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MADRAS RECORD OFFICE.

Government of Madras.

Public works **DEPARTMENT.**

G.O. No. 2720 Press ~~Mis.~~

425-26

Dated 27 10 18

Not to be folded or roughly handled

No. 425. Read the following Endorsement of the Acting Chief Engineer for Irrigation, dated Fort St. George, 28th September 1871, No. 79:—

From the Agent and Manager of the Madras Irrigation and Canal Company, to the Acting Chief Engineer for Irrigation, dated Madras, 2nd September 1871, No. 375.

In continuation of my letter of the 4th August, No. 340, offering some remarks upon the Order of Government, No. 1,975, of the 27th July, I have the honour to hand you copy of a report which I have received from the Company's Chief Engineer, and I have the honour to request that you will be pleased to submit this document for the consideration of the Right Honourable the Governor in Council.

From the Chief Engineer, to the Agent and Manager of the Madras Irrigation and Canal Company, dated Kurnool, 24th August 1871, No. 1,073.

Your No. 598 of 1st instant, enclosing G. O., No. 1,975, of 27th ultimo.

The Madras Government in the first paragraph of this order say that a good deal remains (on 1st July last) to be done to bring the works in even their outward aspect to a finished state, and that the state of completion falls far short of that contemplated in the contract, and understood by the expressions "satisfactorily completed" and "placed in working order."

It will be seen from the two succeeding paragraphs of the order that this judgment of the Madras Government is founded mainly on the report by Captain A. deC. Scott, R.E., Under Secretary to Government, Public Works Department, who inspected the 190 miles of canal in consequence of the illness of Major Ryves, the Chief Engineer of Irrigation. This inspection occupied from the 8th to near the end of June, *i.e.*, it began three weeks before the termination of the contract, and ended before the contract time expired.

The only other ground apparently given for the judgment is that I am *working* the canal and not *testing* it. Certainly it is stated in paragraph 4 that I have taken measures "to ensure that, if the canal should breach, it will do so in the most favourable localities." That seems to me a measure to render the canal more complete; though the wording, taken from a portion of Captain Scott's paragraph 7, is ambiguous, unless the rest of that paragraph taken in connection with it. My measures are there further described to be such "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*." The banks of the canal are no-where lowered below the height fixed by Government for puddle-core banks, nor in such a way as to breach, if sound, under the test proposed by Government.

Since the opinions of Captain Scott seem to me to be the chief support of the condemnation of the canal passed by the Madras Government, I will go through his report in detail and examine them more closely. This is important, because they seem to me to be diametrically opposed to those of Sir A. Cotton, Colonel Rundall, Colonel Orr, and other Royal Engineers of great experience, particularly in irrigating canals in India.

I will first mention that 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 demand, 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 bank is, to start with, moderately impervious. As is known in England, a coat of mud, the thickness of a piece 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. From the failure of the Red Hill tank, owing to the percolation of the water through the banks although puddle, no conclusion can be drawn as to what kind of bank will work best in a canal.

I will now turn to Captain Scott's detailed report, which bears every evidence of being carefully and impartially made.

1*st Mile.*—The earth and rock thrown to spoil from the cutting appears to be not thrown by chance, but is "formed" roughly. The men engaged in finally trimming the tow-path were working up from the third mile. They completed the tow-path in the first and second miles before the end of June.

In the second Mile, I had inspected the calingulah on the 3rd June, in order to decide between two ways of balancing the swinging shutters, so as to ensure their hanging close. One was fitted for trial with additional weight to bring the lower edge down, and another had a heavy bar removed from the upper edge. I preferred the latter method.

The necessary alteration of all the shutters would take a couple of carpenters a day, but was deferred during the issue of the shutters to the small irrigating sluices down the canal, required as the water advanced down the canal. It was completed before the end of June.

3*rd Mile.*—This mile is mostly in heavy cutting. The tow-path on the edge of the cutting can be readily maintained above water by raking down some spoil upon it, for the short distance it is too low. Any alteration of the masked calingulah is involved in the general question of calingulahs.

4*th Mile.*—All culverts under the canal above this mile exclusive have been abandoned. The small patch of ground temporarily flooded while the culvert No. 9 is over-flooded is poor and stony. I believe the inlet to be as old as the culvert.

The tow-path is constructed, as sanctioned, with a broad berm of 40 or 50 feet between it and the canal. This would perhaps be inconvenient with a tow rope of less than 150 feet long. I will have an estimate made for correcting this; also for carrying the tow-path round the rock at 4 miles 40 chains. But a bargee could easily keep his rope clear.

9*th Mile.*—Culvert No. 10 was repaired during my absence. It stood last year in a worse condition. It shall be made tight by the bankers so soon as the season is over. It is reported not to seem dangerous, and passengers and cattle cross through the centre arch.

12*th and* 13*th Miles.*—The theory of rough-stone aprons was described, if I recollect right, by Colonel Orr in reference to the Pennair anicut. As they work down more stone should be supplied until a permanent condition is reached. The process is going on at Nos. 5 and 6 and 7 calingulah aprons. It is useless to pitch the face of such aprons, as was done at these calingulahs, until the rough mass has worked to a final condition.

14*th*, 15*th and* 17*th Miles.*—I will omit further mention of "clearing the tow-path." The bankers maintain it, and correct roughness caused by weather.

General remarks.—The "bank" I suppose alluded to is the flood bank between the cutting and the river, and this is only rough where there is spoil in excess. It certainly was not contemplated to turn spoil. Captain Scott (see his remarks on the 35th and 36th miles) objects to the berm between the canal and the tow-path which was ordered by Colonel Rundall to be at least 10 feet, but has been reduced to 5 feet below the Metacondal cut. Besides the berm, there are discontinuities in the towing, as sanctioned as in the 26th and 28th miles, where two adjacent water-spreads are connected by a cut through a low place in the dividing ridge between them, and the tow-path becomes merely a patch 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 for a short distance otherwise than "easy." The tow-path might readily be taken round the rocky protuberance in the 5th mile at 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 stopped all the small ones up at my suggestion in 1864, solely because he could not otherwise satisfactorily answer the question I pressed upon him (are your works safe to stand through a high fresh in the river with an empty canal) and I have provided for their being permanently closed. The irrigation sluices in the upper sections are small ones, with openings 7 inches by 5 inches

Proceedings of the Madras Government, Public Works Department, 27th October 1871.

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 while 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 also is the only pitching which lies wholly on the bank, and does not accumulate weight on the toe as it is raised higher and higher.

18*th Mile.*—The new bank in the rear of the new wall closing the breach has not settled more than a yard, and has been made up. I am not aware of any slip in it. Estimates shall be prepared for remedying the alleged defects in the tow-path as sanctioned in the 19th and 20th miles.

24*th Mile.*—The rough-stone apron which was stacked for measurement by the Vagoo side, when Captain Scott passed Kaderbagh aqueduct, was all thrown in before the 30th 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. *Below* water level the banks have been found so tight as not to need puddling.

26*th Mile.*—Captain Scott has misunderstood. The new walls (face walls) are raised to 3½ feet above water level, but are none of them plastered nor puddled in front. The old walls have not been raised except at the ends, but some have been plastered and puddled.

28*th 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.

30*th*, 31*st, and* 32*nd Miles.*—I do not know how these banks "appear loosely laid." There is no excessive leakage to indicate this.

In his general remarks Captain Scott argues that there is much ground for believing that the work throughout 2nd section is not of particularly good quality. He bases the argument on the "loose and dry" appearance of filling up of one bank above the highest flood water line, on the general inferiority of soil in this section, and on the breaching of two old *walls* of defective design and work. He argues that the thickness of the higher embankments must be increased beyond that approved and sanctioned by Government, and that, where a wall has stood the recent trial, to raise it to 3½ feet above full water level, carry a foreshore of puddle along the front, and support the rear with a dry rubble slope, the surface slope of which cuts the outer face of the wall above full water level, will prove quite insufficient for security. I shall have occasion hereafter to refer to what Captain Scott describes as an "inferior kind" of masonry. No. 15 calingulah shutters are open here and elsewhere, which is what I suppose Captain Scott means by "removed."

35*th and* 36*th Miles.*—The order for at least 10 feet berms was given in 1861 or 1862, and I cannot lay my hand on the original order of Colonel Rundalls.

37*th Mile.*—A tow-path must be either "dry and loose" as of gravel, or "soft" and liable to be very moist in the rains. That in this mile is the latter. It is very old and thoroughly consolidated. The old upright pitching is being gradually changed to shingling as it gives way.

38*th and* 39*th Miles.*—This core wall is in cutting and therefore has no foreshore. The calingulah is on rock, and what Captain Scott took for an apron is merely rock spoil from the cutting behind, and may safely be washed away.

41*st Mile* 16 *Chains.*—These parapet copings were put on as an experiment without my instructions, and I disapproved them. But they consist of stones of some value, which protect the wall, and are safest as they lie. They could be removed in a day to be used elsewhere.

42*nd Mile.*—This wall, built on fissured quartzite, leaks below, but does not indicate any danger. Leakage would be stopped by a small puddle foreshore, and an estimate shall be submitted.

43*rd Mile.*—Mr. Wilks reports this sluice to work well, excepting perhaps one shutter which does not quite close.

44*th Mile. Mudigutla.*—This bank is formed by raising an old tank bund, which leaked, but has shown no signs of insecurity. The leakage used to be used for irrigation, but is now so small as to be insufficient for that purpose.

45*th Mile.*—The Engineer in these miles (Mr. Furguson) told me he had been careful to keep the best earth in the centre of the banks. They stand very well and are tight, so far as they have been tried.

General remarks.—Stone is plentiful all along this section, and shingling can be readily added if the present is not found to stand. Hitherto it has given no trouble, which cannot be said of packed pitching. I should not say that the masonry is as rough as that of the 1st section and Hindry aqueduct. Ulloor aqueduct and Sultanpoor bridge are of good coursed rubble, but to this I will refer again. No shutters are "removed" further than to raise them. The lowered banks are 3 feet 6 inches above full water level.

63*rd to* 65*th Miles.*—The tops of these want trimming as soon as the bankers are free from irrigating fields.

66*th Mile.*—No further slips have occurred here. The plastering requires a little addition inside the aqueduct. The widening of the banks is now complete, except dressing true.

67*th Mile.*—The necessary shutters and gear complete are now fixed and finished in the irrigating sluice.

68*th and* 69*th Miles.*—The tow-path in this cutting, I regret to say, was not completely trimmed when the bankers were taken off for distribution works. It is "convenient."

71*st Mile.*—The irrigating sluice and gear here and elsewhere is completely fixed.

78*th Mile.*—The bridge does not need replastering. The cutwaters never were plastered and do not need it.

81*st Mile.*—The shutters of Toorcherla head-sluice are fixed, and the raising gear has arrived and is being fitted. They are kept open, there being no need for them at present.

83*rd Mile, No.* 4 *Lock.*—The mitre posts of these gates do 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 cill, between the pointing cill and gate. The caulking is being done by the bankers who watch the locks.

Jootoor Anicut and head-work.—The unfinished masonry was the junction of about 5 feet of the top of the chamber wall with the ancher stones after the straps were in, and was finished before the 30th June.

That the gear of the head and under-sluices did not work easily seemed merely due to the absence of a proper key on the day we were at the work. The contrivance available was a key and lever, such as is used by a London Turncock. There is no difficulty now in working this gear. The shutters were fitted before 30th June by attaching a batten.

97*th Mile* 26*th Chain. No.* 6 *Calingulah.*—I pointed out the unnecessary thickness of these piers in Mr. Ross's design submitted with my No. 1,054 of 13th February 1869. It seemed to me to be a draughtsman's error, hardly worth mention, except to say that it would not be carried into the building. Government, however, in G. O., No. 1,193, 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.

Bridge 7A *and Calingulah No.* 9.—The masonry of these is not said to be rougher than the old work in Hindry aqueduct, approved as sample work.

101*st Mile* 51*st Chain. Syphon culvert.*—I cannot see why the outlet requires clearing. The culvert drains perhaps 10 acres. Its chief use is to carry a small irrigating stream from the 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.

103*rd Mile* 29*th Chain. No.* 15 *Culvert also No.* 17.—These are syphon culverts. Any silt deposited below is periodically removed.

General 7*th Section.*—Captain Scott's remark on the inferior quality of recent work compared with old requires some qualification. The irrigating sluices, which are all recent work, the parapet of Ayaloor bridge and other work are exceptions. The parapet of Byup Goodoor bridge was deferred to 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 just before putting on the coping.

121*st and* 122*nd Miles.*—The canal bed was finished on 30th June.

124*th and* 125*th Miles.*—The banks were completely trimmed and the coolies removed before the end of June.

13·*th*, 135*th, and* 136*th Miles.*—I cannot ascertain where the bank slopes are not trimmed here. They have been looked for, but not discovered.

138*th Mile.*—The rough bank below Lock 12 should hardly be called "Canal bank." It is *spoil.*

Rajole Anicut.—Mr. Knorpp informs me that the under-sluices are complete. No danger nor need of repair has as yet occurred to the anicut from the breaking up of rock. The foundation is on the most solid beds.

Irrigating sluices.—These were all fixed and working when I visited the 9th section this month.

160*th mile. Dhoor Aqueduct.*—When I saw this work, water had been flowing over for some weeks, and the banks were remarkably tight, owing to the improvements made last year.

General.—Owing to the late arrival of parts of machinery made in Madras to replace breakages, or as extras, some of the valves in the 9th Section were not in place and complete at the end of June. No drainage water flows into the canal, except a very small quantity in the first two miles.

The 10th Section requires no special remark.

Having thus referred to the defective points observed by Captain Scott, I beg to offer some remarks on the general results of his inspection, viz., that the masonry is generally inferior, the banks unconsolidated and liable to cut up, and even likely to breach if suddenly filled, and that the lock gates require, in the aggregate, a good deal of work to make them fit.

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 sum furnished by themselves and at their own cost. Economy was as desirable for the interest 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, firstly, the soundness, and, secondly, the finish of all classes of work, without paying an extra price beyond what had been necessary to secure the results already examined and approved by the Engineers of the Government.

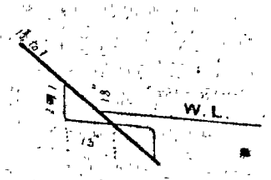
G. O., No. 3,045, of 19th December 1862, paragraph 9, seems to endorse the opinion of Colonel Ludlow, Consulting Engineer, "that the Hindry aqueduct, as far as it is completed, has been "substantially built." This refers to Colonel Ludlow's No. 76 of 29th October 1862, to the Secretary to Government, Public Works Department, paragraph 59. "This large work, 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 Moodelliar, 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 the work. The only question raised was the expediency of using an asphalte lining. Again, Colonel Orr particularly called His Excellency the Governor's attention 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 two inches thick, or even less, upwards, and the thickness of a course, including joints, seems to average three 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 feet 1 inch.	
	17	,, ,, 4 ,, 1 ,,	
	20	,, ,, 4 ,, 6 inches	
	20	,, ,, 5 ,, 5 ,,	
Total...	75	19 ,, 1 inch	

showing an average breadth of courses of three inches. No. 5 bridge is of a similar class of work, with joints occasionally one inch thick, but care has been taken to secure larger stones and avoid small ones, and the courses average four inches thick, and the joints perhaps three-eighth 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 in 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.

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 one in six will take place as water is admitted to the banks. When complete 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 one in six made for 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 (see sketch) is very trifling, although it looks considerable on the bank.



Probably only about one-twelfth of a cubic 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; 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 for a mile and a half above the Vaikal air aqueduct, and as has been done above the Punkal Wunkal. Probably Rupees 5,000 would suffice for all such places when discovered.

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 cill, and when wet they expand and water enters between the gate and cill. 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 cill 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 they 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 loosened, as I have ordered them to be.

P. S.—On re-perusing Captain Scott's letter I cannot help fearing that his comments on the tow-path may give it too much prominence. It is merely a good bridle-path, better in its worst parts than the average of our only road at Kurnool, viz., that between Kurnool and Ghooty, and nowhere worse than a newly-metalled road; as a bridle-path it is better than the road.

(Signed) J. H. LATHAM,
Chief Engineer.

SUBMITTED to Government.

No. 1,073, 24th August 1871.

With this letter the Agent of the Company submits a communication from the Chief Engineer of the Company, commenting on my report to Government on the state of the works of the canal from Soonkasala to Cuddapah, dated the 6th July last, No. 471.

2. It would be in no way profitable, nor do I think it at all necessary now to enter into any lengthy discussion on the subject involved. It is one on which controversy would be inevitable and might be made endless. Taking, therefore, merely a general view of the remarks of the Chief Engineer, it may first be observed that they tend to assertions to the following effect:—

(1.) That my opinion of the works generally, is diametrically opposed to those of Sir A. Cotton, Colonel Orr, Colonel Rundall, and other Royal Engineers of great experience.

(2.) That in many cases where I noticed incompleteness in certain portions of the works, the work remaining to be done was executed before the 30th June.

(3.) That my expressed opinion of the unsoundness of the work in the 2nd section is based on insufficient observation.

(4.) That the masonry described by me as generally inferior is of a quality approved of by former Government officers, and that it is good of its kind.

(5.) That as regards the earthwork, selection and ramming were not neglected, and that the banks will be rendered water-tight by the natural action of the canal water.

3. I cannot find that Mr. Latham establishes in any way the correctness of the assumption made by him, that the opinions of the experienced officers alluded in reference to the quality and general efficiency of the works of the Company is opposed to those I have expressed in my report; on the other hand, I may point to the records of the Proceedings of Government for the last five years containing the correspondence of the Consulting Engineers and their reports, which teem with animadversions on the works of the Company generally, and these reflections are endorsed by numerous Government orders.

4. In noticing the cases where works were in an incomplete state, I have been careful to point out, when I considered myself justified in so doing, that there was every probability of their being finished within the prescribed contract period, and it was this consideration amongst others which enabled me to state that in a general sense the whole of the main canal and accessories might be considered complete in reference to the sanctioned plans.

5. The unfavourable opinion I expressed in regard to the works of the 2nd section in particular was based on a personal inspection of every yard of the canal, and on information gathered on the spot from the Company's Engineers, who associated themselves with me as to the methods of construction both of earth-work and masonry. I saw masons at work and watched their operations, and I examined, as I stated, the interior of the banks where exposed. It is true that they were cut in only two or three places in the 2nd section, but throughout the length of the canal the inner structure was laid bare in at least twenty places where the banks were lowered to breach. I read the official reports of the appearance of

walls and embankments where the breaches had occurred in 1870, and I should certainly have failed strangely in power of connecting causes and effects if I had come to any other conclusion than that which the Chief Engineer pronounces to be unwarranted.

6. In his memorandum the Chief Engineer takes exception to my qualification of the masonry generally as inferior, and refers to the opinions of Colonels Orr and Ludlow, R.E., in an opposite sense. It will be observed that the remarks of these two officers were respectively applied to one isolated structure which, in the case of Colonel Ludlow, was incomplete. Mr. Latham adds that the specifications provided for random rubble work, and that the masonry executed is in general a good specimen of the kind intended to be built. This line of argument can always be adopted, and if it is shown at the same time that the cost of the work was not more than commensurate with its quality, it is often only absolute failure of the structures so built, or a long continued record of the cost of maintenance and repairs enhanced by the original inferiority of the work which can prove its fallacy. In the present case I believe that if the cost of walls already breached, culverts blown up or driven in and repairs was added to the general amount expended on such works, the rate for those now standing would be considerably greater than that estimated.

I cannot, however, concur with the Chief Engineer in his opinion that the masonry on the canal works is, as a rule, good "random rubble," nor do I think that qualification is applicable to stone work of which the courses average 3 inches in thickness, more especially when the beds of the stones which are schistose in character are so smooth that the mortar has but little power of adhesion.

7. I was given to understand that in certain portions of the canal some attention had been paid to ramming and even selection of soil, but all the evidence I could collect showed that these were quite exceptional measures, and that the great mass of the earthwork had been thrown up at random. As regards the tendency of the water flowing in the canal to puddle and improve the banks, and even the walls by depositing silt. This has not been lost sight of in my report, and is clearly pointed out.

8. There are various other points noticed in the comments made by the Chief Engineer on the detail notes recorded with my report, but they seem to me to be of no importance, and certainly do not affect its general accuracy.

(Signed) A. deC. SCOTT, Captain, R.E.,
Acting Chief Engineer for Irrigation.

No. 426. ORDER THEREON, 27th October 1871, No. 2,720.

IRRIGATION, No. 22. ORDERED to be recorded.

(True Extract.)
(Signed) R. F. OAKES, Captain, R.E.,
Offg. Joint Secretary to Government.

Exd. S. T. Augustin.

9

Madras Irrign & C. Co.
Chief Engineer's Office
Rurnool 24th August 1871.

No. 1073.

To,
F. B. Henslowe Esqre
Agent and Manager
Madras.

Sir
Your 598 of 1st instant enclosing
G.O. 1975 of 27th ultimo.

The Madras Government in the first paragraph of this Order say that a good deal remains (on 1st July last) to be done to bring the works in their outward aspect to a finished state; and even that the state of completion falls far short of that contemplated in the Contract, and understood by the impression "satisfactorily completed" and placed in working order".

It will be seen from the two succeeding paras of the Order that this judgement of the Madras Government is founded mainly on the report by Capn A. deC. Scott, R.E. Under Secretary to Govt. Public Works Department who inspected the 190 miles of Canal in consequence of the illness of Major Ryves, the Chief Engineer of Irrigation. This inspection occupied from the 8th to near the end of June i.e. it began 3 weeks before the termination of the Contract, and ended before the Contract time expired.

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for the judgement is that I am working the Canal and not testing it. Certainly it is stated in the para to that I have taken measures "to ensure that if the Canal should breach it will do so in the most favourable localities". That seems to me a measure to render the Canal more complete; though the wording, taken from a portion of Capn Scotts para 7, is ambiguous unless the rest of that para taken in connection with it. My measures are there further described to be such "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."

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I will first mention that 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

never be filled more than enough to supply current demand: 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 bank and so rapidly furnishes to a certain and very appreciable extent a substitute for puddle where the soil of the bank is, to start with, moderately impervious. As is known in England, a coat of mud the thickness of a piece 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. From the failure of the Red Hill tank 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.

I will now turn to Capn Scotts detail report which bears every evidence of being carefully and impartially made.

1st Mile. The earth and rock thrown to spoil from the cutting appears to be not thrown by chance but is "formed" roughly. The men engaged in finally trimming the towpath were working up from the 3d mile. They completed the towpath in the 1st and 2d miles before the end of June.

In the second mile I had inspected the Canal on the 3d June in order to decide between two ways of balancing the swinging shutters, so as to ensure their hanging close. One was fitted for trial with additional weight to bring the lower edge down

and

and another had a heavy bar removed from the upper edge. I preferred the latter method.

The necessary alteration of all the shutters would take a couple of carpenters a day; but was defer=red during the issue of the shutters to the small ir=rigating sluices down the Canal, required as the water advanced down the Canal.

It was completed before the end of June.

3rd Mile. This mile is mostly in heavy cutting. The towpath on the edge of the cutting can be readily maintained above water by raking down some spoil upon it, for the short distance it is too low. Any alteration of the masked Calingulah is involved in the general question of Calingulahs.

4th Mile. All culverts under the Canal above this mile exclusive have been abandoned. The small patch of ground temporarily flooded while the Culvert No. 9 is over flooded is poor and stony. I believe the inlet to be as old as the Culvert.

The towpath is constructed as sanctioned with a broad berm of 40 or 50 feet between it and the Canal. This would perhaps be inconvenient with a towrope of less than 150' long. I will have an estimate made for correcting this. Also for carrying the towpath round the rock at ¼ mile 40 chains. But a bargee could easily keep his rope clear.

9th Mile. Culvert No. 10 was repaired during my absence. It stood last year in a worse condition. It shall be made tight by the bankers, so soon as the season is over. It is reported not to seem dangerous,

and passengers and cattle cross through the centre arch.

12th and 13th Miles. The theory of rough stone aprons was described, if I recollect right, by Colt. Orr in reference to the Penman Anicuts as they work down more stone should be supplied until a perma=nent condition is reached. The process is going on at No. 5 and 6 and 7 Calingulah aprons. It is useless to pitch the face of such aprons, as was done at these Calingulahs, until the rough mass has worked to a final condition.

14, 15 and 17 miles. I will omit further men=tion of clearing the towpath. The bankers main=tain it, and correct roughness caused by weather.

General Remarks. The "bank" I suppose al=luded to is the flood bank, between the Cutting and the river: and this is only rough where there is spoil in excess. It certainly was not contem=plated to turn spoil. Capt. Scott (see his remarks on the 35th and 36th Miles) objects to the berm bet=ween the Canal and the towpath which was or=dered by Colt. Rundall to be at least 10 feet, but has been reduced to 5 feet below the Meta=condal Cut. Besides the berm, there are discon=tinuities in the towing, as sanctioned as in the 26th and 28 miles where two adjacent water spreads are connected by a cut through a low place in the dividing ridge between them, and the towpath becomes merely a patch along the margin of the tank, for a short distance.

In these cases in practice the towing cattle would

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 for a short distance otherwise than easy. The towpath might readily be taken round the rocky protuberance in the 5th Mile at small expense, so as to be kept close to the sanctioned Channel. The only culvert for draining land in the first 3 miles which was found too small was the 6th for which a Calingulah was sanctioned. Mr Lowe stopped all the small ones up at my suggestion in 1864 solely because he could not otherwise satisfactorily answer the question — I pressed upon him are your works safe to stand through a high fresh in the river with an empty Canal and I have 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 while 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 also is the only pitching which lies wholly on the bank, and does not accumulate weight on the

for

towpath as it is raised higher and higher.

18th Mile. The new bank in the rear of the new wall closing the breach has not settled more than a yard, and has been made up. I am not aware of any slip in it. Estimates shall be prepared for remedying the alleged defects in the towpath as sanctioned in the 19th and 20th miles.

24½ Mile. The rough stone apron which was stacked for measurement by the cargoe side when Capt Scott passed Kaderbagh Aqueduct was all thrown in before the 30th June. Where the top of the bank had been removed to a level a foot above full water level, the bank and towpath inetal might look loose, promiscuous and dry. Below water level the banks have been found so tight as not to need puddling.

26½ Mile. Capt Scott has misunderstood. The new walls (face walls) are raised to 3½ feet above water level, but are none of them plastered nor puddled in front. The old walls have not been raised except at the ends but some have been plastered and puddled.

28th Mile. This towpath 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 & 32nd Mile. I do not know how these banks "appear loosely laid". There is no excessive leakage

leakage to indicate this.

In his general remarks Capt. Scott argues that there is much ground for believing that the work throughout 2d Section is not of particularly good quality. He bases the argument on the "loose and dry" appearance of filling up of one bank above the highest flood water line; on the general inferiority of soil in this section; and on the breaching of two old walls of defective design and work. He argues that the thickness of the higher embankments must be increased beyond that approved and sanctioned by Government; and that, where a wall has stood the recent trial, to raise it to 3½ feet above full water level, carry a foreshore of puddle along the front, and support the rear with a dry rubble slope the surface slope of which cuts the outer face of the wall above full water level, will prove quite insufficient for security. I shall have occasion hereafter to refer to what Capt. Scott describes as an "inferior kind" of Masonry No. 15- Calingulah shutters are open here and elsewhere, which is what I suppose, Capt. Scott means by "removed."

35th and 36th Mile. The order for at least 10 feet berms was given in 1861 or 2, and I cannot lay my hand on the original order, of Colt. Rundall's.

37th Mile. A towpath must be either "dry and loose" as of gravel, or "soft" and liable to be very moist in the rains. That in this mile is the latter.

It

It is very old and thoroughly consolidated. The old upright pitching is being gradually changed to shingling as it gives way.

38th and 39th Mile. This core wall is in cutting, and therefore has no foreshore. The Calingulah is on Rock, and what Capt. Scott took for an apron is merly rock spoil from the cutting behind, and may safely be washed away.

41st Mile. 16 Chains. These parapet copings were put on as an experiment without any instructions, and I disapproved them. But they consist of stones of some value, which protect the wall, and are safest as they lie. They could be removed in a day, to be used elsewhere.

42d Mile. This wall, built on fissured quartzite, leaks below, but does not indicate any danger. Leakage would be stopped by a small puddle foreshore and an estimate shall be submitted.

43d Mile. Mr. Wilks reports this sluice to work well, excepting perhaps one shutter which does not quite close.

44th Mile. Mudegutta. This bank is formed by raising an old tank bund, which leaked, but has shewn no signs of insecurity. The leakage used to be used for irrigation, but is now so small as to be insufficient for that purpose.

45th Mile. The Engineer in these miles (Mr. Ferguson) told me he had been careful to keep the best Earth in the centre of the banks. They stand very well, and are tight, so far as they have

have been tried.

General Remarks. Stone is plentiful all along this section, and shingling can be readily added if the present is not found to stand. Hitherto it has given no trouble, which cannot be said of packed pitching. I should not say that the masonry is as rough as that of the 1st Section and Hindry Aqueduct. Ulloor Aqueduct, and Sultanpoor Bridge are of good coursed rubble: but to this I will refer again. No shutters are removed further than to raise them. The lowered banks are 3.6" above full water level.

63rd to 65th Miles. The tops of these want trimming as soon as the bankers are free from irrigating fields.

66th Mile. No further slips have occurred here. The plastering requires a little addition inside the Aqueduct. The widening of the banks is now complete, except dressing. time.

67th Mile. The necessary shutters and gear complete are now fixed and finished, in the Irrigating Sluice.

68th and 69th Mile. The tow path in this cutting, I regret to say was not completely trimmed when the bankers were taken off for distribution works. It is convenient.

71st Mile. The irrigating sluices and gear here and elsewhere is completely fixed.

78th Mile. The Bridge does not need replastering. The cutwaters never were plastered and do not need it.

87th Mile. The shutters of Toocherla Head Sluice are fixed, and the raising gear has arrived, and is being fitted. They are kept open, there being no need for them at present.

83rd Mile No. 4 Lock. The mitre posts of these gates do 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 1 inch broad near the point of the sill, between the pointing sill and gate. The caulking is being done by the bankers who watch the locks.

Toocherla Aqueduct and Head work. The unfinished masonry was the junction of about 5 feet of the top of the chamber wall with the arched stones, after the straps were in, and was finished before the 30th June.

That the gear of the Head and under Sluices did not work easily seemed merely due to the absence of a proper key on the day we were at the work. The contrivance available was a key and lever such as is used by a London Turncock. There is no difficulty now in working this gear. The shutters were fitted before 30th June by attaching a batten.

97 mile 26 ch. No. 6 Calingulah. I pointed out the unnecessary thickness of these piers in Mr. Rofs design submitted with my 105th of 13th February 1869. It seemed to me to be a draughtsman's error, hardly worth mention, except

except to say that it would not be carried into the building. Government however in G.O. 1103 of 26th April 70 positively ordered that the iron 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.

Bridge 7th and Calingulah No 9. The Masonry of these is not said to be rougher than the old work in Hendry Aqueduct, approved as sample work.

101 Mile 51 Ch: siphon Culvert. I cannot see why the outlet requires clearing. The Culvert drains perhaps 10 acres. Its chief use is to carry a small irrigating stream from the 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.

103 Mile 29 Ch: Nos 15 Culvert also Nos 17. These are siphon Culverts. Any silt deposited below is periodically removed.

General 7th Section. Capn Scotts remark on the inferior quality of recent work compared with old requires some qualification. The irrigating sluices, which are all recent work, the parapet of Ayalor Bridge, and other work are exceptions. The parapet of Byapa Goodoor Bridge was deferred to the last moment in hopes of some decision from Government being received before it was built.

It

It is a foot thick and was seen by Capn Scott just before putting on the coping.

121st and 122nd Miles. The canal bed was finished on 30th June.

124th and 125th Mile. The banks were completely trimmed and the coolies removed before the end of June.

134th, 135th and 136th Miles. I cannot ascertain where the bank slopes are not trimmed here. They have been looked for, but not discovered.

138th Mile. The rough bank below lock 12 should hardly be called "Canal Bank" it is spoil.

Rajole Ancient. Mr Knopp informs me that the under sluices are complete. No danger nor need of repair has, as yet, occurred to the Ancient, from the breaking up of rock. The foundation is on the most solid beds.

Irrigating Sluices. These were all finished and working when I visited the 9th Section this month.

160th Mile Ghoor Aqueduct. When I saw this work, water had been flowing over for some weeks, and the banks were remarkably tight, owing to the improvements made last year.

General. Owing to the late arrival of parts of machinery made in Madras to replace breakages, or as extras, some of the valves in the 9th Section were not in place and complete at the end of June. No drainage water flows into the Canal except a very small quantity

in

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 they 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 loosened: as I have ordered them to be.

I have &c.

/Sd/ John F. Latham.

Chief Engineer.

P.S. On perusing Capt. Scott's letter, I cannot help fearing that his comments on the towpath may give it too much prominence. It is merely a good bridle path, better in its worst parts than the average of our only road at Kurnool, viz: that between Kurnool & Gootty, and no-where worse than a newly metalled road; as a bridle path it is better than the road.

/Sd/ J. F. L.

Apl

P. Pr. 46 98 1/71
Manager Canals Letter dated 2nd Sept 1871

27

No 79

From Agent and Manager Madras Irrigation and Canal Company No 375 dated 2nd September 1871. With Enclosure.

Submitted to Government.

With this letter the Agent of the Company submits a Communication from the Chief Engineer of the Company Commenting on the Report to Government on the State of the Works of the Canal from Soukasala to Seddapah, dated the 6th July last No 471.

No 1073 - 24th August 1871.

2. It would be in no way profitable nor do I think it at all necessary now to enter into any lengthy discussion on the subject involved. It is one on which controversy would be inevitable and might be made endless. Taking therefore merely a general view of the remarks of the Chief Engineer, it may first be observed that they tend to assertions to the following effect.,

1

1. That my opinion of the works generally, is diametrically opposed to those of Sir A. Cotton, Colonel Orr, Colonel Rundall and other Royal Engineers of great experience

2. That in many cases where I noticed incompleteness in certain portions of the works, the work remaining to be done was expended before the 30th June

3. That my expressed opinion of the unsoundness of the work in the 2nd Section is based on insufficient observation

4. That the masonry described by me as generally inferior is of a quality approved of by former Government Officers and that it is good of its kind

5. That as regards the Earth work, selection and ramming were not neglected and that the Banks will be rendered watertight by the natural action of the Canal water

3. I cannot find that Mr Latham established in any way the correctness of the assumption made by him, that the opinions of the experienced officers attended and reference to the quality and general efficiency of the

works of the Company is opposed to those I have expressed in my report. On the other hand I may point to the records of the proceedings of Government for the last five years containing the Correspondence of the Consulting Engineers and their reports which teem with animadversions on the works of the Company generally and these reflections are endorsed by numerous Government orders.

4. In noticing the cases where works were in an incomplete state, I have been careful to point out when I considered myself justified in so doing, that there was every probability of their being finished within the prescribed Contract period, and it was this Consideration amongst others which enabled me to state that in a general sense the whole of the Main Canal and accessories might be considered Complete in reference to the Sanctioned plans.

5. The unfavorable opinion I expressed in regard to the works of the 2nd Section in particular was based on a personal inspection of every yard of the Canal and on information gathered on the spot from the Company's En-

gineers who associated themselves with me as to the methods of Construction both of Earth work and Masonry. I saw Masons at work and watched their operations and I Examined as I stated the interior of the banks where exposed. It is true that they were cut in only two or three places in the 2nd Section but throughout the length of the Canal the inner Structure was laid bare in at least 20 places where the banks were lowered to breach. I read the official reports of the appearance of walls and embankments where the breaches had occurred in 1870 and I should certainly have failed strangely in power of connecting causes and effects if I had come to any other conclusion than that which the Chief Engineer pronounces to be unwarranted.

6 In his memorandum the Chief Engineer takes exception to my qualification of the Masonry generally as inferior and refers to the opinions of Colonels Orr and Ludlow R.E. in an opposite sense. It will be observed that the remarks of these two officers were respectively applied to one isolated Structure

which in the case of Colonel Ludlow was incomplete. Mr Latham adds that the specifications provided for random "rubble" work and that the Masonry executed is in general a good Specimen of the kind intended to be built. This kind of Requirement can always be adopted and if it is shewn at the same time that the cost of the work was not more than commensurate with its quality it is often only absolute failure of the Structures to stand built, on a long Continued record of the Cost of maintenance and repairs enhanced by the original inferiority of the work which can prove its fallacy. In the present case I believe that if the cost of walls already breached, Culverts blown up or driven in and repairs was added to the general amount expended on such works the scale for those now standing would be considerably greater than that Estimated by me. I cannot however concur with the Chief Engineer in his opinion that the Masonry of the Canal works is as a rule good random rubble nor do I think that qualification is applicable to stone work of which the Courses average 3 inches in thickness; more especially

Pro: 27th July 71 & 1st Augt 71-473

Public Works 1871 Department

No 77

From Sir H. Beddy

The Act. Chief Engineer
for Irrigation and
Joint Secretary to
Government P.W.D.

To The Secretary to Government
P.W.D.

Dated 28th September
Rec'd 3rd October 1871

Ques 2 ✓

Submits letter from
Agent No 375 giving cover
to a communication from
the Company's Chief Engineer
commenting on Captain
Scotts report to Government
on the state of the works of
the Canal from Soonkosala
to Cuddapah - with enclosures

over

No 2720-27th Oct 71.

No 2720.
to be recorded
H.
11 Oct

6 Copy 6 Oct 71. Mds 16th

Copy

C. L. 4698.

Coll of 1867 Works.

PUBLIC WORKS.

To

Dated.

Read. Encl 2

G. O. 27th Oct & No. 2720.

Nos. 425 & 426

Company communicating on Captain Scallon's report on the state of the works. recorded

Madras Irrigation & Canal Company's Main Canal and works - the endorsement of the Chief Engr for Irrigation submitting letter from the Secretary Jumna Canal Co a communication from the Chief Engr of the