock No. 9A., one 8-foot drop and culvert with three spans of 15 feet for drainage and under-passage. The lock sills are tolerably well built. The floor is paved on a bed of kunker. The valves and gear are fitted, but require stops and guides as in other cases. The masonry is completed, the gates hung, but not caulked.

92nd Mile.—At 91 miles 38 chains, lock No. 10, two 10-foot drops. The work is completed, as in the previous case, except that it requires fitting, as noted in others. The chamber is floored on concrete. The banks are trimmed to proper section, but soft, and they have never had any quantity of water against them. There are numerous holes and cracks to be seen.

93rd Mile.—At 92 miles 8 chains, lock No. 11, one 10-foot drop and 2nd class over-bridge. The work generally is in a complete state. The gates are hung, but not caulked. The sills are fairly built. The masonry, of the usual class, roughly built of small stones, but apparently sound. The valves and lifting gear in their places. The approaches of the bridge completed.

Lock No. 12, at 92 miles 30 chains, one 10-ft. 9-in. drop. This work is in the same condition as the last. The lower gates do not appear to close well.

General Remarks.—This section contains a number of important works in the shape of locks, of which there are 14, giving a fall collectively of 190 feet 5 inches from the water-shed separating the Kistna and Pennair systems of drainage to the bed of the Caulee River. The details of their construction are the same, and, except in respect to certain trifling alterations or additions noted in the mileage observations, they may be considered complete. The masonry work in the section generally cannot be considered anything but inferior; it is composed of small stones, some of them not exceeding 3 inches in thickness, and the joints within the face of the works are large, nor in the cases where the masons were seen at work did it appear that much attention was paid to bond.

82nd to 93rd Mile.—Captain Scott's observations upon these miles, and his general remarks upon the 6th section, are upon the whole very satisfactory; the trifling additions to and want of adjustment in the lock-gates, gear, &c., have been already remarked upon. I have at the commencement of this paper shown that the testing of a canal to the full depth of water immediately after construction is inconsistent with, and might be destructive of, the economic system adopted with the consent of all parties, but I am persuaded that after the present season a test may safely be adopted. The soil used throughout has, like all the rest, been the best to be had in the locality, and has been used with the full knowledge and approval of successive consulting engineers of Government. All its defects will be overcome by proper and gradual consolidation, and no risk incurred.

* We cannot help weeds growing.—
J. H. L.

Until the locks are filled and tested under a full head of water for some time, it would be difficult to pronounce a decided opinion as to their stability. The gates are roughly made; but no doubt, when caulked and altered, as experience shows to be necessary, they will work satisfactorily.

So far as regards outward appearance, the canal banks are generally in a complete and satisfactory state; they are, as a rule, trimmed to a proper section, and the towpath is found (*sic*) to full width. They have, however, never been tested by the presence of water to any depth approaching that which is to fill the canal, and they appear to be loosely formed, so that it is very doubtful whether they would stand such a trial as they would be subjected to by the sudden filling of the canal.

The masonry work sanctioned for this section, including bridges with their approaches, has been completed. There are no 3rd class bridges, and no calingulahs.

As regards distribution works, 80½ miles of irrigation channels and 13 miles of vagoo have been sanctioned, and 27 miles executed, commanding 12,000 acres of land.

About 50 miles of main channel are included in the 80 sanctioned.

7th SECTION (94th Mile to 116th Mile 69 Chains).

Jootoor Anicut and Head-works.—A small quantity of masonry work still requires to be built to raise the side wall of the regulating lock chamber to full level, and a little cutting to lower the bed of the canal in front of the lock. In other respects the works appear to be completed. The lock chamber is on rock foundation; the masonry is of the same character generally as in the works on the section already inspected; the lock-sills are, however, of better construction, formed of thicker stones. The gates are caulked and hung, and fit fairly. The gear for the shutters of the under and head-sluiques has been fitted, and is ready for use. It does not appear, however, to work easily, and the raising and lowering of the shutters will be rather a tedious process. The shutters do not fit closely to the masonry at the head of the vents, being kept out by the iron guide, which has not been counter-sunk into the masonry. Some wooden fittings will be added to close the aperture. A training wall to direct the river into the canal-head and scour the silt from the front of the lock and head-sluique has been completed. The whole of the masonry appears to be in good repair, and free from cracks and signs of unequal settlement.

94th Mile.—At 93 miles 70 chains is a second class bridge of the usual pattern. The approaches have been completed; the canal is in cutting; and the slopes and towpath are in fair order.

95th, 96th, and 97th miles.—At 95 miles 0 chains is an inlet on the upper side, with its crest about 5 feet above the country. A considerable quantity of land will be flooded by the standing water. At 95 miles 17 chains is a 2nd class bridge; at 96 miles 75 chains is an irrigation sluice of five vents, calculated to deliver 10,000 cubic yards per hour. The banks and tow-path are neatly trimmed.

98th and 99th Miles.—At 97 miles 4 chains, culvert No. 5; and 97 miles 26 chains, calingulah

7th SECTION.

Jootoor Anicut.—The whole of the masonry was finished before the 30th June. The cause why the gear did not work well on Captain Scott's inspection was merely the absence of a proper key. There is no difficulty now in working the gear. The shutters were closely fitted before the 30th June.

94th to 97th Mile, inclusive.—Captain Scott's remarks being satisfactory, except the observation that a considerable quantity of land would be flooded by the standing water, I need make no remark beyond the statement that all the works were constructed in accordance with approved plans.

98th to 104th Mile.—I agree with Captain Scott, that the piers of calingulah No. 6 are unnecessarily

No. 6, with a sluice of five vents fitted with English-made gear. The piers of this calingulah are unnecessarily thick, and contract the waterway. The banks beyond have been cut down to 8 feet above bed-level for a length of 350 feet, as a precautionary measure. At 97 miles 53 chains, 2nd class bridge 7 A: the approaches are completed; the masonry is roughly built. At 98 miles 19 chains, an irrigation sluice, and at 98 miles 65 chains, a syphon culvert of 8-feet span have been built. The banks and slopes are in good condition, and the tow-path has been made up.

100th and 101st Miles.—At 99 miles 26 chains, calingulah No. 9, with sluice of five vents fitted with lifting gear as at No. 6; the masonry is rough. At 99 miles 79 chains, an irrigation sluice; at 100 miles 25 chains, a 2nd class bridge completed with approaches; at 100 miles 52 chains, a culvert of two spans; at 101 miles 3 chains, an irrigation sluice completed. The canal banks and tow-path are in good order.

102nd and 103rd Miles.—At 101 miles 13 chains, culvert No. 10 A., two 5-feet vents; masonry inferior. The lower bank of the canal in the 102nd mile has recently been raised; the earth is loosely laid on, not rammed or watered. At 101 miles 51 chains is a syphon culvert of one 5-feet vent; the outlet requires to be cleared, and the ground sloped up from the sill, which is below the bed of the vagoo. At 101 miles 71 chains, Byup Coodoor, 3rd class bridge. The parapet walls are being completed. The roadway is 24 feet above the bed of the canal; the approaches are at an incline of one in six, and almost impracticable for loaded bandies. The width of the roadway is 6 feet. Carts lightly loaded can be drawn over by hand with great exertion, but the passage with bullocks is dangerous.

The banks of the canal are generally in a neat state, and the tow-path formed, but soft.

104th to 109th Miles (both inclusive).—At 103 miles 29 chains, culvert with six 5-feet openings. The outlet requires opening out, as noted in a previous case. 104 miles 15 chains, a 2nd class bridge completed with approaches. At 105 miles 4 chains, a culvert of four 5-feet openings; the outlet too much confined. 106 miles 49 chains, an aqueduct, five spans of 8 feet; the masonry of this work is inferior quality. 106 miles 58 chains, 2nd class bridge, No. 19 A., completed; masonry very rough. 106 miles 72 chains, Nundial aqueduct, 22 vents of 10 feet span; this work was very leaky, and has recently been repaired; the masonry is of the same character as in other works noticed in the section. At 107 miles 79 chains is a culvert, with three vents of 5-feet span. At 108 miles 9 chains, an irrigation sluice of nine vents. At 108 miles 69 chains, a culvert of four 5-feet vents; and at 109 miles 9 chains, a 1st class bridge at Ayaloor with approaches. All these have been completed. When additions of masonry have been recently made, or when building is going on as at Byup Coodoor, the work last built is somewhat inferior to that of an earlier date, and more hastily put together.

110th and 111th Miles.—At 110 miles 13 chains, a culvert with one 8-feet vent; at 110 miles 19 chains, an irrigation sluice; and at 110 miles 22 chains, a 2nd class bridge with approaches; all completed. The banks and tow-path have been trimmed neatly to a proper section. The canal is generally in cutting.

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unnecessarily thick, and contract the waterway. When the plans, as prepared by the divisional engineer, were submitted to the Madras Government, I pointed out the thickness, and stated that it was my intention to reduce it during construction. It seemed to me to be a draughtsman's error hardly worth mentioning, except to say that it would not be carried into the building. The Government, however, in their Order 1103, of 26th April 1870, positively ordered that the error should be adhered to; and, on my remonstrating, the consulting engineer replied that, as Government had expressly ordered it, he saw no reason to refer to them again.

It is satisfactory that, although Captain Scott says with reference to the second class bridge that the masonry is roughly built, it cannot possibly be said to be rougher than the old work in Hindry Aqueduct, approved as sample work; and it has been approved by the consulting engineer as being in accordance with the plans and estimates.

The question regarding bridges has been for a long time under the careful consideration of Government, and all have been constructed according to their wishes, and the plans approved by them. The completion of the parapet of the bridge at Byapgoodoor was deferred till the last moment, in hopes of some decision from Government being received before it was built; it is a foot thick, and was seen by Captain Scott before the coping was put on. Although it is a very trifling matter, I think that the outlet of the syphon culvert, at 10 miles 51 chains, does not require clearing. This culvert drains perhaps 10 acres. Its chief use is to carry a small irrigating stream from the old village tank above, and the villagers treat the outlet as they like, so as to raise the water to the level they need above the surface. Any silt deposited in culverts 15 and 17 in the 104th and 105th miles, is and must be periodically removed.

110th to 116th Mile, inclusive.—The report is favourable regarding these miles, and requires no reply.

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112th and 113th Miles.—At 111 miles 39 chains, a culvert with four vents of 8 feet; at 111 miles 44 chains, an irrigation sluice; at 111 miles 61 chains, a 2nd class bridge, with approaches; all completed. The banks and tow-path are in good form.

114th, 115th, and 116th Miles.—At 113 miles 40 chains, a culvert of two vents of 10 feet. The outlet requires clearing, as the sill is below the level of the bed of the vagoo. 113 miles 56 chains, Deepagoontla, 1st class bridge; completed. The upper portion of the masonry is more roughly built than the lower. The banks of the canal are neatly sloped, and appear to be of full thickness, but the inner slope has bushes growing on it which should be rooted up.

General Remarks.—There is little to note in this section. The masonry works, with the exception of those at Jootoor, are comparatively few and unimportant, and the canal is generally more or less in cutting. The character of the masonry is the same as in the sections above. All the works sanctioned may be considered completed. The earthwork, to outward appearance, is generally in good condition; the banks are neatly trimmed, of full section, and the tow-path formed; and, if the water is admitted with due caution, it is probable that there will be no failure. The approaches of the bridges have been made up, and the parapet walls of the third class bridge lowered. There is only one lock in the section, which is built in connection with the head works at Jootoor, and it will be fully completed by the 30th June.

The surplus discharge works have not been improved, but remain exactly in the same condition as before the floods of August 1870. The irrigation sluices are in all respects completed, and in readiness to deliver water when required. The cutting of the channel leading from the sluices has, in many cases, been suspended, in accordance with the wishes of Government, until a demand has been made by the villages for water.

In this section, 29 miles of channel have been sanctioned for execution; four miles have been cut, commanding 1,800 acres of land.

8th SECTION (116 Miles 69 Chains to 143 Miles 25 Chains).

116th Mile (continued).—At 116 miles 69 chains, a 2nd class bridge completed.

118th and 119th Miles.—At 117 miles 49 chains, a surplus calingulah with sluices for discharging surplus into the Koondaur river, a calingulah and inlet for passing irrigation supply round the lock, lock No. 1, with one 10-foot drop. All these works have been completed. The masonry is rubble coursed, some stones not exceeding three inches in thickness. The lock sills are fairly executed; the gates are hung and work easily. They are well made, much superior to those in the locks above. The valves and gear are in their places, their construction being uniform with that in locks already inspected. The racks carrying the balance weights require re-adjustment, as they reach the stop before the valve is fully open. Other fittings are required to prevent the valves, when being lowered, from swinging off the guide and riding on the flange. The lower gates do not close sufficiently, and require alteration. The canal banks are fairly trimmed and in good condition.

General Remarks on 7th Section.—I cannot add anything to improve Captain Scott's general remarks upon this section; they show the works to be completed and in good condition.

8th SECTION.

116th to 120th Mile, inclusive.—The few trifling matters referred to by Captain Scott as requiring attention, have been attended to; his other remarks are favourable.

120th Mile.—At 119 miles 22 chains, lock No. 2, one 10-foot drop, and 2nd class over-bridge, completed. Calingulah and inlet. The masonry is the same as at No. 1, and the racks and valves require re-arrangement also. The gates are hung and work fairly. At 119 miles 72 chains, lock No. 3 of one 10-foot drop, also calingulah and inlet irrigation sluice of three vents, all completed. The masonry as above. The gates do not fit well, and the valves and gear require alteration as noted before. The canal banks are of good section, trimmed, and the tow-path formed.

121st and 122nd Miles.—The inside slope of the banks requires clearing of bushes. The canal bed is for a few yards too high and is being lowered. The banks are in good order.

123rd Mile.—At 122 miles 7 chains, lock No. 4, of one 10-foot drop. Calingulah and inlet, and 2nd class over-bridge, all completed. The remarks on lock No. 3 are applicable to this work. The canal banks are of good section and trimmed. At 123 miles 5 chains, lock No. 5, one drop of 11½ feet; calingulah and inlet completed. Gates hung and valves and gear in their places. The upper gates work very stiffly. The remarks as to the masonry and gear of the locks above are also applicable here.

124th and 125th Miles.—At 124 miles 4 chains, lock No. 6, of one 10-foot drop, with calingulah and inlet as before, and irrigation sluice on the right bank all completed. The gates are hung. Valves and gear require alterations as at lock No. 1. The canal banks require making. In some places coolies are at work.

At 124 miles 70 chains, lock No. 7, with one 10-foot drop; calingulah, inlet, 2nd class over-bridge, and irrigation sluice, all completed. The gates fit fairly. Valves and gear in the same condition as before noted.

126th Mile.—At 125 miles 67 chains, lock No. 8, with one 10-foot drop. Calingulah, inlet, irrigation sluice, completed. Gates hung, and valves and gear in their places. Re-adjustment required as at the other locks. The canal banks appear to be sound and of full section.

127th Mile.—At 127 miles 11 chains, lock No. 9, with one drop of 11 feet, 2nd class over-bridge, calingulah, and inlet, all completed. The gates work stiffly. The valves and gear require re-arrangement. The canal banks and tow-path are in good order.

129th, 130th, and 131st Miles.—At 128 miles 35 chains, lock No. 10, with one 10-foot drop, and two irrigation sluices, completed. The gates work easily. In other respects this work is in the same condition as No. 9 lock.

At 130 miles 50 chains, lock No. 10A, with one 8-foot drop and 2nd class over-bridge. The works and approaches are completed and the gates hung. The valves and gear require re-adjustment and some fittings, as noted at the other locks.

132nd and 133rd Miles.—At 131 miles 64 chains, is an irrigation sluice with shutters complete, and at 131 miles 29 chains a culvert. The canal banks continue in good condition.

134th, 135th, and 136th Miles.—At 133 miles 57 chains, lock No. 11, with one 12½ feet drop and 2nd class over-bridge; all masonry completed. The lifting gear of the shutters has not been finally fitted. The foundation is on rock.

121st and 122nd Miles.—The banks and bed were finished before the 30th June.

123rd to 125th Mile.—The banks were completely trimmed and the coolies removed before the end of June.

126th to 133rd Mile.—The remarks on these miles are favourable and show completion. The stiffness in working the gates, due to the swelling of the heel-posts by the water, has been corrected. The keys of the anchor straps are designed with a power of double adjustment, so as to admit of correction with the utmost ease and expedition.

134th to 144th Mile.—All the banks and slopes have been trimmed. The previous observations regarding shutters and gear apply here also. The rough bank below lock 12 should hardly be called canal bank. It is spoil.

The inner slope of the canal bank for some small distance has not been trimmed,* but for the greater portion of this mileage the earthwork is in good order.

At 135 miles 47 chains is a 2nd class bridge, with approaches completed. The masonry is of better quality than usual.

137th and 138th Miles.—At 137 miles 1 chain is a 2nd class bridge, with approaches, completed.

At 137 miles 69 chains, lock No. 12, with one 13-foot drop. The gates are well made and fit fairly. The masonry is of better quality than has yet been observed in the locks. The lifting gear for the valves is in place, but not perfectly fitted. The canal banks immediately below the lock are in somewhat rough condition, but throughout the greater part of this distance they have been neatly trimmed. The canal is generally more or less in cutting, and they are of strong section.

139th and 140th Miles.—At 139 miles 49 chains, lock No. 13, with one 12½-foot drop. Foundations on rock, the masonry is equal in quality to that in No. 12. There is one over-bridge with approaches, and an irrigation sluice also connected with an inlet below the lock; all the masonry and earthwork is completed, and the gates are hung, but the lifting gear requires to be properly fitted. The canal banks are in good order.

141st and 142nd Miles.—At 141 miles 70 chains, lock No. 14, with one 12½-foot drop. The masonry is rough and not so good as in the two immediately above. There is an over-bridge of the 2nd class with approaches. The lifting gear to the sluice valves has not been permanently fitted. In other respects these works are completed. The canal bank and towpath are in good order, but loose and without grass.

143rd and 144th Miles.—At 143 miles 53 chains, lock No. 15, with a drop of 12½-feet. This work is completed, and the valves and gear are in their places. The gates are hung. The canal banks are neatly trimmed, and the towpath formed.

General Remarks.—There are 16 locks on this part of the canal, giving collectively a fall of 173 ft. 6 in. to the bed of the Koondaur river. The masonry of all is completed, and appears sound, though not of a high class. The gates have all been hung and are in working order, but it is, of course, not improbable that some slight defects will show themselves when water is let in. The valves and lifting gear of all the sluices are in their places, but it cannot be said that they are in proper adjustment, and some additional fittings are required to prevent the former from swaying off the bed of the guides. It should be remarked that the masonry in the 12th, 13th, and 15th locks is superior to that in other works in the section, all of which are completed.

The canal banks are throughout, or with very trifling exceptions, in excellent order; they have been neatly trimmed and the towpath formed and rammed. They present a very neat appearance, but unfortunately they are but little consolidated, and they must settle very considerably before they can be considered safe. The approaches of

* I do not know whether spoil is referred to or true bank, and I forget whether this was trimmed by the 30th June. I suppose it was, but, as I said, I did not think want of trimming worth notice in detail. The banks are as good in the worst places as the Great Indian Peninsula Railway banks, but of course ought to be, and are as a rule, kept better than railway banks.—J. H. L.

General Remarks on Section 3.—These are very satisfactory, and show good completion.

all the bridges are finished. Except at the head of the section, there are no calingulahs for the discharge of surplus water. The canal is in a succession of still water reaches, that is to say, the bed has no fall between the locks. Water required for irrigation, which it is proposed to supply to a limited extent, is passed round each lock by means of a small calingulah above and an inlet below, connected by a channel.

Sanction has been obtained for the excavation of 64 miles of irrigation channel, of which 23 miles are nearly completed, commanding 10,200 acres of land.

9th SECTION (143 Miles 25 Chains to 178 Miles 40 Chains):

144th Mile (continued).—At 143 miles 77 chains is a culvert, No. 2, of three 5-foot openings. The banks are neatly shaped, but soft.

145th Mile.—At 144 miles 63 chains, 2nd class bridge and approaches completed in fair masonry.

146th Mile.—At 145 miles 52 chains, culvert No. 4; at 145 miles 62 chains, lock No. 16, anicut across the Koondaur river, head sluice, under sluices, and supply branch of canal, constituting Rajoly head works.

The anicut is now perfectly sound, but the action of the river has been to tear up the rocky bed immediately below it, heaping up the fragments some 20 feet lower down. At present the result is the formation of a water cushion below the anicut crest, and it is possible that this will prevent the dislodgment of the rock from being carried so far as to endanger the foundations of the work which are exposed. On the other hand, repairs may become necessary. The only work remaining to be done is the raising of the masonry of the under sluices 18 inches, and this will be completed in a few days. The lock is in readiness for use. The canal at the sluice is in cutting in very bad soil, and it has been necessary to revet the slopes with rough stone for a distance of three-quarters of a mile.

147th and 148th Miles.—Near the head works the drainage water is led into the canal by means of small inlets. The earthwork and tow-path are in a rough state.

At 147 miles 35 chains is a culvert of two spans of 12 feet. At 147 miles 70 chains, Velala, 2nd class bridge, with approaches completed. The outer slope of the canal cutting is fairly trimmed; but the tow-path is not formed, and the soil is so bad that in rainy weather it would be almost impossible to make way. Above the bridge, the lower bank of the canal has been cut down to a level of 2 feet above water, to breach in case of flood.

149th Mile.—Canal partly in cutting; banks rough on the top, but fairly trimmed on the inside. At 148 miles 32 chains is a culvert.

150th, 151st, 152nd Miles.—The soil of which the canal banks are composed is of the worst possible kind, and they are not consolidated. At 151 miles 64 chains the Vaikalair aqueduct carries the canal across the river of that name. This work appears to be in good order, but the banks near it are dangerous; they are said to have breached last year. As they have had water

9th SECTION.

146th Mile.—The under sluices of the Rajoly anicut are complete. No danger nor need of repair has occurred to the anicut from the breaking up of rock. The foundation is on the most solid beds. I make this remark merely to satisfy as to the future. Captain Scott's report shows that the work has been finished, and is in good working condition.

147th and 148th Miles.—The earthwork and tow-path have been under the bankers' hands since Captain Scott's inspection.

149th to 150th mile.—The only remark required from me is that the soil used was the best in its locality (it was so used with the approval of Government), and will consolidate with time permanently. The embankments, however, are so small, that a breach would be but a slight expense.

against them, probably they have improved. They are fairly trimmed.

153rd, 154th, 155th, and 156th Miles.—The following masonry works are noticed. At 153 miles 1 chain a 1st class bridge on the Cuddapah road with approaches completed. The masonry of the usual kind. At 153 miles 26 chains an aqueduct, with five spans of 8 feet, in good order. At 153 miles 22 chains a culvert with two 5-foot vents. At 155 miles 30 chains a 2nd class bridge and irrigation sluice. At 155 miles 77 chains there is a small culvert passing the water of an irrigation channel under the canal. The masonry is very leaky. At 156 miles 6 chains a culvert of three vents of 12-foot span. All these works are completed. The banks of the canal are in far better condition in this part of the section than near the head works. The soil is gravelly, or mixed with kunkur, and the earthwork is neatly trimmed.

Because the soil is better.
—G.G.

157th, 158th, and 159th Miles.—At 156 miles 77 chains an irrigation sluice, the shutter not fitted. At 156 miles 78 chains a culvert. At 157 miles 26 chains an irrigation sluice. At 157 miles 40 chains a 2nd class bridge. At 158 miles 8 chains a culvert. The banks are neatly trimmed and sloped; the canal is mostly in cutting.

160th Mile.—At 160 miles 21 chains an irrigation culvert. At 160 miles 25 chains Dhoor aqueduct, with two 20-foot span, one used as a subway. The masonry appears sound, though roughly put together. The banks on either side are formed of bad soil, and they are not consolidated. They would hardly stand against a full head of water.

160th Mile.—When (after Captain Scott's inspection) I saw the Dhoor aqueduct, water had been flowing over it for some weeks, and the banks were remarkably tight, owing to the improvements made last year.

161st and 162nd Miles.—The canal is mostly in cutting, and the banks are fairly trimmed. At 161 miles 40 chains there is a 1st class bridge, with approaches completed.

163rd to 167th Miles (inclusive).—The banks and side cuttings of the canal are neatly sloped, and present a good appearance; but the soil is of bad quality generally. In the 167th mile they were breached for two years successively, and the earthwork has been puddled and strengthened at the weak point. The following completed masonry works were noticed. At 162 miles 17 chains Dhoor irrigation sluice. At 162 miles 27 chains a culvert of one 12-foot span used as an under passage. At 162 miles 30 chains a calingulah and scouring sluice with two vents. At 163 miles 12 chains an irrigation sluice of two vents. At 165 miles 25 chains Beempad irrigation sluice. 165 miles 40 chains a culvert and subway of three spans of 12 feet. In the roadway there was more than a foot of water. At 166 miles 32 chains a culvert of four vents, each 9-foot span.

168th Mile.—The canal was breached last year by the Chintagoonta tank surplus water. The channel has now been diverted by a cut to the Bainapillay aqueduct. At 167 miles 16 chains is an irrigation sluice, with shutters and gear completed.

169th to 171st Miles (inclusive).—The canal is generally more or less in cutting in fair soil. At the beginning of the 171st mile the banks are narrow at the top and too much rounded, otherwise they are in neat condition. Masonry works, as enumerated below, have been finished. At 168 miles 48 chains Bainapillay aqueduct, with eight openings of 15 feet. At 169 miles 23 chains Pee-

chapaud tank supply channel, culvert two vents of 9 feet. At 169 miles 55 chains Peechapaud aqueduct, with seven spans of 15 feet. The wing walls are said to be somewhat leaky. At 169 miles 65 chains a calingulah 160 feet in length. All the masonry is sound, though roughly built.

172nd Mile.—At 171 miles 30 chains Yaitoor irrigation sluice of 10 vents is incomplete; the lifting-gear stands have not all been built in. There is about three days' work to do. Also Maidkoor irrigation sluice, at 171 miles 41 chains, requires an addition of about 1½ feet of masonry at the top; a couple of days' work would complete it. At 171 miles 60 chains stands the 1st lock in the section. There is one drop of 8½ feet. The masonry is completed, the gates are hung, and the valves and gear of the sluices are in their places; but it is evident that the latter especially have been hastily put together, and they are by no means fully adjusted. The vents will be fitted with guiding stones or blocks to force the valves when they are about to close into their proper places, and prevent them from swaying on to the projecting flange of the iron groove in which the rollers should work. In fact, the same arrangements should be made as have been proposed for the works in the upper sections, and the racks with balance weights require arrangement. The gates are well made, and appear to fit fairly. The masonry is rough, but there are no settlements or cracks to be seen; the mortar, however, appears to have been a good deal washed out of the joints, so much so that in some places repointing is required; this would lead to the inference that the lime used was not very good. The banks of the canal are in good order.

173rd and 174th Miles.—At 172 miles 15 chains lock No. 2 with one 8½ feet drop. The racks belonging to the lifting gear of the emptying sluice valves have not yet been fitted. In other respects the condition of this work is generally the same as that of No. 1 lock. At 172 miles 61 chains lock No. 3 with one 10 feet drop. The upper gate on the east side will have to be re-hung and the anchor refixed. When swung, the masonry holding the anchor was torn away from its bed. The condition of the work is the same as No. 1 lock. The gates work very stiffly. The canal banks and towpath are in proper order. At 173 miles 32 chains is a culvert with two spans of five feet.

175th Mile.—At 174 miles 3 chains lock No. 4, one 12 feet drop. The masonry is completed, and is of better quality than that at Nos. 1, 2, and 3. The gates are hung, but the upper pair do not fit properly, and, though the valves are placed in the guides, the gear for lifting them has not all been fixed. At 174 miles 75 chains lock No. 5 of one 10 feet drop. Masonry as at No. 4. The upper gates do not close well, and the gear for the valves requires adjustment. The banks and towpath are properly formed.

176th to 178th Miles.—At 175 miles 26 chains culvert with one 5 feet vent. At 176 miles 70 chains lock No. 6, one 10 feet drop. Masonry completed. The gates have been hung and work fairly. The valves are placed, but the lifting gear requires some more fitting. There is one over-bridge of the 2nd class with approaches completed.

178th Mile.—At 177 miles 34 chains, lock No. 7, one 8½ feet drop, masonry completed and 107.

161st to 178th Mile.—I need not notice the remarks as to these miles, because they report satisfactory
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appears sound. The gates are hung, but neither pair close properly. The lifting gear to the lower valves has not yet been fixed, but it is on the ground. The canal banks have been sloped and trimmed to a proper section.

General Remarks.—In the first mile below the Rajoly head works the earthwork is hardly in as finished a state as it might be; but throughout the remainder of the section the embankments are in fair form and of full dimensions, the canal bed is clear and the slopes neatly trimmed. The soil is, however, in many parts of exceedingly bad quality, and not at all consolidated, and the banks will settle very considerably when water is admitted against them. There are not a

There are a few places where a sudden filling would be dangerous. — G. G.

few places where it seems almost certain that breaches would be made, if a full supply were allowed to flow in. Great caution and watchfulness will be needed in working the irrigation supply in this section, until all settlement has ceased. The top of the bank is only 3 feet above full water. All the masonry work has been completed, except in some trifling instances, involving a few days' labour. The lock gates have been hung, and the sluice valves are in their places, but it cannot be said that all work in connexion with these appurtenances is finished; on the contrary, there is hardly a single lock at which there is not something more to do in adjusting lifting gear, valves, or gates, and in some cases the gear has not been put up; certainly the work to be done is, in each particular case, trifling in extent, but in the aggregate it amounts to something not inconsiderable. The bridge approaches have all been made up. In this, as in all the other sections, there has been no attempt to enlarge or improve the surplus discharge works. All the irrigation sluices in the canal banks have been built, and the fittings still required for some of these may easily be supplied in a few days.

None is needed in this section. — G. G.

As regards the irrigation channels, Government have sanctioned projects involving the cutting of 37 miles 60 chains of primary channel, of which 14 miles 60 chains have been completed, commanding 8,600 acres.

10TH SECTION (179th to 189th Miles).

179th and 180th Miles.—At 178 miles 52 chains lock No. 8, one 10 feet drop, and 2nd class over-bridge. The masonry all completed, and the gates hung, but the lifting gear is not fitted. The canal banks are very neatly trimmed, but they are soft. The high flood bank to the Pennair river commences at the lock on the west side of the canal.

182nd Mile.—At 181 miles 10 chains stands the Pennair tail lock, giving access to the river above the anicut. The masonry of this work has been completed, except that part which is required to bed the wooden frames carrying the stands of the lifting gear. The gates are hung and fit fairly. The valves are placed, but the lifting gear is not fixed, and, in fact, some of it only arrived from Madras on the day on which the inspection was made. The quality of the masonry is good. The flood bank connecting the lock with the anicut wing-wall is completed, and in good order. The whole of the anicut with the under-sluices is in a complete state and good repair, and the quality of the work is very good. The head-sluices are also completed in every respect, and so is the head lock, with the single exception of

satisfactory completion, the stiffness in working the gear, shutters, &c., being matters to be remedied by the Conservancy Staff.

General Remarks on 9th Section.—Owing to the late arrival of parts of the machinery made in Madras to replace breakages or as extras, some of the lifting racks in the 9th Section were not in place and complete by the end of June. They were all delivered about that date, and required only bolting on. No drainage water flows in this canal, except a very small quantity in the first two miles—and for this the surplus discharge works are already more than sufficient.

10TH SECTION.

179th to 190th Mile.—All the trifling requirements of Captain Scott have been supplied, and as his remarks are favourable (except as to the question of consolidation, which I have dealt with at the commencement of this paper), I need not further refer to them.

some fittings required for the lifting gear of the upper-sluice valves.* There are no flood banks below the anicut, but they would seem to be necessary, for the afflux caused by the anicut would probably not equal 18 inches in a high flood, and the water below would only be lower by that quantity, which would leave the flood level considerably above the top of the existing canal bank on the east side.

182nd and 183rd Miles.—The canal is in cutting. The slopes are neatly cut. The water throughout the canal from the head-sluice on the Pennair to the Cuddapah terminus was on the average 1 ft. 6 in. deep.

184th Mile.—The banks are trimmed, and appear to be of proper dimensions, but they breached in two successive years with a small head of water. They have been puddled at the places in question. At 183 miles 51 chains is an aqueduct, with seven spans of 30 feet, crossing the Punkal wunkah. The work is completed, and there appeared to be no leakage worthy of notice.

185th Mile.—The small quantity of water now in the canal has had a considerable effect in the banks. In many places they are undercut by the wash, and they will require to be revetted.

186th Mile.—At 185 miles 48 chains a culvert, with one 10 feet vent, and at 185 miles 55 chains a second, with two 10 feet vents. At 186 miles 30 chains a 2nd class bridge and approaches, and an irrigation sluice. All these are completed.

187th Mile.—At 186 miles 69 chains an aqueduct of four spans of 10 feet; the masonry is of average quality. The face walls leak, but not to any serious extent. At the junction of the wing-wall with the earthwork, the earth has been cut away by the scour, and it is being revetted to prevent a breach.

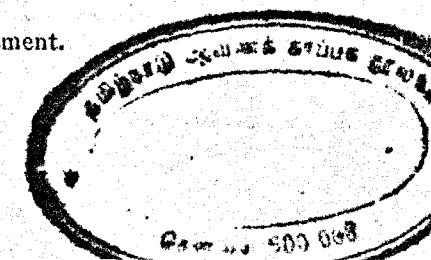
188th and 189th Miles.—The canal banks are cut by the water. They would hardly stand the wash caused by boats without considerable injury and frequent repairs. At 188 miles 8 chains, one 10 feet culvert and irrigation sluice (Mundla Pilly), completed. Also tail sluice, with three vents of 4 feet square. The gear for the shutters is not yet fixed.

General Remarks.—The earthwork in the last section of the canal is very much in the same condition as in the portions above. The banks have been neatly trimmed, and they appear to be of proper height and section, but there is little appearance of consolidation, and it seems very unlikely that they would throughout stand against a full head of water. There is very little appearance of grass which would protect the slopes, and those inside the canal are altogether too steep to be permanently maintained without revetment of some kind. They seem to yield at once to the lap of the water and fall in. All the masonry works will be completed by the end of the present month, as the quantity remaining to be done is very trifling. The lock-gates are hung and work tolerably well, and the valves of the sluices are placed, but there is still some gear to be fitted. All the bridge approaches are made up. There are no surplus discharge works, properly so called, in the section. The irrigation sluices are all completed and fitted with shutters.

Nine miles 57 chains of irrigation channel have been sanctioned for execution, and seven miles 70 chains have been completed, commanding 3,788 acres.

Fort St. George,
6 July 1871.

A. de C. Scott, Captain, R.E.,
Under Secretary to Government,
Public Works Department.



26. I have now reviewed Captain Scott's mileage and general remarks, and I must express my gratification at the result of his inspection. The Main Canal is 190 miles in length, and these contain works of some importance in an engineering view; but so satisfactorily and completely have they been constructed (according to the system adopted), that, setting aside conjectures which I have not discussed, since they are irrelevant to the question, no defect worth consideration was discovered, after a careful inspection by an officer specially appointed for that purpose (those noticed being such insignificant matters, as stiffness and want of adjustment in the working of lifting gear, shutters, and lock-gates, with slight irregularities in the tow-path, and the like), whilst all the additions stated to be necessary or advisable were so inconsiderable, that they have been since supplied, or are being so, and the entire cost will not exceed, as I believe, 1,500 £. Every requisition made by the Government of Madras before the 30th June was complied with; those mentioned in Captain Scott's Report were not, as the date of the Order of Government (27th July 1871) will show, made known until one month afterwards.

27. The two questions as to consolidation and the construction of additional calingulah accommodation, do not affect the question of completion under the terms of the supplementary contract, and are in the hands of the Board, who will, I doubt not, issue all necessary instructions regarding them.

Little Eaton, Derby.

J. H. Latham, Chief Engineer.

MEMORANDUM.

CAPTAIN SCOTT'S Report is, I think, on the whole, favourable, for he states generally that the works are finished according to the sanctioned plans, and in a state to deal with the water when it is admitted.

Although the constantly recurring remarks as to the "inferior" quality of the masonry, and that the banks are not consolidated (he should have said not *yet* consolidated), give an unfavourable complexion to the Report, Mr. Latham's reply shows that they do not imply non-completion. A very high class of masonry would have been unsuitable and extravagant. The banks will consolidate and they have *not*, as far as my observation in the last two years I was on the works enables me to report, been thrown up at random. A gang of men was always employed ramming the earth; employed by the company, and not by the contractors.

Other unfavourable remarks of Captain Scott's, which I have marked P, are less criticisms of the work than strictures on the opinions of the various consulting engineers of Government, as expressed in their approval and sanction from time to time. No amount of finish could have insured the canal being completed "to the satisfaction of Government," to which expression no limit is fixed. If, as in the matter of the calingulahs, a work is not allowed to be complete until every possible improvement has been made, it would *never* be finished.

The Government Order seems to me to go beyond Captain Scott's Report. The canal is in working order if it can supply the water required.

London, 8 November 1871.

G. Gordon.

— No. 24. —

The Assistant Under Secretary of State for India to the Secretary of the Madras Irrigation Company.

Sir,

India Office, 7th November 1871.

I AM directed by the Secretary of State for India in Council to draw your attention to Mr. Melvill's letter of the 13th of July last, and to request that he may be favoured with an early reply to the inquiry therein contained, as to the pecuniary resources of the Madras Irrigation and Canal Company.

I am, &c.

James C. Melvill.

— No. 25. —

The Secretary of the Madras Irrigation and Canal Company to the Under Secretary of State for India.

8 and 9, Queen-street-place, London.

21 November 1871 (No. 7).

Sir,

By the desire of the directors of this company, I have the honour to acknowledge the receipt of your letters of the 7th instant, and the 13th of July last, and, in reply to the former, to state, for the information of his Grace the Secretary

tary of State for India, that the fund remaining in the hands of the company on the 1st of July last, when the works which form the subject of the supplementary contract were completed in accordance with the terms of that deed, consisted of a small balance of capital augmented by receipts from other sources.

Portions of this fund have since been, and are now being applied to the construction of irrigation channels, postponed at the instance and with the approval of the Government of Madras; in the construction of additional bridges and other buildings not included in the original contract, directed subsequently to the 1st July by the same Government to be executed by the company under the terms of that contract; also, in carrying out, in addition to the original design, certain additions and improvements lately suggested by the acting consulting engineer; and in the preparation of plans and estimates required by Government for enlarged calingulah accommodation, recommended as expedient from the experience of past seasons, which works will likewise have to be constructed under the provisions of the original contract.

In addition to providing for the foregoing works, the fund referred to will be sufficient to provide for any temporary deficiency in the revenue from the works, to meet the charges of conservancy staff for keeping the section between Soonkasala and Cuddapah in working order, as approved by the Madras Government.

The directors have requested me to add, for the information of his Grace the Secretary of State, what they are assured he will be most gratified to learn, that the ryots have shown, during the past season, a cheerful readiness to avail themselves of irrigation from the company's works, which has been supplied to them without difficulty or obstruction of any kind to the fullest extent required, and that there is every reason to anticipate a very general application for water next year, to an extent more than sufficient to cover all charges of maintenance.

It is, however, right that I should add that, besides the fund referred to, there will be available for the same purposes, if necessary, the amount expended by the company under the circumstances explained in my letter to you of the 23rd of January last. See No. 1.

I have, &c.

J. Westwood, Secretary.

— No. 26. —

The Secretary of the Madras Irrigation and Canal Company to the Under Secretary of State for India.

8 and 9, Queen-street-place, London,
29 November 1871 (No. 8).

Sir,

THE directors of this company have requested me to express to his Grace the Secretary of State for India, their grateful appreciation of his kindness in authorising Mr. Thornton to read at their last board meeting the Despatch under date 15th September last, from the Government of India, regarding the important works executed by them between Soonkasala and Cuddapah, in the Madras Presidency. In that Despatch the Supreme Government state their unfavourable opinion in respect to the design, construction, usefulness, and value of those works, which the directors consider is not borne out by the facts of the case, founded upon Reports and Minutes made by Members and Officers of the Madras Government, and Officers of the Government of India, of which they have heard for the first time. As these records are calculated seriously to affect not only the professional characters of the chief, deputy chief, and executive engineers engaged in the construction of the works, but reflect blame also upon the manner in which the managing body of the company have performed the important trust committed to them, the directors most respectfully and earnestly solicit that his Grace the Duke of Argyll will further favour them by issuing instructions that they shall be supplied with a copy of the Despatch referred to, and of the several Reports and Minutes upon which it is based, or which may be connected with it, in order that they may have an opportunity

of placing before him, as they are convinced they can, an effectual, complete, and satisfactory answer and explanation.

I have, &c.
J. Westwood, Secretary.

— No. 27. —

The Governor General in Council to the Secretary of State for India.

My Lord Duke, Fort William, 6 December 1871 (No. 151.,

In continuation of the concluding portion of paragraph 5 of our Despatch, Public Works, No. 119, dated the 15th September last, we have the honour to inform your Grace that the Government of Madras has recently reported to us that, in order to ascertain the locality of all weak points in the embankments and walls prior to forming an estimate of the cost of putting the Madras Irrigation and Canal Company's main canal in a thoroughly safe and efficient state by rectifying all existing defects, it is absolutely necessary to subject the canal to the test of carrying a full supply of water, but that the company's engineers are disinclined to run the risk of subjecting the work to this test; so that it must necessarily be deferred until the works are either surrendered to the State, or the board of directors express their willingness to meet the wish of Government.

We have, &c.
Mayo.
John Strachey.
R. Temple.
J. F. Stephen.
B. H. Ellis.
H. W. Norman.

— No. 28. —

The Government of Madras to the Secretary of State for India.

My Lord Duke, 18 December 1871 (No. 29).

IN accordance with the instructions of the Government of India, we have the honour to forward, for the information of your Grace, the revenue account of the Madras Irrigation and Canal Company for the half year ending 30th June 1871.

2. It will be observed that the available balance of revenue at the end of the half year in question was Rs. 12,080. 4. 5.

Napier.
Fred. Haines, Lieutenant General,
 Commander in Chief.
J. D. Sim.

MADRAS IRRIGATION COMPANY.

Enclosure in No. 28.

THE SOONKASALA AND CUDDAPAH SECTION REVENUE ACCOUNT OF THE MADRAS IRRIGATION AND CANAL COMPANY FOR THE HALF-YEAR ENDING 30TH JUNE 1871.						
Receipts.	Amount.	Total.	Grand Total.	Payments:	Amount.	Total.
	Rs. a. p.	Rs. a. p.	Rs. a. p.		Rs. a. p.	Rs. a. p.
Balance on 1st January 1871 -	-	-	20,914 - 2	Proportion or Share of General Management -	228 5 10	228 5 10
Amount collected and credited to the Company in the collectorate books, as per collector's receipt.				Maintenance and repairs -	-	-
				{ Establishment -	-	-
				{ Plantation -	6,978 1 -	-
				{ Compensation and remission -	-	-
Kurnool.					9,978 1 -	-
Irrigation -	-	-		Maintenance and repairs -	629 11 8	-
Special water rate -	-	-		{ Establishment -	889 1 1	-
				{ Plantation -	-	-
				{ Compensation and remission -	-	-
Produce of land, &c.	-	-			1,518 12 9	-
Navigation -	-	-		Maintenance and repairs -	343 4 -	-
Water-power -	-	-		{ Establishment -	-	-
				{ Plantation -	-	-
				{ Compensation and remission -	-	-
Miscellaneous	260 4 10	260 4 10	260 4 10	Building.		
				Repairs to Ayaloor building Main Canal.	25 9 -	-
				Balance on 30th June 1871	-	-
TOTAL			21,174 5 -	TOTAL		21,174 5 -

G. R. Walker, Lieutenant, R.F., Government Examiner.
C. A. Badham, Chief Accountant.
F. H. Henslowe, Agent and Manager.

Madras, 22 November 1871.

— No. 29. —

The Under Secretary of State for India to the Secretary of the Madras Irrigation Company.

Sir,

India Office, 9 January 1872.

I AM directed by the Secretary of State for India in Council to acquaint you, for the information of the Directors of the Madras Irrigation and Canal Company, that communications have been recently received from the Governments of India and Madras, which represent the affairs of the company as in an exceedingly unsatisfactory condition.

According to these documents, although more than a million and a half sterling has been expended on the Company's works during the twelve years which have elapsed since their construction was commenced, "they are practically useless for the objects for which they were originally designed," and are not deemed to be "anything like security for the 600,000 £. which the Government have advanced upon them.

"It seems doubtful whether, in their present state, the works can prove remunerative, for 130,000 acres must be irrigated to pay the interest alone on the capital expended, while the largest extent of land actually irrigated hitherto by the works has only been 1,887 acres. Works which were originally estimated to cost 493,348 £. are said to have actually cost 1,015,552 £. Serious mistakes appear to have been made in the designs; insufficient passages have been constructed for the watercourses of the canal; perpendicular masonry walls have been adopted as retaining walls, in lieu of the usual sloping earthen banks, and contrary to the universal practice of the country. But the defects of construction appear to be more serious than those of design. Up to this time, the canal has never been filled; notwithstanding which it has always been breached somewhere, when partial attempts have been made to fill it. The masonry walls are of indifferent materials and faulty construction, and the water supply is so uncertain that the ryots appear unwilling, even in a country where the value of irrigation is thoroughly appreciated, to take the water. The instability of the embanked portion seems to be a source of constant apprehension to the cultivators," who, having seen the canal breached every year for three years, "cannot help looking on these works, constructed for their good, with feelings of fear, if not aversion."

See No. 20.

See Enclosures in No. 17.

Copy of the Despatch from the Government of India, from which the greater part of the foregoing passage is extracted, and also copies of minutes by the Governor of Madras, and by members of his Council, and of a Report by the Consulting Engineer to the Madras Government, in all of which similar views are expressed, are enclosed herewith.

The practical conclusion to which his Grace, in common with the Governments of India and Madras, has come, is that no public advantage whatever, but, on the contrary, very serious disadvantage, has accrued from the recourse which, for so many years continuously, has been had to the co-operation of the company in the construction of irrigation works; and he sees no reason for supposing that anything would be gained by either the Government or the people of India from further perseverance in the same course. He desires it, therefore, to be distinctly understood, that in any future operations which may be contemplated by the company, they must rely entirely on the resources which they can independently command, for that no further pecuniary aid in any shape will be afforded by the Government.

At the same time it must be his Grace's duty to secure to the State the repayment of its advances to the company (600,000 £.), as the instalments fall due.

I am, &c.

Herman Merivale.

— No. 30. —

The Secretary of the Madras Irrigation and Canal Company to the Under Secretary of State for India.

8 & 9, Queen Street Place, London,
29 February 1872 (No. 1).

Sir,

I HAVE the honour to acknowledge the receipt of your letter of the 9th ultimo, and of the documents thereto appended. See No. 29.

The Directors of this Company desire me, in reply, to assure his Grace the Secretary of State for India, that they have read with astonishment the statements contained in the papers forwarded by the Governor General of India in Council, with his Despatch of the 15th of September last, reflecting seriously upon the design, construction and value of the canal and works between Soonkasala and Cuddapah, completed on the 1st of July last, and which, if well-founded, would justify the decision communicated by your concluding paragraphs. But, as the facts within the knowledge of the Directors evidence a state of things of an entirely opposite character, they are persuaded that, when these shall be known by his Grace, he will be convinced that the great experimental enterprise entrusted to the company has been so conducted, and is, upon its own merits, such, as to entitle it to his most cordial support and encouragement. See No. 20.

Accompanying this letter you will receive printed copies of memoranda written by the chief engineer, the late deputy chief engineer, and the late senior executive engineer of the company; and to their contents as affording a satisfactory reply to the statements now under review, the serious attention of the Secretary of State for India is earnestly desired. The directors, however, feel that, besides those professional statements, confirmed as they have been by the experience of the past season, there are circumstances and considerations of equal, if not higher importance, which could not be dealt with by the writers of those papers; and, therefore, to place these also before the Duke of Argyll, that he may be able to view the matter in connection with all its attendant facts, is the object of this communication.

A detailed answer to the Official Papers now furnished by you is indispensable, but it is thought essential that the following overlying circumstances should be brought in the first instance to the notice of his Grace.

First. The Minutes recorded by his Excellency the Governor of Madras, and the Honourable Messrs. Arbuthnot and Sim, and also the Official Memorandum by Colonel Carpendale, were written *before the commencement of the irrigating season of 1871*, and before water had passed down the whole length of the Main Canal for the first time after its completion; consequently, the writers of those papers, as also the signatories to the Despatch of the Government of India of the 15th of September last (which was founded on the opinions and fears expressed by the former), were not in possession of the important experience of that season, which has shown that the doubts expressed regarding the stability of the banks were groundless; that the stated uselessness of the canal was based upon inaccurate information; and that the alleged mistrust and aversion of the native cultivators, if these feelings ever existed, disappeared altogether before the actual flow of water in the canals, and the unchecked supply for irrigation. It is now known that, during the last six months of 1871, water uninterruptedly flowed through the entire length of the Main Canal, to a depth at one time within two feet of the full designed capacity; also, that the consolidation of the banks has proceeded satisfactorily, and in accordance with the system upon which they were made; that the cultivators came forward and used the canal water to a greater extent than was anticipated by the company's local engineers; that every demand made for water was immediately met; that tanks in the neighbourhood of Cuddapah, and at the extreme end of the canal, belonging to the Government, and which had during the season run dry, were supplied from the Company's Canal; that, in accordance with previous experience connected with other works of irrigation in Southern India, the native cultivators of the contiguous lands, having gained confidence by the proved stability of the banks, are now in all directions making preparation for the growth of wet crops during the coming season (*i.e.*, between June and January next), and that there are sufficient grounds to justify an expectation

pectation that an area of from 40,000 to 100,000 acres will then be irrigated by the company's water; the returns from the lowest of these numbers being more than enough to cover all working expenses.

It may be useful to add here, that in the lately irrigated districts of Orissa, where the benefits of irrigation were not perfectly understood, the progress of irrigation has been as follows:—During the year 1868–69 the gross revenue from the works was, as stated by the Governor General (in a letter dated 20th September 1869, published in the “Calcutta Gazette” of 4th October 1869), 441 l. only. During 1869–70, according to officially published returns, the total income from tolls upon traffic and from irrigation amounted to 5,235 l., and although it is believed that at least one-half of this sum arose from tolls, if the whole be credited to irrigation only, it would represent barely 21,000 acres irrigated. In 1870–71 the acreage actually irrigated, according to statements in the public press, amounted to 160,000; and it was expected that in the season 1871–72 the total area watered would be 260,000 acres. If this progress be adopted as a criterion of what will take place in the country traversed by the Company's canal, where, as stated in the Governor General's Despatch, the value of irrigation is thoroughly appreciated, it will appear that during the year 1873 (if not during 1872) the 130,000 acres required, according to the same Despatch, to pay interest on the capital expended on the Company's works, will be exceeded.

Second. The combination of navigation with irrigation, now for the first time officially charged as an error in the design of the Company's canal, is a matter with which the Company had nothing whatever to do, and for which it is in no way responsible. If this combination be an error, it is one for which the Government are exclusively answerable, for the Company from the outset has simply acted the part assigned to it by the Secretary of State for India, and to which it was bound by its contract with him. In a Despatch dated 12th January 1859, Lord Stanley (now the Earl of Derby), as Secretary of State for India, requested the Madras Government to select a project for construction by the Company, adding, “It is desirable that if possible the project should be adapted to purposes of navigation as well as of irrigation.” In obedience to these instructions that Government selected “the Toombuddra project,” and distinctly pointed out that navigation was to form an essential feature. Upon this the Secretary of State for India (then Sir Charles Wood) offered that project to the Company, who accepted it, and entered upon its construction. Pending these matters, and subsequently, various discussions took place between the Secretary of State for India and the Company as to the appropriation of the profits from navigation, and it was ultimately agreed that the same should belong to the Company solely, subject to the contribution presently stated. In 1863, after a general design of the canal and many detailed plans of the works, all exhibiting the combination of navigation with irrigation, had been submitted to and approved by the Government, the original contract between the Secretary of State and the Company was executed, and this not only distinctly enforces the provision of navigation, but contains stipulations giving the right of priority of transport to the Government for military purposes, and renders the profits from traffic liable to contribute, if necessary, to the liquidation of each half year's guaranteed interest.

The original contract was followed by an Act of Parliament (amending the Company's Act of Incorporation) passed in the same year, and therein the intended combination of navigation with irrigation is distinctly recited. The very numerous printed records of the Proceedings and Orders of the Government of Madras in connection with the Company, from 1859 to the present time, also teem with recognitions of this combination without objection being raised; and, when the Company desired to reduce the size of their locks, the Government of Madras declined to give an assent thereto, their consulting engineer reporting thus: “The probable traffic on the canal must at present be a matter of mere conjecture. If the navigation be good, if by the construction of reservoirs it be kept open throughout, or for five-sixths of the year, if the Company eventually continue their canal from Cuddapah to the coast, there would be hardly any limit to the traffic which such a means of communication would create, and be capable of accommodating.” It is a fact also, that 39½ miles of the main canal have been constructed *exclusively for navigation*, according to plans approved by the Government.

The directors have been from the first, and still are, convinced that the combination

bination of navigation with irrigation was a wise measure, calculated to be of great public advantage; and that it would have been a serious error, both in a financial and a public view, had the project been confined to irrigation only.

It is fair to add that the addition of navigation adopted in the original design of the Toombuddra project has been effected in the Soonkasala and Cuddapah section, not with reference to that section by itself, but because it was designed to form part of a scheme intended to terminate on the coast, and to be in operation during the entire year by the aid of a reservoir.

Third. When the arrangement established by the supplemental contract of 1866 was entered into, the design and substitution of stone walls for earthen banks, the design of the flood escapes, and the mode adopted in the construction of the banks, in all of which it is alleged there were errors and defects for which the Company is now responsible, were perfectly known to, and had been copiously discussed by, the Government of Madras and its consulting and chief engineers, as shown by the printed records of the proceedings of the former. By the provisions of that supplementary deed, the relations previously existing between the Government and the Company were intentionally placed upon a new footing, and it became impossible for the latter to alter the designs already approved, and wholly or partially executed, or to reconstruct the existing works; for it was stipulated that those works should be *completed*, by the expenditure of a fixed sum and before a given day, *in accordance with the plans approved by the Government*; wherefore it is respectfully submitted that the only question which should now regulate the treatment henceforth to be accorded by the Government to the Company is, has the duty imposed by the supplementary contract been fairly performed? * This question has been satisfactorily answered: First, by the Minute of Lord Napier, which states, “The officers of the company have gained experience; they would go in future on much safer ground, and their ability and trustworthiness are guaranteed by the excellence of their later performances,” meaning from the date of the Supplementary Contract of 1866. Secondly, by the official memorandum penned by Colonel Carpendale, which says, “All work of late years, that is, since the date of the supplementary contract, both earthwork and masonry, is much superior in quality, and the masonry especially may be called excellent; the only objection † I would raise is, that hydraulic mortar has not been used in the masonry works, such as locks, aqueducts, &c.” Thirdly, by the circumstance that Captain Scott, an engineer officer of the Madras Government, who, under special instructions from the latter, made a minute and careful inspection of the whole section one month before the expiration of the contract, reported that the works had been in substance completed, and did not point out or recommend any other than trifling defects, alterations, or additions, the cost of the whole of which was about 1,200 l. only. Captain Scott certainly expressed fears of future breaches in the banks, should the canal be tested by being at once filled to its full designed capacity; but such a test would have been inconsistent with the system adopted in the construction of the embankments, as explained in the chief engineer's memorandum, a copy of which was forwarded to you on the 2nd of November last. And, fourthly, the canal has, during the past season, been shown to be in perfect working order, seeing that it satisfactorily supplied all the demands of the local community, that supply being the object for which it was made; and, when the calingulahs, originally designed, in the opinion of the Government, no less than in that of the Company's engineers, to provide for all probable floods, but which experience has since shown should be made available for a greater discharge, have been enlarged accordingly, as in the accompanying memoranda described, and shall be brought into operation (as they will be before the coming season), the directors are assured, by their chief engineer and others, that breaches in the banks from full water or floods will be effectually guarded against. Moreover, it is important to add, that the original estimate

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* In a letter addressed by the Under Secretary of State for India to me on the 8th March 1866, and forming part of the negotiation which preceded the supplementary contract, the following passage, confirmatory of the above, occurs:—“Earl de Grey cannot but regret such disappointing results (that is, the then inability of the Canal to yield revenue), to whatever cause they are attributable. He admits that the enterprise in which the Company has embarked, is one of a character comparatively novel to English capitalists, attended with many difficulties which might not easily have been foreseen; but the costly experience of the past may reasonably be expected to afford safe guidance for the future, if the immediate difficulties in which the Company now find themselves can be surmounted.”

† This objection has been satisfactorily explained in the Memorandum of the Chief and Deputy Chief Engineer of the Company.

of the Company's chief engineer of the cost of completing under the supplementary contract has not only not been exceeded, but many works not included in that deed, such as additional bridges, and costly investigations into the other portions of the full scheme, including sites for reservoirs, all carried on at the express request of Government, have been executed out of the loan of 600,000 £.

When the supplementary contract was made, it was reasonably expected by the directors and shareholders that all the Company would have to do to insure a continuation of Governmental support, would be to fulfil to the best of its power the covenants there entered into; and, using the words written by the Hon. Mr. Sim, in his Minute: "The reasonable conclusion of the agreement surely is, that, if the Company succeeded in this work, other work would be entrusted to them, and, if they failed in this work, others would not be entrusted to them." The Company has *beyond question* faithfully performed its engagements, and the objections now made are to designs previously settled, approved, and acted upon, and to work done at an earlier period (that is some seven or eight years since), under a system then in universal action throughout the country, and which was adopted and sanctioned by Government, all defects and weak parts having been since remedied and strengthened.

Fourth. By the supplementary contract, the Secretary of State agreed to lend to the company funds to *complete* the construction of the canal and works as *previously designed*, but the transaction was not treated by him as a loan to be repaid by the company, for he insisted upon retaining the same power of control over the expenditure of that sum, and over the proceedings of the company, as he before possessed in respect to the capital upon which he had given a guarantee of interest, and that power of control was rigidly enforced; every plan and every estimate of original or amending work was submitted to, and deliberately investigated by, engineer officers, specially appointed by Government; almost daily communications were maintained between these officers, and the manager and chief engineer of the company, and material alterations were made in some of the submitted plans and estimates; all expenditure was minutely controlled by the Government; explanations regarding the most trifling amounts were continually called for, and sums actually paid were disallowed. The number of the professional staff and of other employes, and all salaries to be paid to them, as also all increases of salary, were fixed by the Government; and, in some instances, both staff and salaries were reduced below those proposed by the company's chief engineer. Indeed it cannot be said that the company were free agents in the matter. The works themselves were inspected at least every three months during progress, by the most able and experienced of the engineer officers of the Government, and on these occasions elaborate reports were made to the latter, in which defects were pointed out, and requisitions made regarding alterations and additions, all of which the company were from time to time called upon to carry out.

The directors would here most respectfully submit that the repayment of money thus expended upon a work of permanent public utility, and under the direct control of Government, may reasonably and fairly be postponed by the Secretary of State for India, until a sufficient time shall have elapsed after the opening of the canal to allow for the realization of full returns; and they make these remarks with the greater confidence, because in my letter to you of the 14th May 1866, when the loan was first proposed to be for a period of five years, they urged that it should not be made payable until at least 10 years after each advance, adding, "The directors would observe that a much longer period than five years from the present time may reasonably be expected to elapse, before a fair development of the capabilities or the productive character of the works to be constructed can be prudently effected; and, as the ability to raise capital to liquidate the whole of the intended loan or debentures may depend upon such full development, 10 years from the day of loan is in their judgment and belief the shortest period within which that liquidation should be rendered compulsory."

Fifth. The canal and works as now constructed form an incomplete project, which, as fairly stated by Lord Napier in paragraph 4 of his Minute, "can only under the most favourable circumstances do more than half its duty, on account of a failure of water during half the year."

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An indispensable feature of the original design was the construction of storage reservoirs to supplement the river supply, and a terminus on the coast, or other connection with Madras; and these are still essential to develop the section constructed; for, until they shall be provided, and until vessels are placed upon the canal, the extent of profits originally contemplated cannot be realised. Whatever may be the return upon outlay which this incomplete work shall produce, the additional expenditure required to construct a reservoir will (as all competent to speak with the authority of experience declare) yield additional profit sufficient to pay a fair per-centage on cost of construction over and above that now available, seeing it will provide the power of irrigating for a second crop the same number of acres, and navigation during an equal period with the existing works, constructed at a cost three times as much. The canal, without a supply of water for six months in the year, is assuredly no guide for judging what its capabilities and value would be, were this deficiency rectified and the canal brought into full use.

Sixth. This Company is now the only joint stock association in existence connected with works of irrigation in India. It was, after mature deliberation, wisely instituted by the present Earl of Derby, as "an experiment" to ascertain whether such works could be successfully carried out by means of a private company with English capital, and whether the latter could be made use of in aid of the efforts of Government in the same direction. It has passed through those difficulties and impediments which inevitably attend all enterprises of magnitude and novelty sought to be established by what at the time is viewed by many as a foreign agency; its non-productive period (so far as its present works are concerned) has elapsed, and that of returns commenced; and, although its operations have been restricted to one section only, which cannot, as it is, be more than half employed, success sufficient to decide the experiment in favour of private enterprise is now within view, and will be attained, provided the Company shall be simply permitted to pursue its course, and receive from Government that encouragement which the directors respectfully submit they may justly claim.

The foregoing important facts having been pointed out, it remains that the charges brought against the Company and its works should be spoken to in detail, as they appear in the papers appended to your letter.

It is true, as stated in the opening paragraph of the Despatch of the 15th September last, that the operations of the Company commenced in 1859, and that 12 years have since elapsed; but a perusal of the printed Proceedings of the Government of Madras will show that many delays have been interposed, that all working operations were twice stopped by order of the Government, and the professional staff dispersed; and, calculating only the months in which work was practicable, the progress made will bear favourable comparison with that of other works of the kind in India, especially taking into consideration the difficult character of the country, the large extent of rocky cutting required, the novelty of the work, and the difficulties connected with the procuring and price of labour in such extended operations.

It is likewise true that, up to the date of the same Despatch, the income from the canal had reached only 4,740 £.; but this limitation of revenue arose, not from want of skill in the design or faults in the construction of the works, but from the stipulations of the supplementary contract, which bound the Company to complete the canal and works within a given time, and compelled it to apply all its powers, as sanctioned by the Government, to the contemporaneous construction of the entire length of main canal and works, leaving until the last the provision of irrigation channels. The small income referred to was in fact derived from a slip of land contiguous to the first section of the canal, situated 30 miles above the first favourable spread of land for cultivation, and the acreage irrigated actually formed five-sixths of the total area commanded, whilst much of the small residue consisted of soud (or reh) land, which cannot be cultivated until by a series of periodical floodings it has been cleansed of the soda it contains. It was impossible to do more until the works had been made available for the lower country.

The statement that it was supposed the original project would probably cost about 1,000,000 £. is accurate; but the Directors would add that this estimate was made by officers of Government, and that the Company had no voice whatever in the matter, but was left to accept or reject the work so estimated. Sub-

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sequently to its acceptance, the discovery was made that the complete project would cost far more than 1,000,000 L., which discovery is recited in the original contract as a reason for the power thereby given to the Company to raise additional capital.

In reply to the observations in the second paragraph of the same Despatch, that, "after the guaranteed million had been spent, and the first part of the scheme " was still incomplete, the Company applied for an extension of the guarantee, " but the Government refused, offering to buy the undertaking," &c., the Directors have to explain that these observations were made under a misapprehension of the facts. Shortly before the Company's guaranteed capital of 1,000,000 L. had been expended, the Directors, having unabated confidence in the value and success of their undertaking, were anxious to prosecute it to completion by means of *unguaranteed* capital; but, finding in the altered state of the money market that the stipulations of the original contract (by which subscribers to unguaranteed capital could only participate in profits from irrigation after the current interest upon the 1,000,000 L. should have been satisfied, and then only to 5 per cent. until the arrears of interest due to the Secretary of State should be liquidated), created an obstacle to the raising of capital of that description, they, by my letter to you of the 28th September 1865, expressed to the Secretary of State for India their wish to procure independent resources, and proposed that he should agree to a modification of the impeding stipulations; but he objected to the proposal, and voluntarily offered to extend his guarantee upon certain terms, which offer was declined by the Company; whereupon another was made by his Lordship, viz., to purchase the undertaking or to lend to the Company a sum of 600,000 L. This proffered purchase was not approved by the shareholders, but the loan was accepted, upon the terms set forth in the supplementary contract.

The doubt expressed in the third paragraph of the same Despatch, whether the works can prove remunerative, because 130,000 acres must be irrigated to pay the interest alone on the capital expended, should be satisfactorily removed by a reference to the extent of irrigation supplied during the first season after opening, and a comparison with the progress made in the less favourable case of the Orissa works, from which it would appear reasonable to expect that in 1873 the required 130,000 acres will be exceeded.

The limited quantity of land irrigated prior to July 1871, mentioned in the same third paragraph, has been already explained, and shown to be a proof of the readiness of the people to take water when made available for their use.

In the same third paragraph two "serious mistakes" are alleged to have been made in the designs: of these, one, viz., the insufficiency of the waterways, has, in the memorandum of the chief engineer, as well as in the printed proceedings of the Madras Government, been shown to be one of those requirements which in works of the kind can only be efficiently supplied through experience of exceptional rainfalls.* In the present instance, the defect was, to the surprise of the engineers of both Government and Company, discovered by the occurrence of a storm at Kurnool of unprecedented force (which may not occur again, and which also displayed the insufficiency of all the public bridges in

* The original design of the water ways (calingulahs and sluices) now discovered to be insufficient, was calculated to pass off half an inch of rain per hour. By the rain gauge kept by the Company at Kurnool, which was read and recorded by the Engineer in charge of Head Quarters there, during the years 1862 to 1871 inclusive, and checked for some years by the Superintendent of Revenue Survey, and since 1 January 1868 by the Government Observatory at Kurnool (the records of 1868, a year when rain was so scarce as to cause a famine, being alone incomplete), the following results were given:—

Within this period of 10 years, in one month only (September 1862) did a total of 13.77 inches of rain fall; the heaviest fall in any 24 hours being 4 inches, on the night of the 24th of that month. In two other months only did as much as a total of 7 inches fall, viz. 7.73 inches in August 1865, and 7.38 inches in August 1868.

Since the establishment of the Government Observatory in 1868, excepting in the storm of 7th August 1870 above referred to, more than 2 inches fell in 24 hours three times only, viz. 30th August 1868, 29th September 1868, and 10th October 1869, and 3 inches have never fallen in 24 hours during that time. The results thus shown represent fairly the general state of the locality as to rainfall during all previous time, so far as is known.

In the night of 7th August 1870, however, the exceptional storm occurred, and 12.009 inches fell at Kurnool between half-past ten p.m. and half-past ten the next morning; and not only were the banks of the Company's Canal breached by it, but every bridge built by Government in the neighbourhood was found insufficient to pass the flood, and consequently the approaches were, without exception, more or less destroyed by it; in some cases the water, after the demolition of the approach, forming a volume broader by at least one quarter of a mile.

The design complained of was sufficient to carry off a rainfall half as much again as the heaviest registered between 1862 and 1870, and therefore, except that of August 1870, the severest known in the country; the calingulahs, as now being enlarged, are calculated to pass (*irrespective of the sluices*) a flood equal to that of August 1870.

in the same district), and *is now being remedied at a cost of 6,000 L.*; a trifling outlay when viewed as connected with a canal of large capacity, 190 miles in length, costing 1,600,000 L.; and especially when it is remembered that Colonel Carpendale has styled this insufficiency "the great radical defect of design," and that in the other papers it is held out as a main cause for withholding support from the Company in future. The other alleged error, viz., that masonry walls were substituted for earth-banks, refers, as above and in the accompanying memoranda by Messrs. Latham and Gordon explained, to walls constructed before the date of the supplementary contract.

The original designs of these walls are shown in the plan accompanying this letter, and as so shown were carefully examined by the consulting engineer of the Government for the time being, and were approved by him as well suited to the circumstances of the section of the canal in which they were introduced.

After operations had been recommenced under the supplementary contract, these stone walls were considerably strengthened, by the direction of the Company's chief engineer, by the addition of a wide embankment, and in some instances of a spoil bank of large dimensions, in the rear, and a footing of puddle in front; and were then considered by the consulting engineer of Government, as they are now by the chief and executive engineers of the Company, amply safe and efficient for all possible purposes. These additions are also shown on the same plan.

The opinions expressed in paragraph 5 of the despatch in question, that "For the objects with which the works were originally designed they are perfectly " useless," and "It seems unlikely that the works in their present state would " be anything like security for even the 600,000 L. which the Government have " advanced," were evidently formed upon inaccurate data, and were not entertained by Lord Napier or by Colonel Carpendale, as may be seen by a perusal of the minute of the former and the memorandum of the latter. The experience gained during the last irrigating season must, the directors feel assured, have effectually changed these views of the Governor General and the members of his Council. They would also remark that the Toombuddra project had been, before its selection for construction by the Company, advocated by the most eminent of the engineer officers of the Madras Government from so far back as 1815; and its merit, as a work of public utility, combining navigation with irrigation, had been many times investigated by some of those engineers under the orders of Government. When offered to the Company, it was recommended by the Madras Government thus: "The general information before us, derived from " the investigations of various officers, is quite sufficient to enable us to arrive " at a decision that, &c., * * * and that it holds out very encouraging " prospects of a pecuniary return, while in respect to public benefit it is second " to none in the country." Its original design, when selected by Government, was that since adopted in the section now completed, with the exception pointed out by the chief engineer, viz., the substitution of a navigable canal for the rendering the Koondair River navigable. The then chief engineer of the company was assisted in laying out the more detailed plan by Colonel F. H. Rundall, who was then acting as consulting engineer to the Government of Madras, he having been selected for that post (as stated by that Government) as the best engineer officer in their service, and who has since been promoted, and is now the officiating Inspector General of Irrigation Works throughout India.

The detailed plans and estimates of the works as they were carried out were closely investigated by the several succeeding consulting and chief engineers of Government, viz., Colonel Rundall, Colonel Ludlow, Colonel J. Bell, Colonel Hbrsley, Colonel Orr, and Major Mullins, before the execution of the supplementary contract, all of these being officers of experience.

The directors are unaware of a single opinion having been pronounced to the effect that the canal and works are useless for the objects for which they were designed; and, if such an opinion has been given, it has, by the experience of the last season, been most conclusively refuted; moreover, the directors respectfully submit it is impossible that so much special professional skill and experience as has been brought to bear upon the works on the part both of the company and the Government, and such close supervision as has been exercised over expenditure, could result in the failure represented.

The directors, in submitting the foregoing narrative and explanation to the Secretary of State for India, respectfully express their sincere conviction that their undertaking has so far been a great success, and that it will confer immense

benefits upon the country; at the same time they feel it their duty to represent, as emphatically as possible, that it is essential that a reservoir to store flood waters, and a short railway to connect the canal with the Madras Railway at Cuddapah, should be constructed without delay, and also that steamboats and other vessels should be provided to carry on navigation. Until these essential adjuncts are made available, the work now constructed can only, so to speak, be half useful for the objects for which it was designed; to provide these important additions, the directors were in hopes that the Secretary of State for India would be willing to afford them the facility of raising the necessary capital by a guarantee of interest, but, if he will not entertain this proposal, they are desirous to meet his wishes by raising unguaranteed capital for effecting those objects; they have satisfied themselves, however, that it is impossible to do so under the unfavourable conditions to which they are bound by their contract, which place the company as to the power to offer inducements to subscribers for further capital, in an exceptionally disadvantageous position.

Were the impediments now referred to removed, the company might be able to carry on its operations without any pecuniary aid from Government, and therefore the directors respectfully solicit the assent of the Secretary of State for India to such modifications of the contract, as, whilst not in any way prejudicing but improving his interests, will enable the company to offer to the public terms sufficient under existing circumstances to induce capitalists to subscribe the necessary funds; and they are prepared to state, for consideration by his Grace, their views regarding the nature and extent of the required alterations.

I have, &c.

John Westwood,
Secretary.

Enclosure 1, in No. 30.

MEMORANDUM by the Company's Chief Engineer on the Letter of the Under Secretary of State for India, dated India Office, 9th January 1872, and on the Documents accompanying it, regarding the Works constructed by the Madras Irrigation and Canal Company.

I APPREHEND that the most important of the communications referred to in paragraph 1 of Mr. Merivale's letter, and which I am called upon principally to notice, are those written by Lord Napier and by Colonel Carpendale, both of whom have actually inspected the works of the Canal and communicated on the spot with the Revenue Officers and ryots. The Canal, however, was very far from complete when last visited by Colonel Carpendale in October 1870, whilst Lord Napier's inspection took place in 1867; and it is to be noted as a matter of some importance that the Memorandum of the former was written on the 8th, and the Minute of the latter on the 21st June 1871; that is, at the very commencement of the last irrigating season, and therefore before the results of that season—which are of the highest value in judging of the Company's works—had been attained. The Despatch from the Government of India is open to the same observation.

The writers just named refer to errors in the design of the Company's Canal and to faults in its construction, all of which are stated to have been committed before the date of the Supplementary Contract, whilst the work executed subsequently to the date of that deed is described in terms of commendation, and as satisfactory. Bearing in mind, therefore, the date of my acting as Chief Engineer of the Company (December 1865), it will be apparent that my observations are in no wise personally defensive.

The Despatch from the Government of India contains remarks regarding the state, fitness, and value of the Company's works, which are of a much stronger character than any made by either Lord Napier or Colonel Carpendale, and these I will touch upon as I proceed.

As to Alleged Errors in Design.

1. *Combination of Navigation with Irrigation.*—The general design of the Canal to combine navigation with irrigation was originally fixed by the Madras Government on the (never since retracted) opinion of the most experienced engineers in the Presidency, and the Company had nothing to do but simply to accept the work so designed and to execute it in that shape.*

This

* The contract with the Secretary of State expressly recites as follows:—"And whereas, with a view to carry the said arrangement into effect, the Government of Madras, under the orders of the Secretary of State in Council, selected and recommended, as the work or project to be constructed by the Company under the said arrangement, a certain work or scheme of works for providing irrigation and means of water transport, &c., which work or scheme of works was described in a Memorandum dated 13th May 1858, drawn up by the order of the said Government of Madras by their Commandant of Engineers, and has since been known between the parties as the 'Toombuddra Project.'"

This decision of the Madras Government was, in an engineering, in a commercial, and in a public view, wise, and can only be objected to upon the assumption that the means of transport provided will never be made use of by the community, even though vessels be provided by the Company; an assumption which is, I venture to, assert, opposed to all experience in all parts of the world, and especially in India.

By the combination of navigation with irrigation in the design of the Company's canal, the two are made to assist each other; thus, the supplying of irrigation to the land will render it necessary that the canal should be kept in a navigable state, and in this respect it differs from the Ganges Canal, which, by affording irrigation, stops navigation.

In this latter canal, if all the land it commands above be supplied, water may fail to suffice for navigating its lower part. In the case of the Company's canal, sufficient land is not commanded by the upper portions of each of its sections, and in each of these the far greater part of the whole distribution is taken off just above the first lock, and thus insures navigation down to the still-water portion, and a supply for lockage and evaporation below.

The combination of navigation with irrigation, now, as I believe, for the first time objected to by a consulting engineer of the Madras Government, is, in my opinion, and in that of many other engineers of great practical experience, a substantial public good; it certainly is not an engineering error, and the Government by whose authority it was determined, and who bound the Company to carry it out, conferred a great boon upon the community; and it is a fact that not only do the most successful canals in the Madras Presidency combine navigation with irrigation, but the leading characteristic of the extensive and important Orissa and Behar projects, now being carried on under the orders of the Government of India, is this same combination.

2. *The Substitution of Stone Walls for Earthen Embankments.*—No doubt the usual practice in making banks in the Madras Presidency, with so few exceptions that it might be called universal, has been to make them of simple unpuddled earth, protected where necessary by rubble or masonry revetment, often nearly vertical. This rule has been followed in the case of the Company's canal; but, wherever the simple earth of the locality proved too gravelly, or too salt, to hold water safely, and the expense of bringing better from a distance was known to be too great, puddle has been employed, or a nearly vertical masonry wall built to prevent percolation of water through the bank behind it, which plan was adopted after submission to, and with the well-considered assent of, the consulting engineer of the Government and of the Government itself.

It was after the adoption, and almost completion, of the highest masonry walls in banks, that the Government and the Company made the supplementary contract; and it seems to me that Lord Napier and Colonel Carpendale are just, in their opinion that no blame attaches to the shareholders if they fulfilled this contract, as it is admitted they have done.

Modifications of details, in the form of puddle banks and of walls, have certainly been made since the signing of the supplementary contract; but these are all admitted to be improvements, and have certainly added strength, whilst removing all ground for objections to the walls in question.

No doubt, in the use of masonry for forming the inner face of canal banks, the Madras Presidency is behind the age.

Setting aside the masonry reservoir bands in Spain—where they are the usual practice, as in the dam at Alicante, 134½ feet high; and in France, as in the dam at Furens, which is 164 feet high—I may instance the Henares Canal, in Spain, lined with masonry, and the Cavour Canal, in Italy, lined, where necessary, with brickwork.

3. *Insufficiency of the Waste Weirs in the upper part of the Canal.*—I have, in my explanatory Memorandum of the 12th of October last, fully explained this matter. The error of design, if it can be so called, was committed equally by the engineers of the Madras Government with those of the Company; but, in fact, no one was to blame. The weirs and waterways were designed (and were considered by the Consulting Engineer of Government, and correctly so, according to the then existing data) as being fully sufficient to provide against the largest rainfall then supposed possible. The storm of August 1870, against all previous experience, however, exceeded these calculations, and was the only known storm for which the weirs would not have been ample. Last year, as usual, the sluices sufficed to prevent flood water rising within several feet of the crest of the waste weirs. During the present year the capacity of these escape works will be enlarged by the Company, according to a principle approved by the Madras Government, and will be made (at the slight cost of about 7,000 l.) so as to provide even for a repetition of a rainfall so extraordinary as that of August 1870; and then, by the trifling outlay named, that which is termed by Colonel Carpendale "the great radical defect in the general design of the main canal" will disappear. The Government of Madras, in their order, quoted in my previous Memorandum, properly exonerate the Company from blame regarding the original design of these waterways.

As to alleged Faults in Construction, and Statement that Breaches have occurred whenever Water has been admitted.

1. *Alleged Faults in Construction.*—I have, in my Memorandum of the 12th October last, shown, as I submit, conclusively, that the embankments of the Company's canal have been constructed (with the exception of the strengthening walls to which I have already referred)

referred) in accordance with the mode universally adopted throughout the Madras Presidency, and with the concurrent approval of the Government; and I have there shown that they only require that consolidation which it was intended time should, and which it will, effect, to make them perfectly secure, and also that the masonry works are good and sound. I need not, therefore, repeat what I have there said, or go into detail again.

I will, however, with reference to Colonel Carpendale's remark that in the masonry works hydraulic lime has not been used, observe that the lime used throughout the canal is that known as Kunkar lime. Except in one portion of the canal it will not set hard in water, but in all cases if once set hard it will remain hard in water. The lime is, therefore, of the kind called *partially hydraulic* at worst; and is used everywhere for public works, road bridges, road dams (as Irish bridges are officially styled), and privately for plastering the inside of indigo vats, for roofs, &c., and stands satisfactorily in all cases if properly used, as it has been on the canal.

2. *Alleged Breaches.*—The bare statement that breaches have occurred whenever water has been admitted into the canal, and the fear expressed that breaches will continue to happen, is calculated to produce a wrong impression, both as regards past facts, and the actual stability of the canal embankments as they now stand.

The canal is unlike any other in India; it traverses an undulating country, passing through deep natural indentations or valleys, necessitating embankments of many miles in extent, and of a height greater than any other canal before constructed in that country; in many localities the soil was found to be of a very inferior description, and in others altogether bad, so that the engineer had to make the most of these unsatisfactory materials, or to incur an expense not practicable or to be thought of. Slips of earthwork and breaches during construction, and until consolidation should be attained, were a natural result, and formed part of the process and cost of completion; other causes beyond control, and not connected with construction, were also contemporaneously at work, and operating in the same direction: for instance, the canal banks, for want of reservoirs to maintain the supply of water between the 1st of January and early in June, became dry, and animals burrowed deep into them; and, when water was admitted, it, by the aid of the holes so made, forced its way through, and caused breaches. In a Report to the Madras Government made by him in November 1870, Colonel Carpendale refers to this subject in these words: "The canal being dry for more than half the year, is one cause (of additional expense of maintenance), for there can be no doubt that vermin do burrow in the banks, and make holes that sometimes lead to breaches." In the same report Colonel Carpendale relates the following: "The formation of the banks in this section (the 10th) has been well done, and the Executive Engineer expects he will have a saving on this item. I passed up this section in a boat, in the first week of October, to inspect the Adamapully Anicut, when there was but five feet of water in the canal. The banks appeared quite sound, yet in the night of the 6th a breach occurred in the bank near the Punkal Wunkah Aqueduct, and all the water ran out. The supposition was that vermin had burrowed in the banks when dry; the breach was repaired, and water readmitted before my arrival again at Adamapully at the end of the month, when on the night of the 29th a similar breach occurred close to where the old one had been. There is reason to believe that the canal at this place traverses what was at some former period the bed of the Punkal Wunkah, and that quicksand, some depth below the ground surface, is put in motion when the water in the canal percolates to it, which entails the sinking of the banks; a careful examination into this matter will be made when repairing the present breach, and it may be found necessary to dig a trench along the toe of the bank to be filled with clay puddle. The banks near the breach seem well made and sound, and grass had grown over them satisfactorily." Allowance should, therefore, in all fairness, have been made for these uncontrollable circumstances.

It is true that breaches have occurred from the insufficiency of the works constructed before the recommencement of work in November 1866; but, with the exception of those caused by the storm of August 1870, they were chiefly of slight importance, and were remedied at a small expense; at the same time, by these breaches, defects in construction and all weak points were discovered and satisfactorily remedied; indeed, about eight miles of bank were in consequence protected successfully by masonry or puddle. Not only were the parts of the banks, in which on trial the soil proved dangerous, thus made sound and secure, but all other parts known or supposed to be similarly constructed, though never proved to be defective, were likewise protected; and all embankments, except those portions which were then actually breached, stood the very severe test of the unprecedented storm of 1870 successfully; so that now the only known danger attaching to the use of the canal is that inseparable from such a work being left unfilled and dry half the year. Against such danger masonry is the most obvious security. I would here add the fact that a constant flow of water was maintained throughout the canal during the whole of the last season (which at one time reached in the upper sections within two feet of the full depth designed), and every demand for irrigation was promptly supplied without any impending accident or breach. The intended increased calingulah, or waterway, accommodation will render breaches (humanly speaking) impossible. I need not in this portion of the present Paper further refer to the breaches caused by the storm of 1870, because they arose from a well-ascertained and admitted special and wholly unexpected cause, and should in no way be brought forward as an accusation to the prejudice of the mode of design or the actual construction adopted.

As to the stated Practical Uselessness of the Works for the objects for which they were designed, and the smallness of Irrigation afforded by them.

1. *Uselessness, &c., of the Works.*—I do not find any statement in the Papers under review which justifies the assertion made in the Despatch of the Government of India that the works are practically useless for their designed purposes; but, on the contrary, I read in the minutes of Lord Napier and Colonel Carpendale statements positively affirming their sufficiency for those objects; and I cannot bring myself to believe that any engineer of experience will be found who would pass a different judgment. The fact that during the past season of 1871 the canal has been found capable of effecting all that it was intended to perform, without complaint or stoppage, has so far disproved this assertion, and I entertain no doubt whatever that the results of this year will finally and satisfactorily dispose of all doubt upon the subject.

It seems to me that the repetition in the Papers under review of the fact that "The largest extent of land actually irrigated hitherto by the works has been 1,887 acres," as an argument that the ryots cannot be expected to take the water when they can get it, is not only misplaced, but that, coupled with subsequent events, it really forms a strong argument in favour of the Company and its works, but condemnatory of the terms of the Supplementary Contract, which bound the Company, under penalty of extinction, to finish the whole of the 190 miles of canal at once—that is, by a given day; and that the Revenue Officers, as well as the shareholders, may well regret that expenditure was not so applied as to produce revenue continuously as it was made.

Up to 1870 the only portion of the canal which the necessary prosecution of the works, with a due regard to the fulfilment of their contract, permitted the Company to open for irrigation, were the 1st, and sometimes a part of the 2nd section. The total area of irrigable land commanded in the 1st section is 1,386 acres, and in the 2nd section 1,956 acres, of which less than half was under the opened part of the canal; and yet 1,887 acres, that is, five-sixths of the land available, were actually irrigated; a proof that the native cultivators were ready to avail themselves of irrigation when placed within their reach.

On the 8th April 1870, the Madras Government sanctioned a conservancy staff for opening, during the then approaching season, the first 75 miles of canal. Unfortunately, in August of that year, the unprecedented rainfall before mentioned breached the canal, by which the prospects of extended revenue for that year were annihilated. During 1871, however, the irrigation supplied has exceeded all expectations; and, in addition to the direct supply of water to 10,000 acres from the canal itself, the Government tanks of the neighbourhood, which had run dry, have been filled from the Company's canal, and the crops dependent upon them have been saved from failure.

As a natural consequence of this satisfactory position, the Resident Engineers report that there is hardly a village under the canal in which some trial has not been made of irrigation, that the quality of the crops yielded surpasses that of crops cultivated under the Government tanks, and that earnest and very extensive preparations are being made for wet cultivation during the present year. Could any work of irrigation have a better prospect?

I will not say more about the alleged fear of the cultivators, and their aversion to the Company's works, than that the facts previously stated prove the contrary; and, further, that I presume the knowledge comes to the Government of India through the reports of the subordinate Revenue authorities. The very fact (known to me) that hundreds of ryots consulted the Tahsildars as to whether they should irrigate or not, indicates that even before the assuring experience of last season their fears did not extend to aversion; but the very proper refusal of those officers to guarantee the continued safety of the canal and a sure supply of water to the land, could not but have a depressing effect on the obvious ardour of the simple and ignorant, who would consider the Tahsildar's opinion, or refusal to give an opinion, as conveying the most favourable view of the canal, which they, as the collector reports, persist in considering to be a Government work. Neither Lord Napier nor Colonel Carpendale, who speak with a knowledge of the locality, seem to have noticed this alleged aversion, and I never heard of it; and, judging from the papers under review, that aversion is apparent at Simla, but not in Madras. Successive distances seem to render the view taken of the canal less and less enchanting.

As to the alleged Excess of Cost over Estimate.

It is said, in the Despatch from the Government of India, as against the Company, that works originally estimated at half a million have actually cost a million. This, doubtless, refers to estimates made before the final contract with the Company, and therefore does not apply to prove the inefficiency of the Company. In justice to Colonel Orr, who is, I presume, the officer referred to, and who acted on behalf of the Government, it should be borne in mind that, when he submitted his estimate of 590,000 l. to the Madras Government in 1861, after inspecting the proposed line of canal (and after Colonel Cotton, acting for the Company, had submitted an estimate corresponding, except in one particular, to which I shall presently refer), prices and wages in the less populous parts of the district traversed by it were about half of what they have averaged since that date; and in justice to the Company it should be stated that it has worked more economically, at any rate since the supplementary contract, than any other department, so far as I know, for similar qualities of work, and has during that time saved much on the rates sanctioned by Government: it has also, by an expenditure within the contract, completed not only the contract works, but many additions, accessories, and improvements since introduced.

When Colonel Orr's estimate, mentioned by the Government of India, was made, the design was to make the Koondair River navigable below Nundial, at a cost of 80,000 £ only. Instead of this, a canal of 85 miles length has been substituted at a cost of 217,800 £, to the great improvement of the navigation.

In concluding this portion of my Memorandum, I must state that the estimate of the Company's then Chief Engineer (Colonel Cotton), made, as I have said, previous to Colonel Orr's inspection, differed from Colonel Orr's estimate in one item only, that of locks, of which Colonel Orr reckoned that 60 would be required at a cost of 180,000 £, against Colonel Cotton's estimate of 40 at a cost of 40,000 £. The actual number constructed and found ample is 41, and the cost about 70,000 £ only. As to rates, both of the officers named had the same means of judging; both inspected the trial pits in the 4th, 5th, and other sections. In those sections all the trial earthwork had been executed at 15 cubic yards the rupee; whereas the abolition of all pressed labour, the rise in the price of provisions due to influx of workmen, and the partial diversion of agricultural labourers to canal work, caused rates to rise to double that amount, while the canal was under construction.

As to the actual Cost of the Canal and Works.

Upon the whole, and especially when it is considered that the project itself was an experiment, no such a work having been before undertaken in India, and that the Company was a new and untried agency, and was not left to carry out the work in its own way and upon its own responsibility, I am clearly of opinion that the cost incurred has been moderate. To those who remember the failure of the Ganges Canal to supply water during the famine year of 1859 (five years after it was opened), and again in 1863, and its insufficiency of water for navigation, it will not seem an unfavourable indication that (omitting management) 190 miles of the Company's canal (in a difficult country, and the first of its kind) have cost 1,015,552 £, against 2,006,000 £ spent on the construction of the 520 miles of Ganges Canal up to 1863, irrespective of maintenance and repairs, especially when it is borne in mind that in 1864 this latter work was admitted by its designer to be defective, and that in 1866 a committee of engineers, appointed by the Government to report on its condition, stated that 1,250,000 £ was wanted to remodel it. But even the first-sight appearance of expensiveness of the Company's canal, by a comparison of figures only, disappears when it is compared with neighbouring efficient works of a similar kind. For instance, the Company's Soonkasala Anicut, 4,500 feet long, raises the summer level of the Toombuddra River 14 feet, and cost 48,150 £. The Besworah Anicut, on the Kistna River below, 3,750 feet long, raises the summer water 14 feet, and cost 70,000 £. The Company's Adinamayapilly Anicut, on the Pennair, 2,510 feet long, raises the summer water level 10 feet, and cost 38,000 £, including plant. The Dowlshwaram Anicuts, on the Godavery, together 11,866½ feet long, raise the summer water about 8 feet, and, built partially, I am informed, by pressed labour years before, and certainly at a time when rates were considerably lower than those which prevailed during the Company's operations, cost about 100,000 £. The main cause of the expense incurred by the Company is the difficult nature of the ground in the first 30 miles, which made the cost more than 10,000 £ a mile. The first 75 miles of canal, including the above 30, cost 8,066 £ a mile on the average, and the remaining 115, 2,900 £ a mile. The rise in the rates also added materially to the total outlay. There seems to me to be no ground whatever for depreciating the Company's canal on account of its cost.

As to the Efficiency and Financial Success of the Works constructed.

Upon these points we have the following evidence: First, the universal evidence of Indian revenue officers, before the Company borrowed funds from the Government, and before a desire was said to exist for its transfer into other hands, that the cultivators would take the water if they were supplied with it. Secondly, the similar evidence borne by Indian revenue officers now, with the single proviso that the cultivators must be quite sure of the continuation of the supply annually, a proviso which the experience of every existing tank and every existing canal proves ungrounded. Thirdly, the eagerness shown by the ryots of every village under the canal to try the water, though they were not encouraged, and were doubtful whether they would incur displeasure by so doing, and the actual irrigation of 10,000 acres during last season, although the season's sowing was over before water was running down the subsidiary channels.

In conclusion, I, as the chief engineer of the Company, beg to record my opinion that the banks, walls, and works of the canal are in an efficient condition; and that, with a well-drilled staff of bankers to watch the filling, and after due adaptation of the water passages to meet the requirements of a storm like that of 1870, no contingency of wind or weather of which we have had experience up to date will interfere with the safe and constant supply of water by the canal during every irrigating season. Were the navigation opened by boats doing 100 miles a day, my opinion is that the immediate traffic, irrespective of the carriage of the surplus produce caused by the irrigation supplied, cannot be estimated at less than 5 £ a mile a week.

I cannot, however, completely close this Paper, without expressing my satisfaction at the statements made by Lord Napier and Colonel Carpendale, affirming the absolute necessity for the construction of reservoirs. Without these all-important adjuncts the canal, as now constructed, will be of less than half its proper value to the country, and will prove less than half as productive of profit upon outlay. The result of an outlay of say 500,000 £ upon a reservoir, will be that the canal and distributary channels already constructed will

be

be made use of, both for irrigation and navigation, for 12 months, instead of at present, six months only. If no reservoir be constructed, the canal will have to produce, during its six months' working, a return upon the capital of 1,600,000 £ already expended by the Company, whilst the cost of repairs and maintenance will be increased by the exposure to the sun of the embankments, whilst dry for the remaining six months. On the other hand, if a reservoir be constructed, the returns upon its cost (say, as above, 500,000 £) will be at least equal to those upon the 1,600,000 £, whilst the cost of maintenance will be lessened. These facts show how exceedingly advantageous, in a financial point of view, the outlay of additional capital must prove for the Company.

20 January 1872.

John Herbert Latham,
Chief Engineer.

Enclosure 2, in No. 30.

MEMORANDUM by Mr. Gordon, late Deputy Chief Engineer of the Madras Irrigation and Canal Company, on the Letter from the Under Secretary of State for India, of 9th of January 1872, and the Documents thereto annexed.

LORD NAPIER, in his Minute, states that the "objects of navigation were admitted by Government and the Secretary of State deliberately," and that "the canal is well adapted for irrigation in connection with its other use," and the Government engineers, including Colonel Carpendale, have admitted the present design to be at least "generally suitable." If, therefore, the combination of irrigation with navigation be a defect of the canal, it is one which would have existed had the work been constructed by any other agency than that of the Company, and should accordingly not be brought forward as a reason against the Company being assisted to extend their operations.

What Colonel Carpendale calls the "great radical defect," viz., the insufficiency of the canal to pass extraordinary flood waters when full without breaching the banks, is also one which I think would probably have existed in any other design; for I have been informed by Government engineers that, in designing escape works for tanks, &c., it is impracticable to make them equal to the discharge of the extraordinary floods which occasionally, though very rarely, occur, and that those are provided for by inducing them to breach the works at points where least damage will be done, and where it will be most quickly repaired. This plan the chief engineer in his memorandum states to have been adopted, temporarily, in these works also since the experience of 1870, while the intended permanent discharge works are calculated to a higher coefficient than that now adopted for the Ganges Canal.

It appears to me that the Government of India have misunderstood the remarks of Colonel Carpendale, with regard to the employment of masonry walls, where the canal crosses deep valleys. These remarks can, I think, be meant to apply only to some of the walls of earlier construction, as none of those constructed since 1865 have given way, and Colonel Carpendale characterises the masonry of these as excellent. The defects in the earlier constructed walls have been remedied, and I think most engineers would consider the later ones better and safer works than earthen banks of the materials available. The ordinary banks made of earth in the manner usual in the country were always expected to take years to consolidate. It should be remembered that there is no clay wherewith to make proper "puddle" in that part of the country.

Although the mortar used in the masonry walls will not set under water, it gets extremely hard under water after setting in the air, as is shown by some spare concrete left at the Soonkasala Anicut, which has stood a fall of water on it of upwards of 15 feet for eight or nine years. It is made with the same lime as the mortar.

The statement in paragraph 5 of the Despatch of the Government of India, that "the works are practically useless for the objects with which they were designed," does not seem to be borne out either by the opinions expressed by Lord Napier, Colonel Carpendale, and the Honourable Mr. Sim, or by the facts that all the water that was applied for was successfully supplied last season, that is, the first after completion of the works, and that, in addition to this, water was supplied to Government tanks of which the natural supply had failed. At the same time, there can be no doubt that the usefulness of the works would be immensely extended, and their profitableness, in a pecuniary sense, rendered certain, by the storage of sufficient water to yield a second crop to the whole or even part of the land which will eventually be irrigated by the canal. A full supply would not be necessary for maintaining the navigation. Storage of water always formed an important part of the Company's scheme, and is still, as Lord Napier truly observes, an indispensable feature in it. Three large reservoirs have been surveyed and carefully estimated, and all the information which the Company can afford has been given. In one case, a complete land survey on a large scale was also given, and sent to Government some time after the 1st September 1870. The valuation of the land to be submerged is the only information not given, and that the Company cannot supply. It is quite true that the execution of these large storage works would be a novelty in the Madras system of public works; but that Government has not rejected other works on the plea of novelty and uncertainty of cost, as is shown by the construction of the magnificent anicuts across the Godavery and Kistnah, and in later times by the experiment of constructing a high dam near Ootacamund by a method which was, I believe, quite new in British India. Colonel Carpendale, in paragraph 7 of his Minute, advocates the construction of reservoirs. The estimated cost of storage works is so favourable

Paragraph 3 of
Despatch.

able that, even if the Government's mistrust of the estimates were well founded, and the least favourable estimate were doubled, so as to make a reservoir for the Kurnool works cost, as Colonel Carpendale suggests, half a million, it would still be a profitable addition to the works. But it can hardly be doubted that that is the most unfavourable view that could possibly be taken. Were it not for the want of information on public works in India, and the hesitation to embark in them, caused by the disfavour with which private enterprise is viewed by the Indian Government, unguaranteed capital would soon be forthcoming for the construction of reservoirs.

With regard to the excess of cost over the *original* estimates, I can only confirm what the chief engineer has so clearly stated under that head in his full and satisfactory Memorandum, and add that my estimates of the Bellary Irrigation Canal, amounting to one and a quarter millions, were based on the experience of the Kurnool works, which have been executed since 1865, and that the rates are, for reasons I have elsewhere given, somewhat in excess of those found sufficient for those works.

I have, &c.

G. Gordon,

Late Deputy Chief Engineer,
Madras Irrigation and Canal Company.

London, 5 February 1872.

Enclosure 3, in No. 30.

MEMORANDUM by Mr. Dodson, late Executive Engineer of the Madras Irrigation and Canal Company, upon the Letter of the Under Secretary of State for India, of the 9th January 1872, and the Documents attached to it.

It is evident that the chief object of all these Memorandums addressed to the Secretary of State for India, on the present condition and future prospects of the Madras Irrigation Canal is to show that the works are faulty in design, and so inefficiently constructed that they are not trustworthy. Also, that if the works should stand the test of full water, yet they are so constructed as not to be efficient either for the purposes of irrigation or navigation. The question of the original design has been fully answered by our chief engineer, Mr. Latham, who has also successfully met all the other charges; but, having been for eight years one of the company's executive engineers, and from time to time in charge of all the works of the first 90 miles of this canal, I feel justified in making some remarks on their supposed insufficiency and uselessness as now completed.

The only proof brought forward by any of the writers of these Memorandums, that the works of the canal are not constructed properly, is that several breaches have occurred during the time they were in progress, especially those in the year 1870.

Having inspected all these breaches soon after they were made, and being well acquainted with all the circumstances which caused them, I am convinced that most of them would not have taken place, had the canal been provided with a sufficient amount of waste weirs, or calingulabs; some of the smaller breaches no doubt were caused by the water finding its way through the banks at holes made by vermin; but all the large breaches of 1867 and 1870 were, I am convinced, caused by the water in the canal rising during sudden heavy storms far more rapidly than the existing waste weirs could carry off, and, therefore, topping the banks generally where they joined some one of the masonry walls. That sufficient waste weirs were not provided has been shown by Mr. Latham not to be a matter for blaming any one, and the Government of Madras have so acknowledged. When the proposed additions to these calingulabs have been constructed, I am of opinion no breaches of any importance will occur again, even if heavy storm floods, such as that of 1870, should flow into the canal when full.

In Memorandum 4, the Honourable Mr. Sim remarks that, "if the canal is placed in such a condition that the ryots may be sure of water, the Company need be under no apprehension of want of customers." This is encouraging to the shareholders, and his anticipation is already partly fulfilled; for during 1871, when for the first time water was admitted all along the canal, no breaches took place, and the confidence of the ryots in the stability of the works was restored, while their knowledge of the advantages of wet over dry cultivation was greatly increased, and in consequence the amount of irrigation under the canal rose from 1,887 acres to 10,000 acres; and, from the private information I have received from the engineers now in charge of conservancy, I am convinced that next season near 100,000 acres will be irrigated, and then the remarks made by Mr. Sim further on in his Memorandum, that "the works with which they (the Company) have been entrusted have proved a ruinous failure," and that "the Company has been tried, and has lamentably failed," will prove to be not only premature, but also lamentably erroneous.

In conclusion, I may state my conviction that, when the proposed storage reservoirs have been constructed so as to secure a supply of water for second crops of rice and for sugar, and when navigation has been established, and the canal connected with the railway at Cuddapah, the success of the canal, both as a source of profit to the shareholders, and a cause of wealth and general prosperity to the country through which it passes, will very soon be most fully established.

I have, &c.

A. J. Dodson,

Late Executive Engineer,
Madras Irrigation and Canal Company.

London, 6 February 1872.

— No. 31. —

The Secretary of the Madras Irrigation and Canal Company to the Under Secretary of State for India.

Madras Irrigation and Canal Company,
8 and 9, Queen-street Place, London, E.C.,
29 February 1872 (No. 2).

Sir,

WITH reference to the last two paragraphs of your letter of the 9th ultimo, I *See No. 29.* have received instructions from the directors of this company to assure his Grace the Secretary of State for India that, from the passing of "The Madras Irrigation and Canal Act, 1866," which specially authorised the loan of 600,000 £, they have steadily proposed to raise funds, at the proper time, to pay off the debentures given as security for its repayment, by issuing bonds, mortgages, or debentures under the express authority given to them by the 6th section of that Act; and upon the receipt of your communication they proceeded to put their resolve into force, and for their guidance sought advice as to the proper mode of procedure, when to their surprise it was suggested that it is not certain whether, under the existing powers conferred upon them by the Act of Parliament, they can issue fresh debentures in substitution of, and placing the holders in the same position of priority as that of the Secretary of State for India in virtue of, those now held by him.

Under these circumstances, in order to remove any difficulty, such as that which has been suggested, and to enable the company to issue securities unquestionably free from doubt, the directors propose to apply for a short supplementary Act, which, with the concurrence of his Grace, may be obtained this Session, and will enable them to raise funds to provide for the discharge of the debentures as they fall due, and thus meet his requirements, as expressed in your letter. In anticipation of his Grace's confirmation of this action on their part, the directors have instructed their Parliamentary Agents to take the necessary steps for that purpose, in order that if possible such an Act may be passed before the falling due of the first debenture.

I have, &c.

John Westwood, Secretary.

— No. 32. —

The Government of Madras to the Secretary of State for India.

My Lord Duke,

12 March 1872 (No. 4).

WE have the honour to forward, for your Grace's information, copy of a report by the Acting Chief Engineer for the Madras Irrigation and Canal Company, furnishing particulars regarding the result of the operations of the season now closing, together with the observations of the Acting Chief Engineer for Irrigation thereon.

Proceedings of
Government, dated
6th March 1872,
No. 613.

We have, &c.

A. J. Arbuthnot,
Fredk. Haines, Lieut. General,
Commander in Chief.

J. D. Sim,
R. S. Ellis.

Enclosure 1, in No. 32.

The Acting Agent and Manager of the Madras Irrigation and Canal Company to the Acting Chief Engineer for Irrigation; dated Madras, 23rd January 1872, No. 24.

I HAVE the honour to forward copy of the Acting Chief Engineer's Report for the month of December 1871.

REPORT to accompany Divisional Reports for December 1871.

WATER has been kept during December at a uniform depth of 4 feet 6 inches in the canal below Soonkasala head sluices. At Jupaud the average depth has been 2 feet 9 inches, and at Lockinsala 5 feet 2 inches. From Jootoor anicut down to Cuddapah, water has been allowed to flow about 2 feet deep on an average, and there has been no serious accident.

Since commencement of this month a small breach has occurred near the end of the canal at Cuddapah, from which I expect no inconvenience to arise.

Just now the works are undergoing a most careful scrutiny, so that whatever weak places exist may be found and repaired during the dry season now beginning.

There are 42 locks upon the canal, and, as till now they have been untried, it is quite certain that repairs will be needed. But, from what I already know, the cost will not be great.

The consolidation of earthwork throughout the canal also will render some work necessary.

The season may now be considered at an end, and it is the universal opinion here that it has been very successful indeed.

Throughout the season no serious accident has occurred, and the flow of water from Soonkasala to Cuddapah has been uninterrupted and sufficient for all demands.

It is to be hoped that, before next season, at least one steam launch will be sent out and put upon the canal.

Recently we have filled a number of the Government tanks, which were either dry or had an insufficient supply of water, owing to the want of rain this year. At one time it was almost expected that there would be a famine; and then it was wonderful to find how the canal was looked upon by all as a source of safety for this neighbourhood.

I will now make one or two remarks on the accompanying reports.

There can be no doubt whatever that it would be an immense improvement to our works, if one of the large tanks proposed in Mysore were to be constructed. It would enable the canal to supply two crops without any doubt; and when cultivators can get water for two crops the use of it is likely to spread in area as well as quantity.

I am sorry to see Mr. Wilks thinks he over-estimated the area of land flooded on his district. It is, as he says, most difficult to prevent the surreptitious use of water where floodings are allowed; and my impression still is that the area of land irrigated and flooded has not been over-estimated, though I fear in some places the proof may this year be difficult.

I will here explain the difference between the above two terms, which we have so often to use, and concerning which there might be misconception.

We supply water at two rates. Rice, which has to be watered every day, is charged at the rate of 6 rupees per acre for the crop; and this we call land-irrigated.

Crops of indigo, &c., which may only need one good watering, are supplied at the rate of 1 rupee per acre for each efficient watering; and this we call land-flooded.

It certainly has been our interest to extend the use of water as much as possible this year, even if some has been used surreptitiously.

It must be remembered also that on the whole canal of 188 miles, with about 250 miles of minor channels, we have only had two surveyors to measure up all the land irrigated.

Mr. Knorpp estimated the irrigation for next season at 50 or 60 per cent. of the land commanded on the 10th section. This would give from 2,100 to 2,500 acres, and that proportion on the whole of the channels designed for the whole canal would give 86,000 acres; but I do not expect so much next year, though under favourable conditions, I think, the canal may irrigate upwards of 40,000 acres.

There is one question which gives me much anxiety now, namely, the termination of the conservancy engineers' engagements, and the delay there has been in coming to an understanding with them. It is most unfortunate, but before this reaches England I hope to have telegraphed that an understanding has been arrived at.

A. Browning,
Acting Chief Engineer.

Enclosure 2, in No. 32.

MEMORANDUM by Captain Scott.

SUBMITTED for the information of Government.

2. With the above letter the acting agent of the company forwards the chief engineer's report for the month of December last. It would appear that water has been continuously passed down the canal during the season now closing. In the upper half of the work the depth retained has varied from 2 feet 9 inches to 5 feet 2 inches, and in the lower half it has been limited to 2 feet. The chief engineer adds that no serious accident has occurred, but notes that at the commencement of the current month a small breach had been made near the Cuddapah terminus.

3. The result of the season's operations are so far satisfactory, that a considerable body of water, though much below that which the works were constructed to retain, has been impounded in each of the tanks formed by the canal banks, where depressions have been crossed,

crossed, and the earthwork will undoubtedly have become to a certain extent consolidated and improved thereby. In those portions, however, where the normal bed level is but slightly above the natural ground, or where the canal is partially in cutting, the depth water standing against the new earthwork has been so small that but little effect can have been produced tending to render it water-tight; and the raising of the supply to the full level, if carried out next year, would, in my opinion, result in more disastrous breaches. Several seasons must elapse, marked by progressive increase in the depth carried in the canal, combined with annual additions to the earthwork, before it will be in condition to carry the full supply.

4. Considering the small depth of water which has been allowed to exert pressure on the lock, invert, or retaining walls, they ought not to have suffered if properly constructed in the first instance; and it is to be hoped that the anticipation of the chief engineer, that any needed repairs will be of moderate extent, will be realised.

5. No details of the extent of land irrigated are given; but there is, I think, little probability of the Budget Estimate for 1872-73 in this respect being exceeded.

A. de C. Scott, Captain, R. E.,
For Acting Chief Engineer for Irrigation.

See Enclosure 3 in
No. 35

— No. 33. —

The Secretary to the Government of Madras to the Under Secretary of State for India.

Public Works Department, Fort St. George,
12 March 1872. (No. 689.)

Sir,

I AM directed by the Honourable the Governor in Council to forward the accompanying statement, which has been furnished by the Accountant General of this Presidency, showing the sums received and disbursed in India on account of the Madras Irrigation and Canal Company for the month of January 1872. The aggregate amount disbursed up to the 31st January was Rs. 94,40,762. 3. 10.

	Rs.	a.	p.
Capital Account	93,58,307	-	5
Revenue ditto	82,455	3	5

I have, &c.
J. Carpendale, Colonel, R.E.,
Secretary to Government.

Enclosure in No. 33.

STATEMENT showing the Sums Received and Disbursed at this Presidency on account of the Madras Irrigation and Canal Company during the Month of January 1872.

	RECEIPTS.		DISBURSEMENTS.	
	Capital Account.	Revenue Account.	Capital Account.	Revenue Account.
BANK OF MADRAS.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
NIL.	—	—	—	—
COLLECTOR OF KURNOOL.				
Tax for water supplied by the Irrigation and Canal Company realised in January 1872 -	- - -	889 8 5	—	—
Amount received in ditto on account of assessment of land made over to the company -	- - -	61 7 4	—	—
Payments from the commencement, namely, 1st October 1859 to 31st December 1871, on Capital Account -	- - -	- - -	93,58,307 - 5	—
Ditto ditto to ditto, on Revenue Account -	- - -	- - -	- - -	82,455 3 5
Receipts from ditto, namely, 1st May 1865 to ditto, on Capital Account -	1,68,417 5 9	—	—	—
Ditto ditto, namely, May 1865 to ditto, on Revenue Account -	- - -	57,198 12 9	- - -	—
GRAND TOTAL of Receipts and Disbursements up to 31st January 1872 -	Rs. 1,68,417 5 9	58,149 12 6	93,58,307 - 5	82,455 3 5

Fort St. George, Accountant General's Office,
4 March 1872.

R. W. Ludwick,
Acting Accountant General.

— No. 34. —

The Under Secretary of State for India to the Secretary of the Madras Irrigation Company.

Sir,

India Office, 16 March 1872.

See Nos. 30, 31,
and 29.

I AM directed by the Secretary of State for India to acknowledge the receipt of your letters Nos. 1 and 2, dated 29th February, in reply to mine of 9th January, whereby the directors of the Madras Irrigation and Canal Company were apprised that, in any future operations that may be contemplated by the company, they must rely entirely on the resources which they can independently command, for that no further pecuniary aid will be afforded to them by Government; and whereby it was likewise intimated that the Secretary of State will consider it his duty to take steps for securing to the State repayment of its advances of 600,000 £. to the company, as the instalments fall due.

2. With reference to the concluding paragraph of the first of these letters, I am to state that the Duke of Argyll can give no opinion on the subject, until he shall be made aware of the nature and extent of the proposed alterations of the company's contract.

3. With reference to the second letter, I am to request that a copy of the draft of the Supplementary Act of Parliament, which the Board desire to obtain, in order to enable them to issue fresh debentures in place of those at present held by his Grace, may be forwarded for the information of the Secretary of State in Council.

I am, &c.

M. E. Grant Duff.

— No. 35. —

The Governor General in Council to the Secretary of State for India.

My Lord Duke,

Fort William, 20 March 1872. (No. 38.)

We have the honour to forward herewith, for your Grace's information, the Budget-Estimate of the Madras Irrigation and Canal Company for 1872-73.

2. It will be observed from the estimate that, up to the end of 1872-73, the working expenses of the company are likely to be in excess of the gross receipts by 50,305 rupees, as follows:—

	1871-72.	1872-73.	TOTAL.
	Rs.	Rs.	Rs.
Receipts - - - - -	15,000	50,000	65,000
Expenses - - - - -	61,377	75,792	1,37,169
Deficit - - - - -	46,377	25,792	72,169
Deduct balance in favour of revenue at end of 1870-71			21,864
Probable net deficit to end of 1872-73		Rs.	50,305

3. The question as to the manner in which this deficit should be met has received our attention, and we have decided that it should for the present be provided for from the ordinary grant assigned to Madras for irrigation works; but we do not consider this as a final or satisfactory solution of the question. By para. 21 of the contract with the irrigation company, it is provided that, if the works are not kept in good repair and in good working condition, the Government of Madras can execute the necessary repairs, the cost of so doing being met from the amount payable for guaranteed interest.

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4. In the present case, should the estimate prove correct, the funds for the purpose will have to be advanced by the State; and we are of opinion that the strict letter of the contract should be enforced, and that the net amounts advanced should be recovered from the guaranteed interest payable to the company. This, however, is a point which can be decided by your Grace alone. But we may observe that, in our opinion, the charge to the State, arising from the operations of the Madras Irrigation and Canal Company, is already excessive, and that we hope that the decision that may be arrived at will have the effect of preventing any increase to that charge.

We have, &c.

Napier.

Napier of Magdala.

John Strachey.

R. Temple.

J. Stephen.

B. H. Ellis.

H. W. Norman.

Enclosure 1, in No. 35.

The Secretary to the Government of Madras to the Secretary to the Government of India.

Public Works Department, Fort St. George,

16 February 1872. (No. 444.)

Sir,

I AM directed to transmit the Budget Estimate of the Madras Irrigation and Canal Company for the year 1872-73, with the orders of this Government thereon.

2. The following is an abstract of the estimate:

State Outlay.		Rs.	a.	p.
Establishment	- - - - -	5,000	-	-
Land	- - - - -	11,000	-	-
		Rs.	16,000	- -
Construction Funds.				
Main Canal	- - - - -	25,000	-	-
Distribution Channels	- - - - -	8,000	-	-
Establishment	- - - - -	50,000	-	-
Enlargement of Calingulahs	- - - - -	60,000	-	-
		Rs.	1,43,000	- -
Revenue Account.				
Gross earnings up to end of 1872-73	- - - - -	86,863	7	11
Working expenses -	- - - - -	1,37,168	15	2
Against Revenue	- - - Rs.	50,305	7	3

3. Accepting the estimate of Revenue Returns as modified by the Acting Chief Engineer for Irrigation, it will be observed that the working expenses are estimated to exceed the revenue receipts by—

Rs.	a.	p.
24,513	7	3 on the 31st March 1872.
25,792	-	- in 1872-73.

Rs. 50,305 7 3

In requesting the attention of the Government of India to the remarks of the Acting Chief Engineer in paragraph 7 of his letter, I am to observe that, if this extraordinary charge is to be met from the Ordinary Agricultural Assignment, it is absolutely necessary that the grant under that head should be supplemented to the extent above shown. On this subject

197.

N 2

I am

I am to invite attention to the Madras Public Works Budget for the ensuing year, from which it will be observed that it has not been practicable to make provision for more than two irrigation works, while the minor works grant is utterly inadequate to meet heavy demands for incomplete and other works, for which funds will have to be allotted after the 1st April next.

4. Under these circumstances, and looking to the necessity, which the Government of India have admitted, of providing a larger sum than has hitherto been available for agricultural repairs, I am to express a hope that that Government will, in reviewing the demands of the Empire for next year on account of its public works, not lose sight of the claims of this presidency to an increased assignment under Agricultural.

I have, &c.

J. Carpendale, Colonel, R.E.,
Secretary to Government.

Enclosure 2, in No. 35.

The Acting Chief Engineer for Irrigation to the Secretary to Government, Public Works Department; dated Fort St. George, 18th January 1872, No. 99.

I HAVE the honour to submit herewith the Budget Estimates of expenditure from State funds and from guaranteed and loan capital of the Madras Irrigation and Canal Company for 1872-73.

- 1 Statement of State Expenditure, with Appendix (C.)
1 Ditto Revenue, ditto.
4 Statements received from Agent.
1 Statement A, received from Collector of Kurnool.
2. The estimated outlay on the Establishment of Control, now amalgamated with the office of the Chief Engineer for Irrigation, and for compensation for land taken up, amounts to 16,128 rupees, made up as follows:—

	Rs.
Proportion of the establishment of the Chief Engineer for Irrigation employed in connection with the company - - -	5,128
Compensation for land taken up for the project - - -	11,000
Total Outlay - - - Rs.	16,128

3. The outlay from guaranteed and loan capital is estimated by the agent as follows:—

	Rs.
Agency and engineering establishment - - -	50,000
General work on the main canal - - -	25,000
Ditto - on the distributory channels - - -	8,000
Enlargement of the Calingulahs - - -	30,000
Total - - - Rs.	1,13,000

The present monthly charge for the construction and agency staff, sanctioned by Government Order, No. 38, dated 8th January 1872, is 6,515 rupees; but its gradual reduction is contemplated. It is necessary to provide for an agency establishment, as it is obvious that the accounts of the Company will not be wound up by the end of the current year; in fact, the extension of the works for the discharge of surplus water, sanctioned in Government Order No. 1089, dated 18th April 1871, and the completion of the distribution projects providing employment for an engineering staff, infer the continuance, for a portion of the year at any rate, of the agency. A provision of 2,500 rupees for each section of the main canal has been made, and will undoubtedly be required, to meet the cost of raising the earthwork to make good sinking from rain, and for other contingencies due to original faulty construction. Such expenditure is fairly chargeable to capital. In an estimate received from the agent, of later date than the Budget under review, the cost of the reconstruction and extension of the calingulahs is calculated at 60,000 rupees instead of 30,000 rupees, as in the latter document; and consequently the total estimated outlay under Construction should be increased to 1,43,000 rupees.

4. The Company having drawn the whole of the amount which Government engaged to furnish under the supplementary agreement, dated 2nd October 1866, the expenditure under "Construction," detailed above, will have to be met from the balances in the hands of the agent and the directors, which amount at present, as far as can be ascertained, to about four and a half lakhs.

5. The expenditure against Revenue is made up of the charge for the conservancy establishment sanctioned in Government Order No. 817, dated 18th March 1871, and of an item of 3,000 rupees for the repair of the irrigating channels. The monthly allowance for Establishments

Establishments for the first six sections being 3,044 rupees, and for the remainder 3,022 rupees,

	Rs.
The total annual charge is - - - - -	72,792
Adding for repairs - - - - -	3,000
The Total estimated Expenditure is - Rs.	75,792

But this amount taken by the agent as debitable against Revenue in 1872-73 must be increased considerably. In a statement from this office of the 23rd August 1871, No. 332, recorded by Government Order No. 2823, of the 7th November 1871, it is shown that, under the head of "Work Chargeable to Revenue," there is a sum of 4,062 rupees not brought into account, which has not been taken into consideration by the agent in his Budget Estimate now forwarded. Again, in consequence of the actual cultivation during the current year having fallen far short of the moderate estimate made in the statement above referred to, the balance to the debit of Revenue at the end of this year is now estimated at 24,513 rupees, which sum must be carried forward to the year now budgetted for, raising the probable charges against Revenue in 1872-73 to 1,00,305 rupees. The agent estimates the area of land that will be irrigated during the ensuing year at 37,300 acres, but does not detail the nature of the crop or crops for this area, so that the rates leviable and the revenue cannot be deduced. As far as can be ascertained at present, the results of the present year (1871-72) have been disappointing. The return now furnished by the agent shows an area of 9,500 acres supplied with water during the year, but it is not to be understood that all this is for rice; in fact, there is reason to believe that by far the greater portion of the land was under dry crop cultivation, and that the water supply was limited to one or two floodings, for which a very low charge of from 1 to 2 rupees is leviable.

The Collector of the Kurnool district, in his statement appended, gives 7,256 rupees as the amount of collections realised up to the 30th September 1871, and 6,000 rupees as the probable collections up to the 31st March 1872, making an addition for the small amount of irrigation in the Cuddapah district. I have estimated the probable receipts during 1871-72 at 15,000 rupees.

The agent's estimate of irrigation for 1872-73 is, in my opinion, very excessive, and, if the area to be irrigated were set down at 8,000 acres, and the revenue derived from all sources at 50,000 rupees, it would probably be found much nearer the truth. There is no doubt that there will, if the present rate of expenditure is continued by the end of the year, be a large balance of expenditure against revenue, and the deficiency, 50,305 rupees, provided for in this Budget, is as near an approximation to it as can be made at present.

6. Recapitulating, it will be seen that provision has to be made in the Budget of 1872-73 for the following:—

	Rs.
Controlling establishment under the chief engineer for irrigation -	5,128
Compensation for land - - - - -	11,000
Excess of expenditure over gross revenue receipts - - -	50,305
TOTAL - - - Rs.	66,433

7. Under the 21st clause of the agreement between the Secretary of State and the company, of the 3rd June 1863, the latter are bound to keep the works in repair and in good working condition, and, in default of their doing so, and after due notice, this Government is authorised to carry out necessary repairs, and the expense of the same may be set off against any monies payable, or which may become payable, to the company by the Secretary of State under the agreement. It becomes, therefore, a matter for consideration whether Government should enter upon a system of advances to the company, under the head of Revenue Account for the maintenance of the works, which would probably never be refunded, or whether the provision of the agreement should be carried out.

190456

CORRESPONDENCE RELATING TO THE

DETAIL of ESTIMATE of State Expenditure on Account of the Operations of the Madras Irrigation and Canal Company for the Year 1872-73.

ABSTRACT.				Rs.
I.—Establishment	-	-	-	5,128
II.—Purchase of land	-	-	-	11,000
III.—Excess of cost of maintenance, &c., over gross revenue receipts	-	-	-	50,305
TOTAL				Rs. 66,433

I.—CONTROLLING ESTABLISHMENT.

Number.		Particulars.	Salary of Office.	Estimate of 1872-73.			Budget Estimate of 1871-72. Charges per Annum.	Regular Estimate of 1871-72.
1871-72.	1872-73.			Per Mensem.	Per Annum.	Total.		
			Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1	-	Consulting Engineer graded as Chief Engineer, Class II.	2,000	-	-	-	24,720	1,991
-	-	Ditto - Presidency house-rent	60	-	-	-	-	-
1	-	Manager	225	-	-	-	-	-
1	1	Accountant	42	42	504	-	-	-
1	1	Head Clerk	50	50	600	-	-	-
1	1	Draughtsman and Estimator	60	-	-	-	-	-
1	1	Ditto ditto	40	40	480	-	-	-
1	1	Record-keeper	50	50	600	-	-	-
1	1	Moochee	10½	-	-	-	-	-
1	1	Peon	8	8	96	3,528	7,254	4,599
1	1	Ditto	7	7	84	-	-	-
2	1	Ditto	6	-	-	-	-	-
1	-	Ditto	3	-	-	-	-	-
1	-	Sweeper	3	-	-	-	-	-
<i>For the Government Examiner :</i>								
1	1	Accountant	90	90	1,080	-	-	-
1	1	Peon	7	7	84	-	-	-
				-	-	-	3,528	6,590
				-	-	-	1,000	926
				-	-	-	600	352
				-	-	-	5,128	7,868
				-	-	-	35,744	7,868
				-	-	-	31,974	6,590
				-	-	-	2,570	926
				-	-	-	1,200	352
				-	-	-	5,128	7,868
				-	-	-	35,744	7,868

II.—PURCHASE OF LAND.

Number of Item.	Particulars.	Area.	Amount of Estimate.	Computed Payments to 31st March 1872.	Estimate for 1871-72.	Regular Estimate of 1871-72.	Estimate for 1872-73.
		Acres.		Rs.	Rs.	Rs.	Rs.
<i>Kurnool District :</i>							
	For Calingulah Channels enlarged	24	Not estimated, for the Land Registers and Bills are sanctioned by Government from time to time prior to the transfer of the land	68,571	10,000	4,555	5,000
	TOTAL for Kurnool	24	- - - - -	68,571	10,000	4,555	5,000
	Cuddapah District	-	Ditto - ditto - ditto	19,343	10,000	2,000	6,000
	TOTAL for Cuddapah	-	- - - - -	19,343	10,000	2,000	6,000
	GRAND TOTAL for Kurnool and Cuddapah	24	- - - - -	87,914	20,000	6,555	11,000

A. de C. Scott, Captain, R.E.,
For Acting Chief Engineer for Irrigation.

APPENDIX (C.)

ESTIMATED EXPENDITURE from Guaranteed and Loan Capital of the Madras Irrigation and Canal Company for 1872-73.

ITEMS.	Budget Estimate for 1872-73.	Budget Estimate for 1871-72, i. e., from 1st April to 30th June 1871.	Regular Estimate for 1871-72.
	Rs.	Rs.	Rs.
Main Canal	25,000	3,89,336	-
Distribution	8,000		
Buildings	50,000		
Establishment	60,000		
Electric Telegraph	-	-	-
Alteration of Calingulahs	-	-	-
Total Outlay	1,43,000	3,89,336	-

NOTE by the Chief Engineer for Irrigation.

No State provision will have to be made for this expenditure, as it will be met from the balance of the loan and guaranteed capital in the hands of the Company.

REVENUE ACCOUNT.

	Gross Earnings + Balance Cr. brought forward from previous Year.			Working Expenses + Balance Dr. brought forward from previous Year.			Balance Cr. or Dr. at the End of the Year.			Per-centage of Working Expenses.		
	1871-72.			1871-72.			1871-72.			1871-72.		
	1872-73.	Budget Estimate.	Regular Estimate.	1872-73.	Budget Estimate.	Regular Estimate.	1872-73.	Budget Estimate.	Regular Estimate.	1872-73.	Budget Estimate.	Regular Estimate.
Main Canal from Soonkasala to the Pennair	Rs. 50,000	Rs. 10,14,882	Rs. 36,863	Rs. *1,00,305	Rs. 40,334	Rs. 61,376	Rs. 50,305	Rs. 9,74,548	Rs. Dr. 21,513	Rs. 200.6	Rs. 11.36	Rs. 166.5

* This sum represents the estimated working expenses in 1872-73 added to the debit or loss on Revenue Account in 1871-72.

A. de C. Scott, Captain, R.E.,
For Acting Chief Engineer for Irrigation.

III.—REGULAR ESTIMATE, 1871-72.

STATEMENT of REVENUE EXPENDITURE in Comparison with REVENUE RECEIPTS, for two Years, namely, from 1st April 1871 to 31st March 1873.

Number of Item.	Particulars.	Amount.	Number of Item.	Particulars.	Amount.
		Rs. a. p.			Rs. a. p.
1	Balance in favour of Revenue on 1st January 1871, as per Revenue Account for the half year ended 31st December 1870	20,914 - 2	4	Working Expenses for 1871-72, as per agent's statement	56,714 15 2
2	Collections from 1st January to 31st March 1871, as per Accountant General's statements	949 7 9	5	Add Contingencies	600 - -
3	Estimated Revenue Receipts for 1871-72	15,000 - -	6	Work chargeable to Revenue, but not yet brought into account	4,062 - -
	Balance against Revenue on the 31st March 1872	24,513 7 3		TOTAL	61,376 15 2
	TOTAL	61,376 15 2		TOTAL	61,376 15 2

BUDGET ESTIMATE, 1872-73.

1	Estimated Earnings in 1872-73	50,000 - -	2	Balance against Revenue on the 31st March 1872	24,513 7 3
	Balance against Revenue on 31st March	50,305 7 3	3	Working Expenses, 1872-73	75,792 - -
	TOTAL	1,00,305 7 3		TOTAL	1,00,305 7 3

Fort St. George, 18 January 1872.

A. de C. Scott, Captain, R.E.,
For Acting Chief Engineer for Irrigation.

No. 1.
MADRAS IRRIGATION AND CANAL COMPANY.

BUDGET ESTIMATE of the EXPENDITURE required on the CONSTRUCTION ACCOUNT, 1872-73.

NAME OF WORKS.	Amount of Sanctioned Estimate.	Actual Expenditure up to 31st January 1871.	Anticipated Expenditure from 1st February 1871 to 31st March 1872.	Total of Columns 3 and 4.	Probable Expenditure for 1872-73.	REMARKS.
1.	2.	3.	4.	5.	6.	7.
MAIN SUPPLY.						
Ancient and headwork at Kurnool - - - - -	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
Ditto - ditto at Soonkasala - - - - -	3,09,080 - -	60,326 7 8	- - - - -	60,326 7 8	- - - - -	
Ditto - ditto at Somaswaram - - - - -	4,85,122 - -	4,69,671 14 8	1,315 - 11	4,70,986 15 7	- - - - -	
Ditto - ditto at Adamsully - - - - -	1,71,727 1 7	66,048 2 11	- - - - -	66,048 2 11	- - - - -	
Ditto - ditto at Adamsully - - - - -	* 3,86,000 - -	3,92,399 2 -	47,248 8 10	4,39,647 10 10	- - - - -	* Includes the supplemental estimate, 41,500 rupees, submitted on the 24th June 1871.
Aqueduct across the River Hindry - - - - -	2,76,250 - -	2,76,324 10 8	- - - - -	2,76,324 10 8	- - - - -	
Canal for one mile from the head sluice of the Kurnool aqueduct - - - - -	65,000 - -	49,234 8 3	- - - - -	49,234 8 3	- - - - -	
South Main Canal, 1st Section, 17 1/2 mile - - - - -	† 10,95,567 5 4	10,93,812 11 3	9,501 1 5	11,03,313 12 8	2,500 - -	† Includes the amount of supplemental estimate of Rs. 21,880. 8. 6. submitted on the 23rd June 1871.
Ditto - 2nd ditto 18th to 32nd mile - - - - -	19,63,370 - -	19,62,056 12 4	16,007 8 6	19,78,121 4 10	2,500 - -	
Ditto - 3rd ditto 33rd to 43rd mile - - - - -	9,75,790 - -	9,04,800 8 11	13,808 9 7	9,18,609 2 6	2,500 - -	
Ditto - 4th ditto 44th to 60th mile - - - - -	10,55,521 - -	9,78,538 11 7	5,416 11 10	9,83,955 7 5	2,500 - -	
Ditto - 5th ditto 61st to 72nd mile - - - - -	8,80,738 2 9	8,70,372 10 -	9,936 14 8	8,80,309 8 8	2,500 - -	
Ditto - 6th ditto 73rd to 91st mile - - - - -	9,43,427 5 4	8,30,654 6 2	32,230 7 3	8,62,904 13 5	2,500 - -	
Ditto - 7th ditto 92nd to 114th mile - - - - -	7,49,383 5 4	6,50,878 14 6	23,322 - 9	6,74,200 15 2	2,500 - -	
Ditto - 8th ditto 115th to 118th mile - - - - -	* 9,30,111 - -	7,50,379 13 9	76,385 2 2	8,26,764 15 11	2,500 - -	* Includes the probable amount of supplemental estimate, 50,000 rupees, under preparation.
Ditto - 9th ditto 14th to 178th mile - - - - -	9,56,177 - -	7,04,318 11 7	70,621 6 5	7,74,940 2 -	2,500 - -	
Ditto - 10th ditto 179th to 186th mile - - - - -	2,57,437 - -	1,70,593 8 7	24,926 9 7	1,95,520 2 2	2,500 - -	
Breaches, 1st to 4th Section, for 1870 - - - - -	69,780 - -	33,410 13 5	96,369 2 7	69,780 - -	- - - - -	
TOTAL - - - - -	1,14,64,481 4 4	1,02,63,872 8 3	3,67,399 4 5	1,06,31,271 12 8	25,000 - -	
DISTRIBUTION.						
Branch Channel and Sluices of 1st Section - - - - -	7,002 15 5	5,170 3 10	484 15 9	5,655 3 7	- - - - -	
Distribution Works of 2nd Section - - - - -	6,000 - -	4,986 4 6	83 10 8	5,069 15 2	- - - - -	
Ditto - - of 3rd ditto - - - - -	11,150 - -	10,106 10 -	2,453 15 2	12,560 - -	1,000 - -	
Ditto - - of 4th ditto - - - - -	51,463 14 -	26,359 2 1	10,509 6 10	37,068 8 11	1,000 - -	
Constructing a bund across the canal in 43th mile, 4th Section - - - - -	76 - -	72 12 6	- - - - -	72 12 6	- - - - -	
Distribution works of the 5th Section - - - - -	20,550 - -	2,363 7 1	9,108 7 8	11,471 14 9	1,000 - -	
Ditto - ditto 6th ditto - - - - -	71,400 - -	25,320 7 4	26,647 13 11	51,968 5 3	1,000 - -	
Ditto - ditto 7th ditto - - - - -	8,40,000 - -	183 15 8	26,316 - 4	26,500 - -	1,000 - -	
Ditto - ditto 8th ditto - - - - -	49,090 - -	1,199 3 11	44,900 12 1	46,100 - -	1,000 - -	
Ditto - ditto 9th ditto - - - - -	46,565 - -	918 - 5	35,866 8 10	36,784 9 3	1,000 - -	
Ditto - ditto 10th ditto - - - - -	10,000 - -	- - - - -	9,269 15 2	9,269 15 3	1,000 - -	
Ditto - ditto at Soonkasala - - - - -	925 2 6	925 2 6	- - - - -	925 2 6	- - - - -	
Kurnool town water supply - - - - -	1,699 - 7	1,416 11 4	- - - - -	1,416 11 4	- - - - -	§ Includes 25,000 rupees for first range, sanctioned in Government Order No. 2939, of December 1870.
TOTAL - - - - -	3,15,832 - 6	79,311 8 -	1,65,641 10 6	2,44,953 2 6	8,000 - -	

B U I L D I N G S.

Central Hospital, with out-houses and compound wall, at Kurnool - - - - -	5,050 - -	4,692 13 1	- - - - -	4,692 13 1	- - - - -	
Repairs to - ditto - ditto - - - - -	68 - -	60 - -	- - - - -	60 - -	- - - - -	
Overseer's Hut at Kurnool - - - - -	1,244 13 3	- - - - -	- - - - -	- - - - -	- - - - -	
Office, and Store-house, and Workshop at Soonkasala - - - - -	5,847 - -	5,980 9 -	- - - - -	5,980 9 -	- - - - -	
Powder Magazine, Store and Station roads at Bowanassy - - - - -	4,359 5 9	4,359 5 9	- - - - -	4,359 5 9	- - - - -	
Office and Store-room, and Artificer's shed at Bowanassy - - - - -	7,297 8 5	7,110 - 4	- - - - -	7,110 - 4	- - - - -	
Repairing the above building at Bowanassy - - - - -	648 - -	412 8 8	- - - - -	412 8 8	- - - - -	
Improvement of road approaching to the above building, and repairing culvert at Bowanassy - - - - -	578 - -	317 14 -	- - - - -	317 14 -	- - - - -	
Converting the unfinished building intended for a Gunpowder Manufactory into a Hospital at Bowanassy - - - - -	427 - -	30 10 2	- - - - -	30 10 2	- - - - -	
Office and Store building at Valapanoor in Bowanassy - - - - -	1,970 - -	1,999 - -	510 - -	2,500 - -	- - - - -	
Ditto - ditto - at Jupand, in Nagalore Division - - - - -	† 4,782 1 1	4,732 1 1	1,300 - -	6,082 1 1	- - - - -	† Includes the amount of supplemental estimate, Rs. 659. 1. 1, submitted for sanction on the 9th May 1870.
Ditto - ditto - at Pugalal - ditto - - - - -	3,977 7 7	3,833 1 11	- - - - -	3,833 1 11	- - - - -	
Ditto - ditto - at Chintacotta, in Koondaur Division - - - - -	5,283 - -	5,278 1 1	- - - - -	5,278 1 1	- - - - -	
Office and temporary Store-shed at Ayalore, in Koondaur Division - - - - -	642 - -	67 6 -	- - - - -	67 6 -	- - - - -	
Quarters for Sub-Assistant Engineers and Assistant Surveyors, Koondaur Division - - - - -	1,236 - -	561 4 10	- - - - -	561 4 10	- - - - -	
Repairs to Ancient Office at Zorapoor - - - - -	327 - -	307 12 -	- - - - -	307 12 -	- - - - -	
Office, Store, and Workshop at Kurnool - - - - -	30,612 - -	14,488 15 4	- - - - -	14,488 15 4	- - - - -	
Repairs to - ditto - at - ditto - - - - -	294 - -	- - - - -	- - - - -	- - - - -	- - - - -	
Iron and Brass Foundry at - ditto - - - - -	15,327 15 4	15,167 8 7	- - - - -	15,167 8 7	- - - - -	
Room for receiving and dispatching Stores at Kurnool - - - - -	4,979 7 6	4,922 14 7	- - - - -	4,922 14 7	- - - - -	
Engineer's Bungalow, Dhooor - - - - -	3,200 - -	- - - - -	3,209 - -	3,209 - -	- - - - -	
Thirty-two Sluice Lacers' Huts - - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	
TOTAL - - - - -	99,250 10 11	74,362 14 5	5,010 - -	79,372 14 5	- - - - -	
Telegraph line from Soonkasala to Cuddaloh - - - - -	72,000 - -	56,893 1 -	3,900 - -	50,993 1 -	- - - - -	
Alteration of Calingulab, &c. - - - - -	60,000 - -	- - - - -	30,000 - -	30,000 - -	30,000 - -	
GRAND TOTAL - - - - -	1,20,10,503 15 9	1,04,74,459 15 8	5,71,050 14 11	1,10,45,490 14 7	63,000 - -	

No. 2.

Madras, 11 January 1872.

No. 3.

C. A. Badham, Chief Accountant.
F. H. Henslowe, Agent and Manager.

Madras, 15 December 1871.

No. 4.

* *Note by the Chief Engineer for Irrigation.*—No reliance can be placed on this estimate.

Madras, 15 December 1871.

C. A. Badham, Chief Accountant.
F. H. Henslowe, Agent and Manager.

(A.)

STATEMENT showing the Amounts on Account of the Revenue of Madras Irrigation and Canal Company collected up to 30th September 1871, and the expected Receipts up to 31st March 1872.

Amount collected from 1st April to 30th September 1871.	Probable Amount that can be realised from 1st October 1871 to 31st March 1872.	Remarks.
Rs. a. p. 7,255 14 6	Rs. a. p. 6,000 - -	—

Kurnool, 24 October 1872.

E. Turner,
Acting Head Assistant Collector, in charge.

Enclosure 3, in No. 35.

THE Acting Agent and Manager of the Madras Irrigation and Canal Company, to the Acting Chief Engineer for Irrigation and Joint Secretary to Government; dated Madras, 22nd January 1872, No. 22.

I HAVE this morning received from the acting chief engineer an amended estimate of irrigation for the Budget Statement of 1872-73, and I now have the honour to hand you a copy of it.

2. You will observe that in the original statement the error is in the details, the eighth item being entered as 300 acres instead of 3,000, and that the correct total will be 40,000 acres.

BUDGET ESTIMATE of IRRIGATION for the Year 1872-73.

Position.	Areas commanded.	Areas being supplied in 1871-72.	Areas to be supplied in 1872-73.
1st section - - - - -	1,386	4,000	1,000
2nd ditto - - - - -	1,956		800
3rd ditto - - - - -	9,837		1,400
4th ditto { 1st sub-division - - - - -	14,807		6,500
{ 2nd ditto - - - - -	10,511	5,500	6,500
5th ditto { North Bowanassy - - - - -	9,516½		500
{ South ditto - - - - -	12,000		500
6th ditto - - - - -	27,970		3,000
7th ditto - - - - -	19,300		5,000
8th ditto - - - - -	31,737		7,000
9th ditto - - - - -	25,330		5,000
10th ditto - - - - -	4,222		3,000
TOTAL - - -	168,572½	9,500	40,000

Kurnool, 11 December 1871.

A. Browning, Acting Chief Engineer.

Enclosure 4, in No. 35.

ORDER of the Government of Madras, 16th February 1872, No. 443.

THE foregoing letter gives cover to the Budget Estimates of the Madras Irrigation and Canal Company for the year 1872-73.

2. The proposed State expenditure on account of establishments and land is 16,128 rupees, against 55,800 rupees in the budget for 1871-72. This decrease is due chiefly to the appointment of consulting engineer having in G. O., No. 1194, dated 28th April 1871, been abolished, and the duties amalgamated with those of the chief engineer for irrigation, and to the office establishment having been reduced. The estimate of State outlay is passed for an even sum of 16,000 rupees.

3. The estimate of expenditure from guaranteed and loan capital amounts to 1,43,000 rupees, which his Excellency the Governor in Council accepts. The outlay under construction will have to be met from the balances in the hands of the company, which is believed to be about four and a half lakhs of rupees.

4. The revenue account, as modified by the acting chief engineer, furnishes the following particulars:—

REVENUE.		WORKING EXPENSES.	
	Rs. a. p.		Rs. a. p.
Balance in favour of revenue on the 31st March 1871.	21,863 7 11	Working expenses in 1871-72	61,376 15 2
Estimated revenue receipts for 1871-72.	15,000 - -	Ditto - ditto 1872-73	75,792 - -
Ditto for 1872-73 - -	50,000 - -		1,37,168 15 2
	Rs. 86,863 7 11		86,863 7 11
		Balance against Revenue - Rs.	50,305 7 3

5. The Government concur in the opinion that, taking into consideration the circumstances urged in paragraph 5, the revenue returns cannot be more favourably estimated. The excess expenditure over gross receipts is computed at 50,305 rupees, and the question as to whether this charge should be met from the ordinary agricultural grant will be referred for the orders of the Government of India.

Enclosure 5, in No. 35.

MADRAS IRRIGATION BUDGET ORDERS, 1872-73.

THE sum granted for expenditure on ordinary irrigation works in Madras during 1872-73 was 20 lakhs of rupees, but, with reference to the recent correspondence on the subject with the Government of Madras, the Governor General in Council has been pleased to increase the ordinary agricultural grant to 23½ lakhs of rupees.

2. For extraordinary irrigation works the grant assigned was 12 lakhs of rupees, but the estimate submitted amounts to 11 lakhs of rupees only, and this sum is accordingly allowed. But it may be added that, if during the course of the year it is found that additional loan funds are required to admit of rapid progress on works entered in the Budget Estimate, or for works the estimates for which may be sanctioned as extraordinary, the Government of India will be prepared to sanction an extra grant for the purpose. Meanwhile the total agricultural grant to be dealt with in these orders will be—

	Rs.
Ordinary - - - - -	23,25,000
Extraordinary - - - - -	11,00,000
Total - - - Rs.	34,25,000

3. The Budget Estimate for irrigation works, as submitted by the Government of Madras, forms a portion of the Budget Estimate for general public works; but, as it has been decided that the irrigation expenditure should be recorded under the main heads "capital" and "revenue," it is necessary, in order to admit of this being done, that that portion

portion of the general budget relating to irrigation works should be dealt with separately, and that the irrigation grant should be divided off under the heads in which it is essential that the expenditure should be recorded.

4. In this view the provision for irrigation works in Madras is passed as follows:—

	Works.	Establishment.	Tools and Plant.	TOTAL.
<i>Capital Account.</i>	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>
Extraordinary—				
Rooshkoolia Project - - - - -	25,000	17,000	1,000	43,000
Extension of Irrigation in Western Delta of Godavery - - - - -	3,00,000	40,000	12,000	3,52,000
Irrigation Works in Kistna Delta - - - - -	1,20,000	40,000	2,200	1,62,200
Perruair Project, Madura - - - - -	50,000	36,200	1,000	87,200
Pennair Anicut, Nellore - - - - -	65,000	18,000	1,000	84,000
Improvements to Sungum Project - - - - -	50,000	10,000	1,000	1,21,000
Pajandoral Project - - - - -	60,000	-	-	60,000
Chavery and Vennaur Works - - - - -	1,16,000	15,800	2,000	1,33,800
Streevyguntum Anicut Project - - - - -	91,000	24,800	1,000	1,16,800
Total - - - Rs.	8,77,000	2,01,800	21,200	11,00,000
Ordinary—				
Madras Water Supply Project - - - - -	80,000	20,000	2,000	1,02,000
Chembrambakum Tank Project - - - - -	50,000	10,000	1,000	61,000
State Outlay on Guaranteed Irrigation Works - - - - -	16,000	-	-	16,000
Minor Works - - - - -	1,20,200	26,000	1,000	1,47,200
Total - - - Rs.	2,66,200	56,000	4,000	3,26,200
TOTAL CAPITAL ACCOUNT - - - Rs.	11,43,200	2,57,800	25,200	14,26,200
<i>Revenue Account.</i>				
Ordinary—				
Repairs to Irrigation Works - - - - -	12,00,000	3,57,123	19,000	15,76,123
Conservancy Establishment - - - - -	-	97,677	-	97,677
TOTAL REVENUE - - - Rs.	12,00,000	4,54,800	19,000	16,73,800
TOTAL - - - Rs.	14,06,200	5,10,800	23,000	20,00,000
Reserve Ordinary—				
Additional Grant herein allowed - - - - -	-	-	-	3,25,000
GRAND TOTAL Ordinary - - - Rs.				23,25,000
TOTAL Ordinary and Extraordinary - - - Rs.				34,25,000

Proposals for the specific appropriation of the additional grant herein allowed should be submitted for the orders of the Government of India as soon as possible.

5. Of the total expenditure, the home estimates provide for an outlay of 500 rupees on the Kistna Anicut, under the head extraordinary, and 8,250 rupees for tools and plant, under the head ordinary. The sums available for expenditure in India will thus be only 34,16,250 rupees, distributed as follows:—

	Ordinary.	Extraordinary.	TOTAL.
	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>
Capital - - - - -	3,26,200	10,99,500	14,25,700
Revenue - - - - -	16,65,550	-	16,65,550
Reserve - - - - -	3,25,000	-	3,25,000
Rs.	23,16,750	10,99,500	34,16,250

6. Of

6. Of the works provided for under capital extraordinary, those noted in the margin are passed provisionally only, on the distinct understanding that no expenditure whatever will be incurred on them from loan funds until the necessary estimates have been sanctioned as extraordinary by the Government of India.

Rooshkoolia Project.
Sungum Project—
Improvements.
Perruair Project.

7. The information required by the Government of India, before passing the final estimate for the Madras water supply project, should be submitted with the least possible delay.

8. In the cases noted in the margin, the charges for establishment are apparently very high, and will enhance materially the capital account of the several undertakings. This is necessarily the result of apportioning the charges for establishment in the ratio of the expenditure incurred, instead of according to the actual incidence of the outlay. Every endeavour should be made to adjust the establishment charges in the latter way, so as to prevent works which are concentrated, and which consequently only require a small establishment, being debited with a high charge.

Irrigation Works in Kistna Delta.—Grant, 1,20,000 rupees; establishment, 40,000 rupees, or 33 per cent.
Pennair Anicut, Nellore.—Grant, 65,000 rupees; establishment, 18,000 rupees, or 27 per cent.
Streevyguntum Anicut Project.—Grant, 91,000 rupees; establishment, 24,800 rupees, or 27 per cent.

9. The provision for State expenditure on guaranteed irrigation works amounts to 16,000 rupees, viz.:

	<i>Rs.</i>
Establishment - - - - -	5,000
Purchase of Land - - - - -	11,000
Rs.	16,000

But, now that the post of consulting engineer for irrigation works has been abolished, explanation should be furnished of the necessity for retaining the office establishment noted in the margin, and providing 600 rupees for office contingencies.

Rs.
Clerks - - - - - 1,284
Peons - - - - - 180

10. The revenue estimate of the Irrigation and Canal Company shows the following results:—

	Budget- Estimate, 1872-73.	Regular- Estimate, 1871-72.	TOTAL.
	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>
Receipts - - - - -	50,000	15,000	65,000
Working Expenses - - - - -	75,792	61,377	1,37,169
Deficit - - - Rs.	25,792	46,377	72,169
Balance in favour of Revenue at the end of 1870-71 - - - Rs.			21,864
Probable Net Deficit at end of 1872-73 - - - - - Rs.			50,305

11. There are no additional funds available to meet this deficit, and the Government of Madras must, therefore, arrange to provide for it out of the ordinary agricultural grant. On this point attention is invited to Public Works Department Resolution, No. 41 A-I, dated 23rd February 1871, and as an additional allotment of 3,25,000 rupees has been herein assigned under ordinary, there will probably be no difficulty in carrying out the orders contained in that resolution.

12. The provision for repair and maintenance of irrigation works has been shown in one item, but the Government of Madras should divide off the anticipated outlay on these accounts amongst the several irrigation works, for which a distinct capital or revenue account is kept. The establishment charges should be divided off in like manner. In the case of petty works the capital and revenue accounts of minor works may be kept by districts, or in any other way considered suitable by the Government of Madras, so as to reduce the number of distinct accounts, and the establishments and repairs charged off accordingly, but the classification laid down in the irrigation budget form must be maintained. A memorandum of the actual division made should be submitted for the orders of the Government of India.

197.

O 4

13. The

13. The accounts of irrigation expenditure for next year will have to be recorded by projects under the main heads Capital and Revenue. On this point separate instructions will be issued.

Irrigation Revenue.

14. For direct receipts, such as tolls, &c., the estimate for 1872-73 may be assumed at 45,000 rupees.

Fort William, 8 March 1872.

Colonel, R.A.,
Secretary to the Government of India.

— No. 36. —

The Government of Madras to the Secretary of State for India.

My Lord Duke, 22 March 1872 (No. 5).
WE have the honour to forward, herewith, copy of a letter which we have addressed to the Government of India, regarding the endeavours which the Madras Irrigation and Canal Company appear to be making to raise a further unguaranteed capital of 800,000*l*.

We have, &c.

A. J. Arbuthnot.
F. P. Haines, Lieut.-General.
J. D. Sim.
R. S. Ellis.

Enclosure in No. 36.

The Secretary to the Government of Madras to the Secretary to the Government of India.

Public Works Department, Fort St. George,
16 March 1872 (No. 757).

Sir,
I AM directed to invite the attention of the Government of India to the circumstance that, from the advertisements in the London newspapers, it appears that the Madras Irrigation and Canal Company are endeavouring to raise a further unguaranteed capital of 800,000 *l*; and, as it does not seem that the public here have been made acquainted with the opinions held by the Government of India and the Madras Government regarding the unpromising character of the undertaking as a remunerative work, I am to suggest, for the consideration of the Right Honourable the Governor General in Council, the expediency of publishing the following papers in the "Gazette of India":—

To Government of India, dated 26th July 1871, No. 1961, with the report and minutes which accompanied it.

From Government of India to Secretary of State, dated 15th September 1871, No. 119.

* 2. The newspapers are silent as to what the intentions of the company are in regard to the repayment of the loan of 600,000 *l* made to them under their supplementary contract, dated 2nd October 1866; but, if that amount be deducted from the capital now proposed to be raised, only 200,000 *l* will be left, which is a very inadequate sum to meet the outlay required for the works contemplated to be carried out by the company; but it does not appear that this circumstance has been put before the public who are invited to contribute funds for furthering the undertaking.

I have, &c.

J. Carpendale, Colonel, R.E.,
Secretary to Government.

— No. 37. —

TELEGRAM from the Viceroy to the Secretary of State for India,
dated 27 March 1872.

MADRAS Government urge publication of papers on the Madras Irrigation Company, in view to prevent raising of unguaranteed capital. We think the public should know the real state of the case.

— No. 38. —

The Secretary of the Madras Irrigation and Canal Company to the Under Secretary of State for India.

8 and 9, Queen-street-place, London,
6 April 1872. (No. 3.)

Sir,

I HAVE the honour to acknowledge the receipt of your letter of the 16th ultimo, and, by desire of the directors, to forward, for the information of his Grace the Duke of Argyll, a printed draft of the explanatory Act referred to in my letter to you of the 29th February last; and I am requested to add that an Act so framed would be strictly limited to the removal of doubts connected with the issue of securities to pay off the debentures now held by the Secretary of State for India, and to the protection of the rights of the latter until the whole of such debentures should be extinguished; but, as by the addition of the words written in red ink the power given by the 4th section of their Act of 1863 to raise by loan to the extent of one-third of the existing capital of 1,000,000 *l* would also be freed from impediment, so that 333,000 *l* might be raised and expended in or towards rendering the Soonkasala and Cuddapah section available for irrigation and navigation throughout the year, and in the provision of boats for navigating the same, they respectfully solicit the assent of the Duke of Argyll to the Bill so amended. Should, however, his Grace be unwilling to give this assent they (the directors) will proceed with the Bill as it now stands printed. See No. 34.

I have, &c.

J. Westwood, Secretary.

Enclosure in No. 38.

DRAFT of a BILL to amend the MADRAS IRRIGATION and CANAL ACTS in reference to the raising of MONEY.

[The words printed in Italics are proposed to be inserted in Committee.]

WHEREAS, by "The Madras Irrigation and Canal Act, 1858," in this Act called the Act of 1858, the Madras Irrigation and Canal Company (in this Act called "the Company") were incorporated for constructing works for a variety of purposes within the Presidency of Madras, but chiefly for irrigation and navigation within that Presidency; and the Company were empowered to enter into and conclude with the East India Company, on account of the Government of India, or with the Supreme or any of the Local Governments of India, such contracts as the respective parties might think fit and agree upon respecting all or any of the objects and purposes therein referred to, including amongst other things the guarantee of interest on the capital of the Company, and it was by the same Act declared that the capital of the Company should be, in the first instance, the sum of two million pounds sterling, and the Company were further empowered, when and so soon as the whole capital for the time being should have been subscribed for, and one half thereof paid up, to borrow upon mortgage or bond money to an amount equal to one-third of such capital, but subject in all respects to such provisions as the East India Company or the Supreme Government should from time to time approve: Preamble.

And whereas the Secretary of State in Council, in the month of December, one thousand eight hundred and fifty-eight, entered into an arrangement with the Company to co-operate with them in the construction of works for irrigation and navigation upon certain terms and conditions, including (1) That the operations of the Company should, in the first instance,

instance, be confined to one work or project to be approved by the Local Government, the estimated cost whereof should be one million pounds sterling; and (2) That the Secretary of State in Council should guarantee a minimum interest of five pounds per centum per annum on the said capital of one million pounds sterling:

And whereas in pursuance of the said arrangement, the Company raised a capital of one million pounds as a first issue, and on account of the said capital of two million pounds:

And whereas the Government of Madras selected as the work or project to be constructed by the Company under the said arrangement a certain work or scheme of works known as "The Toombuddra Project," consisting of a main irrigating and navigable canal and works, in the Presidency of Madras, with reservoirs for the storage of water, such main canal being divisible into three sections, the first extending from Wallavapoor to Soonkasala, and known as the Bellary Section, the second extending from Soonkasala to Cuddapah, and known as the Soonkasala and Cuddapah Section, and the third extending from Cuddapah to Kisanapatam, and known as the Nellore Section, and the Company entered upon the surveying and planning of the said work or project, and the construction of portions thereof:

And whereas the said arrangement was subsequently embodied in an indenture dated the third day of June, one thousand eight hundred and sixty-three, and made between the Secretary of State in Council of the one part and the Company of the other part, whereby, after reciting amongst other things that it was estimated that the said sum of one million pounds would be insufficient to complete and develop the said Toombuddra Project, and that it had been agreed between the Secretary of State in Council and the Company that in order to meet the deficiency the Company should, subject to the terms and conditions therein contained, be at liberty to raise whatever further capital might be required for the objects and purposes of the Company, it was (by Article 2) covenanted that the Secretary of State in Council should pay to the Company out of the revenues of India half-yearly interest at the rate of five pounds per centum per annum on the said first issue of capital of one million pounds; and (by Article 3) it was stipulated that the Company should be at liberty to raise any amount of capital in addition to the said one million pounds to carry into effect the purposes of the Company therein mentioned, provided that the Secretary of State should not be called upon to pay or be held to be liable to guarantee interest thereon; and (by Article 23) it was stipulated that the net receipts from the said works, or any portion thereof, in respect of water supplied for irrigation from the commencement of such supply up to the first of the half-yearly days therein referred to, and during each succeeding half-year, as should from time to time appear by the Irrigation Revenue Account of the Company, after debiting such account with the payments therein mentioned, and after deducting such sum (if any) as might by arrangement between the Secretary of State in Council and the Company be from time to time appropriated and set apart as a reserve fund for the purposes therein mentioned, should be applied half-yearly, first, in discharging the interest which should be payable by the Secretary of State in Council under the covenant before referred to in respect of the half-year, and so as to exonerate the Secretary of State in Council and the revenues of India, so far as the same net receipts would extend, from the payment of such interest, and afterwards as therein mentioned:

And whereas, by the Madras Irrigation and Canal (Accounts) Act, 1863 (in this Act called the Act of 1863), it was (by Section 4) amongst other things enacted that it should be competent to the Company to borrow money to the extent of one-third of the capital for the time being issued or raised, notwithstanding that the whole capital of two million pounds might not have been subscribed for; and that the directors might from time to time determine the amount of money to be borrowed, and the mode in which the same should be raised, but it was by the same section provided that the Company should not be at liberty in borrowing money to make any charge on the irrigation which should in any way affect the payments set apart in the 23rd section of the agreement, for the purpose of securing payment of five pounds per centum on the first capital of one million pounds, in relief of the covenant of the Secretary of State in Council in regard to interest; and (by Section 5) power was given to raise and apply capital for any separate work or undertaking, and provision was made for keeping such capital separate and distinct from the other capital of the Company, and (by Section 8) it was enacted that all monies raised for any distinct work or undertaking, whether by shares or loan, should be applied only in, for, or towards that work or undertaking, and that the bonds, debentures, or mortgages issued in respect of any such monies should give to the obligees, payees, or mortgagees thereunder or thereof claims only against the assets of the Company in respect of that distinct work or undertaking, and not further or otherwise:

And whereas, by the Madras Irrigation and Canal Act, 1866 (in this Act called the Act of 1866), after reciting amongst other things that a supplementary arrangement was in contemplation between the Secretary of State in Council and the Company, whereby it was proposed amongst other things that the Company should be permitted to draw upon the Secretary of State in Council for such sums as the Company might from time to time require for the prosecution of the canal and works forming the Soonkasala and Cuddapah section of the Toombuddra Project, but not exceeding a total of six hundred thousand pounds, upon certain terms and conditions, it was (by Section 3) enacted that in order to enable the said supplementary arrangement to be carried into effect it should be lawful for the directors (notwithstanding the requisite amount of capital according to the provisions of the Acts of 1858 and 1863 might not have been subscribed for or paid up) to raise by way of loan from the Secretary of State in Council upon debentures such sums of money as the Company should from time to time until the first day of July, one thousand eight hundred and

and seventy-one, require for the purpose of proceeding with the construction of the said canal and works forming the Soonkasala and Cuddapah portion of the Toombuddra project, but not exceeding in the whole the sum of six hundred thousand pounds, and that the directors from time to time should execute under the common seal of the Company, and deliver to the Secretary of State in Council, debentures for the amounts which might be from time to time so advanced and lent by the Secretary of State in Council to the Company, and that such debentures should be respectively made payable at the expiration of five years from the time when the sum of money thereby intended to be secured should have been advanced and lent to the Company, and that the Secretary of State in Council should be entitled to interest on the amount thereof at the rate of five pounds per centum per annum, and that such interest should be a first charge on all profits which should be realized by and payable to the Company from the said canal and works, whether such profits should be derived from irrigation, navigation, or any other source of profit whatever; and it was provided that the said debentures or the provisions thereinbefore contained should not in any manner prejudice or affect the rights of the owners for the time being of the capital sum of one million pounds then raised, to the payment or guarantee of interest at the rate of five pounds per centum per annum, by the Secretary of State in Council, under or by virtue of the said contract of the third of June, one thousand eight hundred and sixty-three, or the Acts of 1858 and 1863, until the cesser of such guarantee in the event and as thereafter mentioned; and (by Section 6) it was also enacted that the directors might from time to time raise by way of loan on mortgage, bond, or debenture, any sums of money which they might consider it necessary or expedient to raise for the purpose only of paying off or discharging the debentures to be given to the Secretary of State in Council as aforeaid:

And whereas the said supplementary arrangement was afterwards embodied in a supplementary contract, bearing date the second day of October, one thousand eight hundred and sixty-six, and made between the Secretary of State in Council of the one part, and the Company of the other part:

And whereas the Secretary of State in Council has, under the supplementary contract, advanced to the Company at various times sums of money amounting in the whole to six hundred thousand pounds, and the Company have given to the Secretary of State in Council debentures for the respective amounts so advanced, which debentures are made payable at the expiration of five years from their respective dates; and the Company have expended the said sum of six hundred thousand pounds upon works approved by the Secretary of State, that is to say, the principal portion thereof in the construction of the Soonkasala and Cuddapah section of the said Toombuddra project, and the other portion thereof in the surveying of the other sections of the same project and the preparation of plans and estimates of the works intended to be comprised in those other sections:

And whereas the first advance from the Secretary of State in Council to the Company on account of the six hundred thousand pounds will shortly be repayable, and the Company have no means of raising the sum required to pay the amount thereof or of the subsequent advances, except by exercise of the powers of borrowing conferred upon them by the Acts of 1863 and 1866, but are unable to do so in consequence of doubts which have arisen as to what would be the rights and remedies of parties making advances to the Company under that power, having regard to the provisions of the recited Acts, indenture, and supplementary contract; and it is expedient that the said doubts should be removed, and that the Company should be empowered to exercise their powers of borrowing under the Acts of 1863 and 1866, notwithstanding any impediments contained in the said Acts, indenture, and supplementary contract, or any of them; but the same cannot be done without the authority of Parliament:

May it therefore please your Majesty,

That it may be Enacted, and be it Enacted, by the Queen's Most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:—

1. This Act may be cited for all purposes as "The Madras Irrigation and Canal Act, 1872."

2. The recited Acts and this Act shall be read and construed as one Act.

3. Notwithstanding the proviso contained in Section 4 of the Act of 1863, or anything in the recited Acts, the indenture of the third day of June, one thousand eight hundred and sixty-three, and the supplementary contract of the eighth day of October, one thousand eight hundred and sixty-six, or any of them, contained, but without prejudice to the priority and rights of the Secretary of State in Council, in respect of the debentures held by the Secretary of State in Council, the holders of all mortgages, bonds, and debentures issued under the authority of Section 4 of the Act of 1863 and Section 6 of the Act of 1866, shall have and be entitled to all such rights, powers, and remedies as are conferred upon holders of mortgages, bonds, and debentures under or by virtue of the Companies Clauses Consolidation Act, 1845, subject nevertheless to the provisions contained in the 8th section of the Act of 1863; and the directors, if they think it expedient so to do, may limit such rights, powers, and remedies to the Soonkasala and Cuddapah section of the Toombuddra project: Provided, That the said mortgages, bonds, or debentures, or the pro-

Acts to be construed as one Act.
Power to borrow money.

visions hereinbefore contained, shall not in any manner prejudice or affect the rights of the owners for the time being of the capital stock or sum of one million pounds already raised to the payment of the guarantee of interest at the rate of five pounds per centum per annum, by the Secretary of State in Council, under or by virtue of the said indenture of the third day of June, one thousand eight hundred and sixty-three, or the recited Acts, until the cesser of such guarantee in the said indenture set forth.

Costs of Act.

4. All costs, charges, and expenses of and incident to the preparing for, obtaining, and passing of this Act, or otherwise in relation thereto, shall be paid by the Company.

— No. 39. —

The Secretary of the Public Works Department, India Office, to the Secretary of the Madras Irrigation Company.

Sir,

India Office, 23 April 1872.

See No. 38.

I AM directed by the Secretary of State for India in Council to acknowledge the receipt of your letter of the 6th instant, transmitting a printed draft of the Bill which it is proposed to introduce into Parliament, for the purpose of enabling the Madras Irrigation Company to raise money in order to pay off the debentures now held by the Secretary of State for India in Council; and, with reference to the 3rd clause of the draft Bill, to request that the Duke of Argyll may be explicitly informed what are the difficulties which it is intended to obviate, and that the Bill may be so framed as to declare in direct terms, not by way of reference, what are to be the rights and position of the persons who may advance money for the purpose of paying off the above-mentioned debentures.

With regard to the words inserted in red ink, I am to observe that the Duke of Argyll is not prepared to give his consent to the powers which they appear intended to convey.

I am, &c.

W. T. Thornton.

— No. 40. —

The Secretary of the Madras Irrigation and Canal Company to the Under Secretary of State for India.

8 and 9, Queen-street Place, London,
24 April 1872 (No. 4).

Sir,

See No. 30.

IN continuation of my letter No. 1, of the 29th February last, and as confirmatory of its statements, I have the honour to forward, for the information of his Grace the Secretary of State for India, extracts from reports made by the company's acting chief and conservancy engineers upon the state and condition of the canal and works between Soonkasala and Cuddapah at the latest date, and with reference to the irrigation supplied between the completion of the main canal and irrigating channels in July of last year and the month of January last, and therefore the first season during which water could be supplied from the complete canal.

I have, &c.

J. Westwood, Secretary.

Enclosure in No. 40.

EXTRACT, No. 1.

From Report of Mr. C. H. Wilks, Superintending Conservancy Engineer of the Upper Division, for November 1871.

I AM glad to report that I see no reason to doubt the accuracy of my October estimate. This was, that the Company will (in this division) irrigate this season about 2,500 acres of wet crops, and that about 2,000 acres would be flooded. Thus the total acreage brought under the influence of the canal waters in these sections will be 4,500.

Although

Although the floodings give much trouble, and there is difficulty in detecting cases of surreptitious waterings, it is still of immense importance to have water spread over as large an area as possible, so as to show the ryots of each village that there is no difficulty in supplying them with water for any kind of cultivation.

The steady delivery of water throughout the season, and the rapidity with which the demands for channels have been complied with, have produced a favourable change in the views of the ryots, too long accustomed to look upon planting rice under the canal as hazardous. They even appear anxious about the matter, and certainly have expressed openly their great satisfaction at the result of this year's cultivation; and, if I were to take their own estimate of what will be done next year, the result would prove most favourable to the prospects of the company.

EXTRACT, No. 2.

From Report of Mr. C. B. Knorpp, Superintending Conservancy Engineer of the Lower Division, for November 1871.

THE additional amount of land brought under irrigation, has been 403 acres in Nundial and Koondair, and 450 acres in Dhoor and Pennair Divisions, during this month. The crops irrigated by the canal water have, as far as they have been cut, been extraordinarily large. A patch of some 300 acres of first class rice, under the Chinnoor Channel, cultivated with rice for the first time this year, is greatly admired by the ryots far and near for its healthy and promising appearance, far superior to any rice crops under tank cultivation. An encouraging sign for next year's cultivation of this, to the company the most paying crop, is that almost in every village in the Dhoor and Pennair divisions plots of from one to 20 acres have been sown confessedly on trial with first class rice, and in these cases also the crops are finer and heavier than the ryots are accustomed to see, and I believe that next season all the fields formerly watered by wells will be sown with this crop, which in Dhoor and Pennair divisions alone exceed 3,000 acres. In many villages commanded by the canal, fields of considerable extent are now being levelled and prepared for next season's irrigation. The rainfall in the Kurnool district not having been sufficient to fill the tanks for the next crop, several of them, notably the Nundial tank, irrigating 1,044 acres, will soon require water from the company's canal.

All the irrigation channels sanctioned in the four divisions, Nundial, Koondair, Dhoor, and Pennair, with the exception of 10 miles in the first two and a-half mile in Pennair, are now completed and carrying water, and there is more or less irrigation under every one of them. Since 1st July nearly 100 miles of main distribution channels, and over 50 miles of subsidiaries, have been made with a very small staff. Nundial and Koondair channels require to be checked, and to be put into thorough order.

EXTRACT, No. 3.

From Report dated 13th December 1871, by Mr. A. Browning, Acting Chief Engineer.

MANY of the rice fields are now cut, and the grain is everywhere said to be very good, and the crops heavier and finer than those grown formerly and irrigated from tanks, or at great expense from wells.

The ryots are very eager to have water for a second crop, and, as we are not allowed to take the Toombuddra water after the 1st of January, I will store up as much water as possible in the canal towards the end of this month, and economise it.

EXTRACT, No. 4.

From Report of Mr. C. H. Wilks, Conservancy Engineer of the Upper Division, for the month of December 1871.

VERY little change occurred during the month; water was kept at 4 ft. 6 in. without alteration in the canal below the Soonkasala Head Sluice. The supply has been sufficient for all purposes, and the villagers everywhere express their satisfaction at the liberality and steadiness of the supply.

Many applications have been made to myself and my staff for water to be supplied for second crops, but, with the exception of a few favoured places, no guarantee could be given for its continuation, notwithstanding which some ryots have planted rice on the mere chance

of the supply being kept up. If Government allowed the company to supply water till the end of January, it is probable that second crops could be grown nearly everywhere, and from this it is clear that a tank able to supply a month and a half's water would enable the whole of the land to be irrigated with double crops. As it is, we are allowed neither the extra month nor a reservoir.

Under the two large tanks in the 4th section, the supply can be easily given for upwards of 1,000 acres at least, taking the crops to require four months' water, and supposing water to be only up to bed level at first; but, as many crops require only three months, there may be much more eventually grown: moreover, I hope in future that second crops will be sown early in November, so that a much greater area may be cultivated in this way.

For the present year I am almost certain that first crops will amount to -	2,250
And second crops probably - - - - -	250
This realises my latest estimate for wet crops - - - - -	2,500

This is a mere trifle to what must follow, but, as I have reported before, everything promises well for future seasons.

With regard to floodings—I fear my estimate was too great. It is exceedingly difficult to say beforehand for how many acres floodings will be taken, but what is more important is to determine how many acres have been flooded.

The areas of land commanded by the canal are so extensive in some parts, that it will be easily seen how very difficult is the task of discovering the fields which have been surreptitiously flooded with our water. Water is easily taken during the night, and fields flooded sufficiently for the ryots' purposes. All traces are soon removed by the sun and a little labour, so that, unless an overseer or banker passes over the land within a few hours, no evidence can be given of the flooding. Great pains have been taken to supply every demand for floodings under any circumstances when application has been made, as it has been thought that this year the spread of water was of the first importance. I believe that the ryots have been assisted in every way in getting water to their fields. This will of course be modified in the coming season, when their confidence in the supply and the profit to be derived will induce them to work at the smaller channels themselves.

EXTRACT, No. 5.

From Report of Mr. C. B. Knorpp, Conservancy Engineer of the Lower Division, for the month of December 1871.

Irrigation.—As expected, most of the Government tanks commanded by the canal have now been supplied with the canal water; the area thus irrigated will exceed 1,400 acres, and this is in addition to the land properly belonging to the canal. Some 800 acres additional land have been irrigated during the month. The preparation of land for next year's irrigation is being pushed on all sides, and the land is rising very greatly in value. No data have yet been collected as to the amount of irrigation to be expected next year, but I am having inquiries made. In the 10th section I believe it will amount to from 50 per cent. to 60 per cent. of the area commanded.

EXTRACT, No. 6.

From Report of Mr. Arrott Browning, the Acting Chief Engineer, dated 18th January 1872.

WATER has been kept during December at a uniform depth of 4 ft. 6 in. in the canal below Soonkasala Head Sluices. At Jupad the average depth has been 2 ft. 9 in., and at Lockinsala 5 ft. 2 in. From Jootoor anicut, down to Cuddapah, water has been allowed to flow about 2 ft. deep on an average, and there has been no serious accident. Just now the works are undergoing a most careful scrutiny, so that whatever weak places exist may be found and repaired during the dry season now beginning.

The season may now be considered at an end, and it is the universal opinion here that it has been very successful indeed.

Throughout the season, no serious accident has occurred, and the flow of water from Soonkasala to Cuddapah has been uninterrupted, and sufficient for all demands.

It is to be hoped that before next season at least one steam launch will be sent out and put upon the canal.

Recently, we have filled a number of the Government tanks, which were either dry, or

or had an insufficient supply of water, owing to the want of rain this year. At one time, it was almost expected that there would be a famine, and then it was wonderful to find how the canal was looked upon by all as a source of safety for this neighbourhood.

There can be no doubt whatever, that it would be an immense improvement to our work if one of the large tanks proposed in Mysore were to be constructed. It would enable the canal to supply two crops without any doubt; and, when cultivators can get water for two crops, the use of it is likely to spread in area as well as quantity.

It certainly has been our interest to extend the use of water as much as possible this year, even if some has been used surreptitiously.

It must be remembered also, that on the whole canal of 188 miles, with about 250 miles of minor channels, we have only had two surveyors to measure up all the land irrigated.

Mr. Knorpp estimates the irrigation for next season at 50 or 60 per cent. of the land commanded in the 10th section. This would give from 2,100 to 2,500 acres, and that proportion on the whole of the channels designed for the whole canal would give 86,000 acres, but I do not expect so much next year, though, under favourable conditions, I think the canal may irrigate upwards of 40,000 acres.

EXTRACT, No. 7.

From Report of Mr. C. H. Wilks, Conservancy Engineer of the Upper Division, dated 1st February 1872.

In my last Report, I mentioned that the area of wet crops cultivated with our water would be 2,500. I am glad to say, that this has turned out to be less than the actual figures, and I now estimate the amount at 3,000 acres.

This will be due to an increase in second crops. It will also be found that some of the crops reckoned as single will come under the head of garden irrigation, for which I think 12 rupees per acre should be charged.

On account of the increase mentioned above, my surveyor has not yet been able to prepare his accounts of dry crop floodings, but I still hope he will show an increase.

In the coming season, some definite regulations might be made with regard to the rates levied for different crops, so that no doubt may arise in our minds when asked by the ryots on the subject.

EXTRACT, No. 8.

From Report of Mr. C. B. Knorpp, Conservancy Engineer, Lower Division, dated 6th February 1872.

IRRIGATION has been extending during the month, although the ryots have been told of the risk they incur in case the season's water supply should stop before their crops are matured. The water is, however, still running in the canal from Jootoor to Cuddapah, and almost daily inquiries as to the possibility of immediate supply of water to certain villages are being received from the deputy collector. The cultivation under the Government tanks of Nundial, Cheypaud, Middekoor, Oopooloor, and Chinnoomasipully, has been supplied with company's water.

Owing to the resignation of the irrigation surveyors, the surveys of actual irrigation are in a backward state; but, from the statements of overseers, I have good reason to believe that the area irrigated this season with company's water will considerably exceed my former estimate. It is hardly possible as yet to give even an approximate estimate of next season's irrigation; but, from inquiries made, I do not consider it rash to assume that from Jootoor to Cuddapah, at the lowest, 16,000 acres will be brought under cultivation.

At Chennai, where the ryots have cut the first crop of first class paddy, the overseer reports that "the crops of rice have yielded to such an extent, that one man alone has got 100 puttys of grain from 20 acres of land, and the ryots now say that they cannot do without our water." The largest yield, under tanks, varies from 2½ to 3 puttys an acre, as far as I can find out from inquiries made on the subject.

Revenue.—Mr. Bradbury has succeeded in getting about 260 rupees, by letting out banks and waste lands for grazing, and by selling bushes for manure. In Dhoor and Pennair, there was very little grass on the banks, and nobody could be induced to rent them. A great number of babul trees are now growing along the canal, and nurseries have been established near bankers' huts, and at Jyaloor and Dhoor, where thousands of young timber and fruit trees are being raised for transplanting to the banks of main canal and subsidiaries at the first rains.

EXTRACT, No. 9.

From Report by Mr. A. Browning, Acting Chief Engineer, dated 15th February 1872.

THE average depth at which water was maintained throughout the canal during January, was as follows:—

Position.	Mileage.	Depth.
Kurnool - - - - -	at 16 miles	4' 0"
Jupad - - - - -	" 62 "	3' 7"
Lockinsula - - - - -	" 75 "	6' 11"
Nundial Division, Calingulah No. 9 - - -	" 99 "	3' 0"
Dnoor - - - - -	" 161 "	1' 10"
Below Adamapully Head Sluices - - -	" 172 "	2' 1"

The chains of locks also were all filled during the month in order to consolidate the work and to discover leakage.

Although the supply is now cut off from the canal below Kurnool, the tanks on the 2nd section are not drying up so quickly as they did in former years owing to the diminished leakage. There are still, however, places on the 2nd section where the leakage through old walls and other works is considerable, but we have made arrangements to commence repairing these places immediately, and by next season I expect to have reduced the waste of water very considerably indeed. Constructed as the canal has been on the first three sections, with a subsoil almost entirely rock and gravel, it was certain there would be much leakage when the canal was new, but year by year it actually has diminished more quickly than could have been expected.

Below the 3rd section, *i.e.*, below the 44th mile, the character of the canal is different, and the loss of water much less.

Distribution.—As Mr. Knorpp was anxious to have a supply of water for the lower sections as late as possible, we threw rough dams across the canal where it is narrow at Nagatoor and Jupad to prevent water from running down too rapidly, and the result is that two days ago water was still 1 foot 11 inches above normal bed level in Tangadancha tank. However, the supply will not last much longer now.

Owing to the very great amount of work to be done by the Conservancy surveyors their returns are not yet finished, but the latest information shows that the season's irrigation will probably be as follows:—

ESTIMATED IRRIGATION for the Season 1871-72.

	Irrigated.	Flooded.	Total.
1st Section - - - - -	416	65	481
2nd ditto - - - - -	510	40	550
3rd ditto - - - - -	597	120	717
4th and 5th ditto - - - - -	907	485	1,392
6th ditto - - - - -	70	40	110
2nd Crops - - - - -	500	-	500
Total in Upper Sections - - -	3,000	750	3,750
7th Section - - - - -	43	1,383	1,426
8th ditto - - - - -	960	512	1,472
9th ditto - - - - -	1,250	990	2,240
10th ditto - - - - -	600	350	950
Total on Lower Sections - - -	2,853	3,235	6,088
GRAND TOTAL ACRES - - -			*9,838

* This is irrespective of the supply afforded by the canal to tanks belonging to Government.

In my report for October it was stated that the area irrigated and flooded this season would probably be about 10,000 acres.

From this, revenue may be expected as follows:—

	Rs.
5,853 acres at 6 rupees - - - - -	35,118
3,985 " " 1 " - - - - -	3,985
Sale of wood - - - - -	400
Supply of water to Kurnool - - - - -	4,000
Grand Total for Season 1871-72 - - -	Rs. 43,503

It is very satisfactory to find that irrigation has made such a good start on the lower sections, where it was an entirely new thing to the people.

Mr. Knorpp gives some most interesting information in his report regarding the yield of the crops irrigated by our canal. In particular, it is worth noting that the yield of rice per acre from land watered by the canal, has been nearly double that of land watered from the old tanks, the reason being, I believe, that in the wells and tanks the water is generally rather salt, whereas the water of the Toongabuddra, which we supply, is singularly pure and wholesome.

There can be no doubt that in a few years this canal will entirely alter the character and appearance of the whole Koondaur valley.

— No. 41. —

The Secretary of the Madras Irrigation and Canal Company to the Secretary of the Public Works Department, India Office.

8 and 9, Queen-street Place, London,
26 April 1872 (No 5).

Sir,

I HAVE the honour to acknowledge the receipt of your letter of yesterday's date, and, in reply, to offer to his Grace the Secretary of State for India the following explanation of the difficulty intended to be obviated by the contemplated Act of Parliament. See No. 39.

The Public and General Act, known as "The Companies Clauses Consolidation Act, 1845," by which the issue of mortgages and bonds by joint-stock companies, and the rights and powers of the holders thereof, are regulated, was incorporated with this company's Act of Incorporation, passed in 1858, so that all such bonds and mortgages as this company were authorised to execute were to be in fact issued under, and to be regulated by, the provisions of that same Companies Clauses Consolidation Act, 1845; but, by the proviso contained in section 4 of this company's subsequent Act of 1863, those rights and powers were specially made subject to the appropriation of net profits firstly provided for by the 23rd article of the original contract between the Secretary of State for India and the company.

In the state of things thus described, the Act of 1866 was procured, whereby the Secretary of State in Council was empowered to lend to the company the sum of 600,000 *l.* upon the security of debentures to be given by the company; and, in order that these debentures might be freed from the special limitation created by section 4 of the Act of 1863, and be made precisely the same as if they had been issued under the previous state of things, that is, in effect, under the Companies Clauses Consolidation Act, 1845, as incorporated into the constitution of the company, it was enacted (section 3) that the interest payable thereon should form a first charge on all the profits realised from the canal and works; and by section 6 of the same Act the directors were authorised to borrow on mortgage, bond, or debenture, any sum or sums of money which they might consider it necessary or expedient to raise for the purpose of paying off or discharging the debentures so to be given to the Secretary of State in Council.

At the time of the passing of this Act of 1866, the directors were advised and believed that any mortgage or bond issued under the section 6 just referred to would be also free from the provision in clause 4 of the Act of 1863, that is, that (like the debentures they were to replace) they would have all the powers and rights conferred by the Companies Clauses Consolidation Act of 1845. The directors still entertain this belief; but, as, upon commencing (in February last) negotiations for the purpose of raising the necessary funds, it was suggested to

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them that, although the existing debentures were, by the special words of section 3 of the Act of 1866, relieved from the provision in section 4 of the Act of 1863, and so placed under the Companies Clauses Consolidation Act, 1845, yet that it might possibly be held that the general wording of the 6th section of the same Act of 1866 would be insufficient to prevent the provision in the Act of 1863 from being applied to mortgages, bonds, or debentures issued under the former, the directors feel that it would not be proper in them to issue any such mortgage, bond, or debenture, without first clearing away by an explanatory Act all ground for objection as to their status; and hence the necessity for the present Bill.

The form of Bill submitted to his Grace the Duke of Argyll was prepared under the view above set forth, and with a desire to render the nature of the intended mortgages, bonds, and debentures as easily understood as possible by capitalists, which would be the case were they issued, like all ordinary railway and other bonds and mortgages, under the well-known public powers which are vested in the company by the Companies Clauses Consolidation Act, 1845, and they therefore hope that the Secretary of State for India will assent to the 3rd section as now printed. In deference, however, to the request contained in your letter under reply, I enclose a modification of that section, which will be found to declare in direct terms what are to be the rights and position of the persons who may advance the money for the purpose of paying off the above-mentioned debentures, and which the directors will cause to be inserted in the Bill should his Grace the Duke of Argyll so desire.

I have, &c.

John Westwood, Secretary.

Enclosure in No. 41.

REVISED DRAFT of a BILL to amend the MADRAS IRRIGATION and CANAL ACTS in reference to the raising of MONEY.

[For Preamble, see page 113.]

MAY IT THEREFORE PLEASE YOUR MAJESTY,

THAT it may be enacted, and be it enacted, by the Queen's Most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:—

Short Title.

1. This Act may be cited for all purposes as "The Madras Irrigation and Canal Act, 1872."

Act to be construed as one Act.
Power to borrow Money.

2. The recited Acts and this Act shall be read and construed as one Act.

3. The proviso contained in Section 4 of the Act of 1863 is hereby repealed, and all mortgages, bonds, and debentures issued under the authority given by the 6th Section of the Act of 1866 shall, subject to the debentures given to the Secretary of State in Council for the said sum of 600,000 l. under the 3rd Section of the Act of 1866, be and form a first charge upon the Soonkasala and Cuddapah Section of the Toombuddra project, and on all profits which shall be realised by and payable to the company from the same section, whether such profits shall be derived from irrigation, navigation, or any other source of profit whatever produced by the canal and works comprised in the said section: Provided, that the said mortgages, bonds, or debentures, or the provisions hereinbefore contained, shall not in any manner prejudice or affect the rights of the owners for the time being of the capital stock or sum of one million pounds already raised to the payment of the guarantee of interest at the rate of five pounds per centum per annum Secretary of State in Council, under or by virtue of the said indenture of the third day of June one thousand eight hundred and sixty-three, or the recited Acts, until the cesser of such guarantee in the said indenture set forth.

Costs of Act.

4. All costs, charges, and expenses of and incident to the preparing for, obtaining, and passing of this Act, or otherwise in relation thereto, shall be paid by the company.

— No. 42. —

The Under Secretary of State for India to the Secretary of the Madras Irrigation Company.

Sir,

India Office, 3 May 1872.

I AM directed by the Secretary of State for India in Council to acknowledge the receipt of your letter of the 26th instant, submitting a modification of the 3rd Clause of the Bill which the Directors of the Madras Irrigation and Canal Company are desirous of introducing into Parliament. See No. 41.

The clause, as now altered, commences with a statement that "the proviso contained in Section 4 of the Act of 1863 is hereby repealed," thereby conferring the powers to which it was intimated, in my letter of the 23rd instant, that the Duke of Argyll was not prepared to give his consent. He cannot, therefore, agree to it. See No. 39.

I am, however, desirous to say, that he will not object to the Bill as originally printed, if the two alterations about to be mentioned are made therein.

On page 6, line 20, the last clause of the Preamble, after the words "Act of 1866," should conclude with the following sentence: "but are unable to do so, in consequence of doubts which have arisen as to whether the holders of mortgages, bonds, and debentures, issued under the authority of Section 6 of the Act of 1866, would be entitled to the same priority in respect of interest thereon, as that to which the Secretary of State in Council is now entitled in respect of the interest on the debentures for the 600,000 l. which are intended to be paid off and discharged thereby." See page 115, line 43.

And the 3rd Clause of the Bill should begin with the following words: "Subject to the debentures held by the Secretary of State in Council, or such of them as may for the time being remain undischarged, the interest on all mortgages, bonds, and debentures, issued under the authority of Section 6 of the Act of 1866, shall, notwithstanding the proviso contained in Section 4 of the Act of 1863, be a first charge on all profits which shall be realised by, and payable to the company, from the Soonkasala and Cuddapah Section of the Toombuddra project, whether such profits shall be derived from irrigation, navigation, or any other source of profit whatever, produced by the canal and works comprised in the said section: Provided," &c. &c. See page 115.

I am, &c.

M. E. Grant Duff.

Note.—It was subsequently proposed by the solicitor of the Irrigation Company, and agreed by the Secretary of State in Council, that the third clause of the Bill, as recited in the last paragraph of the preceding letter, should be further amended, by the insertion after the words "section 4 of the Act of 1863," of the following words, "or anything in the recited Acts and the indenture of the 3rd day of June 1863, or either of them contained."

— No. 43. —

The Under Secretary of State for India to the Secretary of the Madras Irrigation Company.

Sir,

India Office, 3 May 1872.

I AM directed by the Secretary of State for India in Council to remind the Directors of the Madras Irrigation Company that a debenture for 12,000 l. falls due on the 9th of May next; and to request that the amount may be paid to the credit of the Secretary of State in Council of India at the Bank of England.

I am further to observe that interest on the above-mentioned sum, at the rate of 5 per cent. per annum, from the 18th of May 1867, on which date the money was advanced, till the date of the repayment, will be due from the company so soon as the profits of the undertaking will admit of its being defrayed.

I am, &c.

M. E. Grant Duff.

— No. 44. —

The Secretary of the Madras Irrigation and Canal Company to the Under Secretary of State for India.

8 and 9, Queen-street Place, London,
8 May 1872 (No. 6).

Sir,

See No. 43.

See No. 31.

See No. 42.

I HAVE the honour to acknowledge the receipt of your letter, dated the 3rd instant, wherein you remind the Directors that a debenture for 12,000 l., given by the Company to the Secretary of State in Council, will fall due on the 9th instant, and request that the amount may be paid into the Bank of England in manner there stated. In reply, I have respectfully to inform his Grace the Secretary of State for India, that the Bill, referred to in my letter of the 29th of February last, now before Parliament, and to which by your separate letter of the 3rd instant his Grace has signified his assent, subject to certain acceptable modifications, has been read a second time in the House of Commons, and will in all probability by the end of June, or the early part of July next, have been passed by both Houses of Parliament. When this required explanatory Act shall have been procured, the Directors will, without any delay, exercise their borrowing powers to pay off the debentures executed by the Company, and held by the Secretary of State for India, together with interest thereon, and they trust that his Grace the Duke of Argyll will, under the circumstances; extend the time for payment of those sums which may in the meantime fall due.

I have, &c.
J. Westwood, Secretary.

— No. 45. —

The Under Secretary of State for India to the Secretary of the Madras Irrigation and Canal Company.

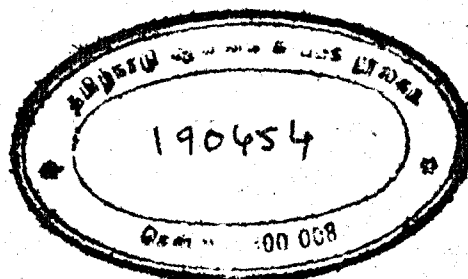
Sir,

India Office, 14 May 1872.

See No. 44.

I AM directed by the Secretary of State for India in Council to acknowledge the receipt of your letter of the 8th instant, and to acquaint you in reply that, in consideration of the circumstances therein represented, he will not press for the repayment of the debentures due by the Madras Irrigation and Canal Company, pending the result of the action which may be taken during the current Session by Parliament with reference to the Bill now before the House of Commons.

I am, &c.
H. Merivale.



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MADRAS IRRIGATION COMPANY.

COPY of recent CORRESPONDENCE between the Secretary of State for *India* and the Governments of *India* and *Madras*, and between the Secretary of State and the Directors of the Madras Irrigation and Canal Company, relative to the present Condition and future Prospects of the Company.

(*Mr. Charles Dalrymple.*)

*Ordered, by The House of Commons, to be Printed,
10 May 1872.*

[*Price 1 s. 4 d.*]

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Under 12 oz.