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Government of Madras.

Police DEPARTMENT.

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*Proceedings of the Madras Government, Public Works Department,
26th July 1872.*

Read the following paper —

No 87.

No 476 *Note by the Acting Chief Engineer for Irrigation*

In his Memorandum No 62, dated 2nd March 1871, Major Mullins made certain observations relative to the estimates for the improvement of the Central Delta of the Godavery, and proposed modifications in the arrangements proposed by the Superintending Engineer. It appears that a demi-official correspondence passed between the late Major Ryves and the Superintending Engineer relative to some of the points on which Major Mullins and the Superintending Engineer were not in accord, and the late Major Ryves is said to have approved rather of the Superintending Engineer's arrangements than of those suggested by Major Mullins. On my assuming charge of the Office of the Acting Chief Engineer for Irrigation, Colonel Carpendale suggested that I should visit the Godavery with a view of settling the points relative to which Major Mullins and the Superintending Engineer differed. This I have done, and the results of my observations will be found below —

G O No 1,077 of 18th April 1871

Paragraphs 28 to 38.

CENTRAL DELTA

2. *Main Canal* — Major Mullins proposes to lower the bed of the main canal by 1 64', to do away with the Ralli and Ramachendrapuram Locks and to build one lock at about the 15th mile, to lower the water-level at the Ganaram Aqueduct by 6", and to provide a surplus weir in the Amalapore Channel at about 11½ or 12 miles to discharge into the Gorinkala Drain.

3 Lowering the bed of the canal will tend to cause accumulations in it even to a greater extent than at present, and this the more, owing to the improvements carried out at the head of the delta to maintain a good approach to the head lock. Large sums* are now annually expended to keep the head clear, these will be augmented if the bed be lowered. Even with a very heavy fall over the Ganaram Aqueduct it is difficult to get the requisite supply over that work, and a reduction of the depth of water by 6" would render even a greater fall necessary than at present, and would render navigation even more dangerous and difficult than it now is. Doing away with the Ralli Lock would leave the western bank and Amalapore Canals open for distances of 15 and 20 miles respectively from the head, the provision of a weir at 11½ or 12 miles would relieve the latter channel of the extra supply which would pass down it, were it necessary to close the western bank canal for repairs, etc, a similar weir

No 2 of 2nd January 1871, paragraph 3
G O No 331 of 3rd February 1871

	RS	
* In 1864-65	6,735	
" 1865-66	5,659	
" 1866-67	8,071	
" 1867-68	4,614	
" 1868-69	1,181	
" 1869-70	7,180	
" 1870-71	1,789	

would have to be constructed in the western bank canal to relieve it when it was necessary to close the Amalapore Canal. A channel of from $1\frac{1}{2}$ to 2 miles in length would have to be excavated from the surplus weir in the Amalapore Channel to the Gorinkala Drain, and the latter, which is a very small stream at its head, would have to be considerably enlarged; these works would cost far more than the construction of a lock at Ralli. With a lock at Ralli the west bank canals could be kept open for navigation without any risk and any wastage of water when the Amalapore Canal was closed for repair and *vice versa*; and this is of no small advantage where the canals afford the only means of communication. The Ralli Lock should therefore be re-built as the existing is a cutcha work, and its levels are not suitable to the canals as now to be arranged.

4 *Western Bank Canal*—The lock at Ramachendrapuram is a cutcha lock, and the surplus weir appears to have yielded somewhat, though no cracks are visible, provision should therefore be made in the estimate for re-constructing these works. As, however, the lock and weir are situated in the 15th mile, and, if it becomes necessary, to divert this channel, owing to the severe set of the Vasista Godavery in these limits, the diversion will extend for a distance of 4 miles, or from the 13th to the 17th mile. It is not desirable that the new work should be built till it has been ascertained whether the encroachment of the river can be arrested, and, if there is any doubt on this point when all the other works have been completed, the lock should be placed at 13 miles, but provision should now be made in the estimate for improving the existing channel, so as to meet its proposed requirements, and the provision made for the 4 miles of new channel should be excluded from the estimate.

5 The level of the side-walls of the Ganaram Aqueduct is at 18 4, and the floor is very uneven. The spandrels between the arches of the aqueduct never having been filled in, the consequence has been that, in some places, large holes have been formed in the masonry work of the arches. The spandrels between the arches should be filled up, but in order that the surface fall over the aqueduct may be reduced as much as possible, the floor may be given a slope of 1 7' over the aqueduct, the level of the floor at the upper end being 13 and at the lower end 11 3, the side walls should be of a uniform slope from 20 25 at the upper to 19 5 at the lower end, and the water-level will be 18 5 at the upper and 17 75 at the lower end of the aqueduct, as indicated in the Section A, when the aqueduct is carrying 1 7 cubic yards per hour per acre for the land to be supplied below it. With the water at 19 5 at the upper end of the aqueduct 2 cubic yards per hour per acre may be passed over the work, leaving a clear margin of 9".

6. At Palampudi in the 26th mile of the west bank canal there is a surplus weir of two vents of 9' 6", by which the quantity of water which passes over the Ganaram Aqueduct has hitherto been regulated. The work is not very substantially built, and the Superintending Engineer proposes to re-build it. The work is not, however, in bad order. With the side-walls of the aqueduct raised as proposed, it is doubtful whether any relief here need be provided; the existing work may, for the present, be retained, and if, when the aqueduct has been altered as proposed, it is deemed advisable to re-build the weir at Palampudi, this may be

done from ordinary funds. The work may, therefore, be omitted from the estimate.

7. The Madapa Lunka Lock is now at about mile 29. The lock is a cutcha work, and in tolerable order. The levels, however, are not suitable for the proposed arrangements, and the surplus weir is roughly built with only wings of 3'. It is proposed, therefore, to build a new lock and to place it at 28 miles, or within half a mile of the aqueduct, that the surface-fall over the aqueduct may be more easily regulated than it now is by the weir at Madapa Lunka.

8. There is now a mere rough stone-wall or weir at Razole at 36 miles; it is proposed to place a lock and weir at $38\frac{1}{2}$ miles in its stead. The water-level above the lock will be at 9 27, and the sill at 3 27. Here the channel will cease to be navigable, but the navigation will be carried into a creek or backwater, in which there is always deep water, by a lock with its lowest sill at — 6 75. This creek falls into the river at Sakinatapilly, and hence the Central Delta will be connected with the sea with Nursapore with the Ooputeru and eventually with Masulipatam as proposed by Major Mullins. All locks on this canal should therefore be of the second and not of the third class.

Paragraph 30

The cutting for the canal from the $38\frac{1}{2}$ miles to the backwater at about $40\frac{3}{4}$ miles will be heavy, and it may be found cheaper or more advantageous to place locks both at $38\frac{1}{2}$ and $40\frac{3}{4}$ miles rather than to place a lock at $38\frac{1}{2}$ miles. It would have been well if the west bank canal could have been made navigable to the 41st mile, but were a lock placed here instead of at $38\frac{1}{2}$ miles, the surface-level of the water at 41 miles would be about 5' above the level of the country, to carry water at this level between artificial embankments would be a hazardous undertaking. Suggestions, however, have here been thrown out, and it can only be determined definitely how communication can be carried from the west bank canal to the river when levels have been taken from the 38th mile to the backwater near the 41st mile.

9 *Amalapore Canal*.—For reasons given in paragraph 3 the Ralli Lock should be re-built, by its construction the conditions supposed by Major Mullins will be changed in the upper part of

Paragraph 33

the canal the conditions he supposes do not exist, for he supposes that the levels of the works shown in the sections submitted by the Superintending Engineer are those of the existing works. They are not so, however, but are those of the new works proposed by the Superintending Engineer. The Chintalapudi Lock which Major Mullins suggests may probably be rendered efficient by a small outlay does not exist. It is useless, therefore, to attempt to follow Major Mullins's suggestions relative to this canal.

10 The Pellivilli Lock at $19\frac{3}{4}$ miles is in good order, but under the proposed arrangements the upper sill will have to be lowered from 21' 21" to 20', the lower sill remaining as it is at 14 86. The surplus weir is in good order. It has two bays of 10' each, with the crest at 23 19. The crest should be lowered to 22 5 and $3\frac{1}{2}$ shutters with screw gearing be provided, and a basin may be formed in rear by building a rough stone-wall across the surplus.

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11. Between the Pellivilli and Mukamala Locks the canal follows the course of an old drain, the section of which is far larger than is necessary, and the water-levels will not be as indicated by the section submitted by the Superintending Engineer. The Mukamala Lock is cutcha, and as its levels are not suited to the new arrangements proposed a new lock should be built in its stead. The lock-weir has two bays of $15\frac{1}{2}$ each, the crest being at 15 03. The wings are very short, and the work could not easily be adapted for shutters worked by screw gearing. A new weir should be built with its crest at 17 1.

12. The Nadupudi Lock may be retained as Major Mullins suggests. The gates will have to be renewed, and the side walls to be carried up to 16', they are now 15 13. The weir is 18' long with its crest at 8 63. The crest may be raised to 11, and be provided with two vents of 9' each with 3' shutters raised by screw gearing. The Chintalapudi Dam should be placed near the 34th mile, where the country begins to fall rapidly.

13. *East Bank Canal.*—Major Mullins proposes that the Lolla Lock at the head of this canal should be retained. With the level of water as proposed by him by lowering the bed of the main canal, this work might have been retained, but with the arrangements as now proposed the water-level would be above the top of the lock-walls, and as the work is cutcha it is as well that it should be re-built. At present this canal is not navigable, it is proposed to make it so as far as the 35th mile, and to connect it from the 22nd mile with the Amalapore Channel at the 26th mile by a still-water canal, the level of the surface of the water in which will be 20 1. Major Mullins proposes not to build a lock at the 18th mile, but to build one at the 25th mile, and arranges his water-surfaces accordingly, this he has done, however, without ascertaining whether the water-level would be as he proposes with reference to the capacity of the existing channels. At the 22nd mile he arranges, or rather supposes, that the water-level will be at 22 16. From this point the Billacaru or junction canal branches and joins the Amalapore Channel above the Mukamala Lock, where the water-level as arranged by him is at 19 36; there would thus be a fall of 2 8' in 4 miles—a very heavy fall for a navigable canal, and by means of which a large volume of water would be drawn from the east bank canal.

Paragraph 34
Paragraph 33.

14. By the arrangements now proposed this channel will be a still-water canal, and all the locks proposed by the Superintending Engineer in the east bank canal will be necessary. Their positions may, however, be altered as per margin with advantage; thus providing navigation 3 miles further than is proposed by the Superintending Engineer.

15. The Bendama Lunka Canal branches at 30 miles from the Amalapore Canal. The canal follows the old course of a drain, and its capacity is far greater than is necessary, and, as Major Mullins remarks "the surface fall of 24 per mile proposed in the Superintending Engineer's scheme could not be maintained." The

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actual surface-falls have been carefully calculated, and are recorded in Statement B. The Superintending Engineer proposes a lock at 37 miles by placing the lock at $32\frac{1}{2}$ miles; embanking between the $32\frac{1}{2}$ and 37 miles will be reduced to a minimum, and the draught from the Amalapore Channel can be regulated by the surplus weir at $32\frac{1}{2}$, for the surface-fall of the channel in the first reach will be only 0 06 per mile. Second instead of 3rd-class locks should be provided in this canal, as Major Mullins proposes, at $32\frac{1}{2}$ and $42\frac{1}{2}$ miles, and a surplus weir must be provided in connection with the lock at Bendama Lunka to pass any water not drawn off above the lock.

16. *Drainages.*—The Gorinkala Drain taps the country lying between the west bank canal on the one side, and the Amalapore Canal and Ambagapetta main branch on the other. The upper Cowsica drains the land between the two last channels and, by a cut called the Sakuru Drain, joins the Gorinkala just before it reaches the Vanthiem Godavery; by these channels the drainage will be sufficiently provided for, but a sluice is required where the united channels join the Vanthiem Godavery to exclude flood-waters. The estimate provides for a sluice of five vents 5×4 , or with an area of 100 square feet. The area drained is about 75 square miles, and the discharge, according to Ryves's formula, might be 10,000 cubic feet per second. Considering, however, that a great part of the land is under wet cultivation, and that water would be retained on the fields, while the supply from the anicut would be cut off during the fall of heavy rain, it will probably be sufficient to provide for the discharge of 2,500 cubic feet per second ordinarily, with a head of about 2 when the back-water in the river is at its highest. An area of 360 square feet will then be required for the vents, and through them 6,624 cubic feet per second may be discharged when the water in the river is at high-tide level, and the water above the sluice 2' above the highest river-flood. Eight vents similar to those proposed for the sluice* over the

* Approved in G O No 1,286, dated 14th May 1872.

Thoregadda Drain will provide the water-way required, and a bridge for the passage of bandies may be provided by turning the upper arches for a length of 13', thus leaving 10' between parapets. This will be an improvement upon the sluice proposed, and will be not more costly than providing the same area in that sluice.

17. The Nagaram Island drainage finds its way into a deep tidal creek which passes near the village of Senkaraguptam. This creek is now navigable for boats drawing 5' of water at low water, by improving it and connecting it with a creek running into the Vasista Godavery, it is probable that inland tidal navigation could be provided between the Vasista and Vanthiem branches of the Godavery, and the drainage of the Nagaram Island would probably be much improved thereby.

18. The lower Cowsica drains the land lying between the Amalapore and the Bendama Lunka Canals, and is to be extended into a tidal creek.

19. The lands below the Vilsa main branch and between the Amalapore and east bank canals are drained by natural drainage streams which find their way into the swamp across which it is proposed to cut two channels to carry the drainages into a tidal creek. These drainages have not been levelled, but lump sums are entered for them in the estimate.

20. From the plan it would appear that the Vilsa channel branched from the east bank canal at 27 miles, but from the statement it would appear to branch at

25½ miles, here the water level will be at 18 85. It joins the Amalapore Channel at 32 miles where the water level will be 8 26, it is presumed, therefore, that the channel is provided with a head sluice, if not it should be so provided.

21. The original estimates appear to have been prepared with great care by Mr. Supervisor Ellis. The duty, however, which he was called upon to undertake, namely, arranging for the improvement of the canals in the Central Delta of the Godavery to admit of their carrying a larger supply, rendering some of the canals navigable, and improving the navigation in others, was by no means an easy one, and in carefully examining the falls and sections he has proposed for the various canals, it has been found that, owing to the sections of some of the canals being far larger than are required merely for the conveyance of water for irrigation with the ordinary surface-slope provided for such canals, the surface-level of the water will not be as he supposes, and hence it has been necessary to revise the whole project. Statement B is the result of this revision. The surface and bed-falls in the canals have been indicated by blue dotted lines in the sections, while the levels of the upper and lower sills of all locks have been given relative to the datum, and the positions the locks are to occupy have been marked, these, as regards the new locks in the eastern bank and Bendama Lunka Canals differ somewhat from the positions assigned to them by Mr. Ellis. The sections of the locks now existing have been shown in burnt Sienna with the ordinary high water-level as it now is. These sections should have been shown in submitting the project to admit of its being ascertained at a glance what alterations were really being made in the water-levels, and what existing works might be retained, had these been given Major Mullins would not have been led into error relative to the works which might be retained, and his suggestions adverted to in paragraph 9 would not have been made.

22. The points kept in view in preparing the scheme now proposed have been, 1st, to maintain a velocity not exceeding 1½' per second, 2nd, to admit of the canals carrying the quantities required for irrigation with the surface-slope arranged for navigation as stated in No. 1, this will prevent wastage of water and difficulties in navigation, 3rd, to admit of the canals being used as still-water canals when the cultivating season is over, and when the water-supply in the river is small, and is but little in excess of what is required to prevent waste by lockage and by evaporation, 4th, to admit of canals being provided with the same régime in the reaches below the points of separation, or where this is impossible to provide for the regulation of the supply to the open channels by means of the dam connected with a lock as in the case of the lock and dam at 32½ miles in the Bendama Lunka Canal; 5th, to provide for as little excavation as possible by increasing the depth of the canals to 7' where an enlarged section, due to a depth of 6', would entail the removal of spoil banks or of large portions of the existing high margins or padugays.

If has not been possible to adhere to points 1 and 3 in their integrity relative to the reach in which the Ganaram Aqueduct is situated; but there the surface fall has been reduced as far as possible.

23. As it is proposed to provide only 2 cubic yards of water per hour per acre through the delta generally, and 1 7 cubic yards for the area supplied by the

west bank canal, a high co-efficient (1 3) should not be used in calculating the velocity as Mr. Ellis has done, for low falls such as those generally in the canals DuBuat's formula is $V = 11 \sqrt{fs}$, and this formula has been used in computing the entries in Statement B.

24. It is necessary that the plans and sections should be returned to the Superintending Engineer for the preparation of the estimate for the arrangements now proposed, for, owing to the inaccuracy of the plotting of some of the sections, it is impossible, in some instances, to ascertain what the area of the existing sections is.

25. In the estimate for the Central Delta the compensation required for land is given at Rupees 9,815. A statement from the Collector should be submitted verifying this estimate as required by G. O. No. 341, dated 5th February 1872. As the diversion proposed is not to be made at Ramachendrapuram, it is

probable that little or nothing will be required for land in connection with the west bank canal.

26. In a Note on the general abstract estimate for the three deltas the Superintending Engineer states, "It is expected that 200,000 acres of land will be brought under irrigation by this expenditure—a revenue of 8 lakhs a year or something more than 22 per cent on the outlay." In examining the figures given by the Superintending Engineer in his reports, this would not appear to be correct. Major Ryves originally estimated the probable increase as follows—

	Present Cultivation	Estimated ultimate Cultivation
Western Delta	208,000	300,000
Central	81,000	135,000
Eastern	147,000	190,000
	436,000	625,000

The present and expected cultivation as estimated by the Executive Engineer and by the Collectors appear to be as follows—

By Executive Engineer		Present Cultivation	Expected Increase
Western ..	.	*189,796	*60,654
Central ..	.	†86,998	5,024
Eastern ..	...	‡123,007	‡65,163
		399,801	130,841
		130,841	
		530,642	
By Revenue Department		Present Cultivation	Expected Increase
Western ..	...	*243,186	*71,021
Central ..	.	†86,998	11,326
Eastern ..	.	‡105,093	‡58,702
		435,277	141,049
		141,049	
		5,76,326	

* See Appendix A in G. O. No. 763, of 14th March 1871.

† Actual cultivation of Fash 1279.

‡ See Appendix 2 of G. O. No. 233, of 29th September 1870.

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From a recent return received from the Collector it would appear that the irrigated area in the Godavery deltas is 459,795 acres, if this is correct the Executive Engineer's estimate of extra cultivation is reduced to 70,847, and that of the Revenue Department to 116,531 acres. The differences shown above should be reconciled or explained if possible.

5th April 1872.

27. It will be observed that in the Central Delta more particularly the increase anticipated both by the Revenue Department and the Executive Engineer falls very much below Major Ryves's original estimate. The estimate for the Central Delta may be stated roughly to amount to Rupees 6,00,000, and if the area irrigated is increased by only 5,024 acres, as estimated by the Executive Engineer, the direct return from the project will be only 3½ per cent, and according to the estimate of the Revenue Department, the return will be 7½ per cent, it is therefore necessary that some definite conclusion should be arrived at relative to the actual increase of cultivation likely to take place. The canals are now designed to carry water for the area estimated by the Executive Engineer, but could be made to carry considerably more as a margin of 2' is provided for the masonry works above the proposed water-level, but the shutters of the weirs would have to be increased from 3 to 3½ or perhaps 4' in height in some of the weirs.

11,326 acres

28. In his Note dated 4th January 1871 Major Mullins refers to the severe sets in the Vasista Godavery at Khandavelly (should be Kakarapurroo) on the west bank and at Ramachendrapuram on the east bank. Steps have been taken to preserve these banks from further encroachment, and these have been, to a great extent, effective. A very large area has, however, to be recovered before the river can be said to be in a satisfactory condition, and this can only be done by commencing operations higher up the river-bed and by the two Range Officers working in concert. The survey of the western bank of the river had been completed in January last. The right bank should be completed as early as possible; and the proposed course to be given to the river having been carefully laid down on the plan, all future works should be designed with a view of forcing the river into the course proposed for it. No general plan, it is believed, if laid down to attain the desired object, could be carried out in its integrity, but the main features of the works proposed will have to be carefully considered, and the joint report of the Executive Engineers in charge of the Central and Western Deltas with the survey called for in G. O. No. 377, of 7th February 1871, should be submitted at an early date.

29. Nothing but the greatest neglect for a considerable period could have brought the river into the condition in which it now is. The present Superintending Engineer and Executive officers are, however, keenly alive to the urgency of the case, and the works already carried out by them have proved to be beneficial, so much so that it seems unnecessary at present to divert the western bank channel of the Central Delta near Ramachendrapuram as the Superintending Engineer proposed.

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30. Just below the Ganaram Aqueduct there is a branch of the river which sets upon and skirts the west bank canal near Mandapa Lunka, this branch is gradually becoming silted, but it should be aided by planting across the bed, and when a considerable shoal has been formed, a bank should be thrown across the branch so as to close it entirely, and to prevent the possibility of one high flood destroying the accumulations and the work of years. The new lock should be placed beyond the influence of danger, or below the point where the river ceases to hug the canal-bank.

31. Several works were in progress in the Eastern and Western Deltas, and were being carried out satisfactorily. There was only one work in which it was desirable to make some alteration in the original design, namely, in the basin which was being constructed below the Bimaveram Aqueduct. A stout retaining wall 3½' broad was found along the rear of the work 1¼' beyond the cut-waters of the piers. Cutting away this retaining wall and excavating for the foundations of the basin wall would probably have endangered the work, the wall was therefore retained. The bed of the channel consists of hard gravel, and as the out-fall is somewhat contracted a natural basin actually exists, and it is doubtful whether any artificial basin was necessary. As the work had been commenced, however, and as it may, under exceptional circumstances, prove a safe guard to the aqueduct, it was not stopped, but a considerable saving will be effected owing to there being no necessity to lower the floor under the aqueduct owing to the existence of the retaining wall adverted to.

EASTERN DELTA

32. In paragraph 13 of his Note on the estimate for the Eastern Delta Major Mullins objected to the arrangements for the western bank canal proposed by the Superintending Engineer, because his estimates* exceeded the original estimate† submitted by Major Ryves by a very large amount, and sufficient explanation had not been afforded relative to the changes proposed. The difference between the estimates was due chiefly to the fact that Major Ryves proposed to retain the three existing locks, while the Superintending Engineer proposed to build new locks in their stead. After inspecting the canal Major Mullins recognized the necessity of re-building two of the locks, but he proposed to retain the existing lock at Kadiyapa Lunka, and issued detailed instructions relative to the new arrangement for the canal, and proposed to extend navigation to Yanam, and thus to connect the west bank canal with Coringa river and with the navigation generally in the delta.

In G. O. No. 2,335 of 28th September 1870

* Rupees	2,14,900
† „	1,15,310
	99,590

† Exclusive of Yanam Extension

Paragraph 20 of Note in G. O. No. 1,077 of 18th April 1871

Kowlaishweram and Kula

33. Yanam and the Coringa River are already connected with the general navigation in the delta by means of the Munjair Lock in the Coringa Canal and the Superintending Engineer's proposition to lock from the Ingeram Canal into the Takee Mam Drain at a point up to which the latter is always navigable, would afford an alternative line of communication between Coringa, Dowlaishweram, and

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Cocanada, when coast traffic is impracticable, and would render it unnecessary to connect the west bank canal with the Coringa River at Yanam. The navigation on the west bank canal will then terminate at the 30th mile, but the produce of the land lying between the west bank canal from the 30th to the 39th mile at Yanam, the Coringa River and the Takee Main Drain can be carried by the two latter streams which are always navigable, and which are or will be connected with the general navigation of the delta when the Eastern Delta works are completed. Under the circumstances I would recommend that the Superintending Engineer's rather than Major Mullins's proposition should be approved, and that the Ingeram Canal should be locked into the Takee Drain rather than that the west bank canal should be connected with the Coringa River at Yanam.

34 From the Superintending Engineer's letter No. 2,912 of 16th December 1871, it will be observed that Major Mullins's arrangements (details of the cost of which in juxtaposition with that of those recommended by the Superintending Engineer are given below) are more costly than those proposed by the Superintending Engineer, if, however, the former are to be adopted it will be necessary to obtain permission from the Chef de-Service at Yanam for surveys being carried into the French territory, and to negotiate with him for the acquisition of the land required for the canal —

Statement showing the approximate Cost of the proposed Arrangements relative to the West Bank Canal of the Eastern Delta

	By Lieut Colonel Fischer	By Major Mullins
	RS	RS
Earth-work	1,17,790	1,62,790
Slight alterations to lock at Kadapa Lunka	29,800	500
New lock and weir at 9th mile at Moolastanam	25,140	...
Do. do, at Kowlaishweram at 16th mile	28,050	25,140
Do do, at Kula at 21st mile	2,260	28,050
Weir at Dangaroo Drain	2,260	220
Weir at 30th mile	...	...
Lock and weir at 30th mile	...	30,000
Tidal lock at Yanam at 38th mile	...	32,500
New channel	...	15,000
15 Miles of minor channels	6,600	6,600
6 Distribution sluices	3,000	3,000
	2,14,900	
Tidal lock in Ingeram Canal into Takee Main	30,500	
Drain, retaining cutcha lock at Yerapoolaveram	2,45,400	3,03,800

35 If a permanent lock be eventually placed at Yerapoolaveram its cost will be Rupees 22,040, and the Superintending Engineer's scheme will be the cheaper by Rupees 36,360, and this irrespective of the re-construction of the Kadeyapa Lunka Lock which will sooner or later have to be re-built, for its side-walls are at present kept up by cross walls 2' above sill-level. Its re-construction would add Rupees 20,640 to Major Mullins's estimate.

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36 Major Mullins takes exception to the Superintending Engineer's proposition to abandon part of the 2nd, 3rd, 4th, and part of the 5th mile of the west bank canal, this, however, is a very judicious proposition. The present canal hugs the foot of the river-bank, and in the 2nd mile a loop-channel is taken off, and enters the canal below the 1st lock in the 5th mile. In this channel the surplus-weir is situated, and the 3 or 3½ miles of the canal below the loop form, as it were, a *cul-de-sac*, or would do so were it not for the existence of two small vents 3×4 about 200 yards above the Kadeyapa Lunka Lock. These were designed to afford a scour to keep the bed clear, but they appear to have no appreciable effect in so doing, and hence the canal here is always much silted, and, under existing arrangements, cannot but be so. The new canal should, therefore, be carried along the bed of the loop and the weir be placed close to the lock at Moolastanam. The course of the old canal should be left open in order that it may become silted up; this will afford protection to the river-bank, and will prevent percolation.

FORT ST. GEORGE,
3rd June 1872

(Signed) R. F. OAKES, Captain, R E.,
Acting Chief Engineer for Irrigation.

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Statement showing the Sections, Falls and Velocities to be given to the

	Main Canal	1st
		Above Amalape Head.
Miles	0 to 8	8 to 8½ miles
Surface-fall per mile in feet .	for 4 miles 0' 3 for 4, 0' 175	25
Proposed area in feet . . .	135 } × 7 = 871½ 114 }	115½ } × 7 = 7 94½ }
Water to be carried in cubic feet per second	1,308	993
Depth in channel in feet . .	7	7
Hydraulic mean depth in feet . .	6 3	6 24
Velocity in feet per second . .	1 5	1 37
Level of water { Upper end of reach	35 5	28 9
{ Lower do do .	33 6	
Level of bed { Upper end	28 5	21 9
{ Lower end	Bed is below level required	
Name	Ralli Lock	
Lock { Upper sill .. .	26 6	...
{ Lower do .. .	21 9	...
{ Side walls	35 5	.
Weir { Crest .. .	6 vents. 9' by 3' 30 6	
{ Backwater in rear ..	28 9	.
{ Basin wall 2½ above floor	24 5	.
{ Floor and bed in rear	21 9	.

REMARKS —But little cutting is required in 1st Section of 4 miles, elsewhere the capacity

Canals as they will be if the lock is placed at 13 instead of 15 miles.

1st Reach.	2nd Reach.
Below Amalapore Head.	To Aqueduct.
8½ to 13	13 to 27
25	32
65½ } × 7 = 385 44½ }	70 } × 6 = 366 52 }
409½	493
7	6
5 53	4 9
1 3	1 375
28 7	23 2
27 66	18 7
21 7	17 2
20 66	12 7
Ramachendrapuram Lock.	...
20 66	..
17 2	..
29 66	..
3 9 feet vents 3½ Shuttles 24 16	...
23 2	...
17 2	...

partment, 26th July 1872.

ery and the Levels of the various Locks and Surplus weirs, &c, &c

2nd Reach	3rd Reach	Remarks
Over Aqueduct	To Mandapa Lunka Lock	
In 27 mile.	At 28 mile	28 to 31½
1 7	3	31
*23 5 × 5 5 = 129 ‡25 5 × 6 45 = 151	57 } × 7 = 346½ 36 }	54½ } × 7 = 308 33½ }
450	450	436
‡5 5 and ‡6 45	7	7
‡3 74 ‡4 16	5 29	5 25
3 5 and 3	1 386	1 41
‡18 5	‡17 75	12 5
‡17 75	‡17 5	11 34
‡13	.	5 5
‡11 3	10 5	4 34
...	Mudapa Lunka Lock	.
.	10 5 5 5 2 0	
...	3 vents. 9' by 3 14 5	.
...	12 5 8 5 5	

ion of Ganavaram Aqueduct.

A † Upper end
‡ Lower end

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Statement showing the Sections, Falls and Velocities to be given to the Canals in the Central

	WEST BANK		
	3rd Reach —		
	—	—	—
Miles	31½ to 32½	32½ to 34½	34½ to 36
Surface-fall per mile in feet .. .	31	31	31
Proposed area in feet	57 } × 6 = 288 39 }	42 } × 6 = 198 24 }	33 } × 6 = 144 15 }
Water to be carried in cubic feet per second .. .	376	246	170
Depth in channel in feet .	6	6	6
Hydraulic mean depth in feet .	4.7	4.25	3.8
Velocity in feet per second ..	1.32	1.25	1.2
Level of water {	Upper end of reach	11.34	11.11
	Lower do do .	11.11	10.61
Level of bed {	Upper end	5.34	5.11
	Lower end ..	5.11	4.61
Name ...			.. .
Lock . {	Upper sill	..	..
	Lower do	..	..
	Side walls . . .	..	..
Weir {	Crest . . .	..	..
	Backwater in rear	..	..
	Basin wall 2½ above floor	..	..
	Floor and bed in rear	..	..

* The quantities of water required at 39½ and 44 miles are 110 and 56 cubic feet per second respectively, if a slope occasion to carry the bed level below 00 or 11 tide level at 52 miles, the bed may slope from 375 to 0 from the 44 h to will be required in the channel, but the banks will have to be formed up to 8' above the water level, the bed may be
 † No cutting required in this section
 ‡ These figures refer to the levels at the actual point of separation

Public Works Department, 26th July 1872.

Delta of the Godavery and the Levels of the various Locks and Surplus-weirs, &c &c

CANAL — (Concluded)		AMALAPORE CHANNEL		Remarks
(Concluded)	4th Reach	1st Reach	2nd Reach	
—	—	—	—	
36 to 38½	* 38½ to 44	8½ to 19½	19½ to 26	
31	4	0.25	for 3½ miles 24 for 3 miles 15	
30 } × 6 = 126 12 }	30½ } × 4½ = 106½ 17 } 21 } × 3½ = 36 10 }	65 } × 7 = 381½ 44 }	†	
135	110 54	493½	448	
6	4½ 3½	7	..	
3.65	3.25 2	5.53	.	
1.16	1.25	1.3	..	
10.03	6.2	† 28.7	21.3	
9.27	4	26	20.09	
4.03	1.7	† 21.7	14.86	
3.27	0.375	19	13.36	
Razole.	..	(a) Rallee Lock	Pullivella lock	(a) Rallee Lock is nearly ¾ mile above the Amalapore Channel head
3.27 — 6.75 11.25		26.6 21.9 35.5	20 14.86 28	
1 vent 9 by 3 6.25	.	6 vents. 9 by 3 30.6	3 vents 9 by 3 23	
6.2 none 1.7		28.9 24.5 21.9	21.3 17.5 14.86	

of 21 be given to the bed and of 4 to the surface, the areas of sections here given will be sufficient. There is no the 52nd mile, and the surface fall will be formed by the draught through the sluices for cultivation, but little cutting rectified in obtaining spoil for the banks, the work in this section will be very trifling

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Statement showing the Sections, Falls and Velocities to be given to the Canals in the Central

	AMALAPORE CHANNEL		
	3rd Reach	4th Reach	
Miles ...	26 to 29½	* 29½ to 30 and 30 to 31½	31½ to 34
Surface-fall per mile in feet	for 2 miles 25 for 1½ miles 06†	33	33
Proposed area in feet	60 } × 7 = 340½ 39 }	39½ } × 6½ = 190 20½ }	29½ } × 6½ = 1266 10½ }
Water to be carried in cubic feet per second	430	250	157
Depth in channel in feet	7	6½	6½
Hydraulic mean depth in feet	5 4	4 37	3 77
Velocity in feet per second	1 25	1 32	1 23
Level of water ..	Upper end of reach 14 6 Lower do. do 14	* 8 97 8 9 7 75	7 75
Level of bed	Upper end 7 63 Lower end 7 63	2 63	7 6
Name	7 63	..	1 27
Lock	Mukamala lock.	Nadupudi lock.	..
Lock	Upper sill 13 36 Lower do 7 6 Side walls 22	7 63 2 63 16	..
Weir	Crest 3 vents 9 by 3 17 1	3 vents 9 by 3 11	..
Weir	Backwater in rear Basin wall 2½ above floor Floor and bed in rear. 14 6 10 7 63	8 97 5 2 63	..

* The 1st quarter of mile to the Bendama Lanka Channel head requires nothing, the surface fall will be 27 per mile.
† These 1½ miles have an enlarged section, and in them the surface fall will be only 06 per mile; the canal will have

Public Works Department, 26th July 1872.

Delta of the Godavery and the Levels of the various Locks and Surplus-weirs, &c &c.

—(Concluded)		EAST BANK CANAL		Remarks
5th Reach		(a) 1st Reach	2nd Reach	
34 to 40		8 to 20	20 to 26½	(a) No cutting required in this reach, the surface fall will be 8 to 15 miles 7 × 185 = 1295 15 to 18 „ 8 × 26 = 78 18 to 20 „ 2 × 112 = 224 23
33			0 33	
20 } × 4 = 56 8 }			39½ } × 6 = 183 21½ }	
38		300	240	
4		..	6	
2 5	Nothing	.	4 23	
76		V=1 09 0 72 and 0 9	1 31	
2		28	20 7	
		25 7	18 6	
-2		22	14 7	
-3		19 7 bed is 15 82	12 6	
Chintalapudi Lock		Lolla Lock	Mandapilly Lock	
1 27		26 5	18 5	
-2		22	14 7	
10		35 5	28	
1 vent 9 by 3 4 6		3 vents 9 by 3 30 6	2 vents 9 by 3 22 7	
2		28	20 7	
none		24 5	14 7	
-2		22	...	

or 07 in the quarter mile to be embanked.

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EAST BANK CANAL — (Concluded)			
	3rd Reach	4th Reach.	
Miles ..	26½ to 35	35 to 43	
Surface-fall per mile in feet ..	0 33	0 33	..
Proposed Area in feet	35½ } 17½ } × 6 = 159	35½ } 17½ } × 6 = 159	..
Water to be carried in cubic feet per second ..	200	200	
Depth in channel in feet ...	6	6	..
Hydraulic mean depth in feet ..	4 05	4 05	..
Velocity in feet per second	1 27	1 27	...
Level of water { Upper end of reach.	13 9	8 66	
{ Lower do do	11	6	
Level of bed { Upper end	7 9	2 66	...
{ Lower end	5	0 00	...
Name ...	Madupadu Lock	Kondakudwa Lock	
Lock { Upper sill ...	12 6	5	
{ Lower do ...	7 9	2 66	
{ Side walls ...	20 5	13	Kundalex-swaram
Weir { Crest ...	2 vents 9 by 3 15 6	1 vent 9 by 3½ 7½	1 vent 9 by 3 3
{ Backwater in rear ...	13 9	8 66	4 or 5 probably.
{ Basin wall 2½ above floor	7 9	2 66	0
{ Floor and bed in rear			

• Where channel branches

Public Works Department, 26th July 1872

Delta of the Godavary and the Levels of the various Locks and Surplus-weirs, etc, etc

BENDAMA LUNKA CHANNEL.		Bellacurru Canal	Remarks
1st Reach	(a) 2nd Reach.		
30 to 32½	32½ to 42½	Still-water Canal from 22 miles on east canal to near Mukamala Lock near 26th mile on Amalapore Canal Water-surface to be at 20 1 Section of channel where cutting is required to be 12 at bottom 27 at top with depth of 5'	(a) The greater part of the 2nd reach has a far larger capacity than is required, cutting will only be necessary from 32½ to 33½ miles, the surface falls will vary as follows —
06			32½ to 33½ from 4 75 to 4 54
			33½ to 35½ „ 4 51 to 4 5
			35½ to 37 „ 4 5 to 4 4
			37 to 38 „ 4 4 to 4 2
			38 to 39 „ 4 2 to 3 9
			39 to 40½ „ 3 9 to 3 53
			40½ to 42½ „ 3 53 to 3 5
33 } 15 } × 6 = 144	33 } 15 } × 6 = 144		
180	180		
6	6		
4	4		
33	33		
• 8 9	4 75		
8 75	3 5		
2 9	— 1 25		
2 75	— 1 5		
Allaneram Lock	Bundamalunka lock		
2 75	— 1 5		
— 1 25	— 8		
10 5	+ 5 5		
1 vent 9 by 3½ 5 25	1 vent 9 by 3 0 5		
4 75	000		
none	none		
— 1 25	{ — 3 } { — 8 } for lock tail		

from Amalapore Canal

(Signed) R F OAKES, Captain, R E,
Acting Chief Engineer for Irrigation

*Proceedings of the Madras Government, Public Works Department,
26th July 1872.*

No. 427.

ORDER THEREON, 26th July 1872, No 1,786.

IRRIGATION, No 24.

IN the Note by the Acting Chief Engineer for Irrigation he reports upon the points relative to which there were differences of opinion between the Chief Engineer for Irrigation and the Superintending Engineer of the 1st Division with regard to the arrangements connected with the canals for the improvement of the Central Delta of the Godavery

2. The Acting Chief Engineer for Irrigation has prepared a statement in which the levels of the various masonry works, the dimensions of the canals, the water-level as it will be, etc, etc, have been laid down. His views on the subject accord rather with those of the Superintending Engineer than with those of the Chief Engineer for Irrigation; the Government resolve to adopt his proposals, and the Superintending Engineer will revise and submit estimates accordingly with the least possible delay.

3. As regards the western bank canal of the Eastern Delta the Government are of opinion that it is unnecessary to connect that canal with the Coringa River at Yanam, and that the alternative scheme of connecting the Ingeram Channel with the Takee Main Drain is preferable. For the reasons stated by the Acting Chief Engineer for Irrigation they approve of the abandonment of a portion of the west bank canal, and of the canal being carried along the existing surplus channel, the Superintending Engineer should, therefore, re-submit the estimate for the western bank canal with such modifications as may be necessary relative to the water-level at the head of the Coringa Canal and to the points adverted to in paragraphs 22 and 23 of the Acting Chief Engineer's Note. His special attention is also called to paragraphs 25 and 26 of the Note, and he will afford the information required relative to the actual increase of area of cultivation which may be expected in the deltas generally, as it is not satisfactory that estimates varying so largely as those of the Revenue Department and the Executive Engineer should be submitted without any explanation or any apparent attempt to reconcile the differences

4. The survey called for in G. O. No. 377, dated 7th February 1871, with the Executive Engineer's proposals for the rectification of the river-bed should be submitted with the least possible delay.

(True Extract.)

Captain, R E,
Acting Joint Secretary to Government.

To the Superintending Engineer, 1st Division
,, Acting Chief Engineer for Irrigation

Act. of 1872 **Public Works.**

THE SUPERINTENDING ENGINEER.

1st Division

Ac, &c, &c

Dated July 26th,

Recd

Encl

G. O., 26th July 1872, No. 1,756

JULY

Nos. 476-477

Central Delta of the Golaery — Pa-
ing orders on Note by the Chief Engineer
for Irrigation on certain points with regard
to the arrangements for the improvement
of the Central Delta of the Golaery

Chief Engineer for Irrigation

No 62, dated 2nd March

10th 1077 of
18 April 1871

para 28 & 38

made certain observations re-
lative to the estimates for the improve-
ment of the Central Delta of
the Golaery and proposed modifications in the
arrangements proposed by the Superintending
Engineer. It appears that a despatch official
Correspondence passed between the late Major
Ryrie and the Superintending Engineer re-
lative to some of the points on which Major
Mullins and the Superintending Engineer
were not in accord and the late Major Ryrie
is said to have approved rather of the Superin-
tending Engineer's arrangements than of those
suggested by Major Mullins. On my assuming
charge of the Office of the Acting Chief Engineer
for Irrigation Colonel Campbell suggested
that I should visit the Golaery with a view
of settling the points relative to which Major
Mullins

Mullins & the Superintending Engineer differed.
This I have done and the results of
my observations will be found below.

Central Delta

Main Canal

2 Major Mullins proposes to lower the bed of
the Main Canal by 1.6 ft to do away with the
Ralli and Ramachandrapuram locks and
to build one lock at about the 15th mile to lower
the water level at the Ganarum Aqueduct by 6'
and to provide a surplus weir in the Annapur
channel at about 11 1/2 or 12 miles to discharge into
the Gornkhala drain.

para 22

para 23

3 Lowering the bed of the canal will tend
to cause accumulations in it even to a greater ex-
tent than at present, and thus the more owing
to the improvements carried out at the head of
of the delta to maintain a good approach to the head
lock. Large sums are now

annually expended to keep

the head clear. There will

be a great deal of the bed

2nd. January 1891 para 3
10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

10
be lowered. Even with a very heavy fall over
the Ganarum aqueduct it is difficult to get
the requisite supply over that work and a re-
duction of the depth of water by 6' would render
even a greater fall necessary than at present
and would render navigation even more dangerous
and difficult than it now is. Doing away with
the Ralli Lock would leave the Western bank
and Annapur Canal open for distances of 15
20 miles respectively from the head; the former
as was at 11 1/2 or 12 miles would relieve the
latter channel of the extra supply which would
pass down it were it necessary to close the Western
bank canal for repairs &c, a similar weir would
have to be constructed in the Western bank Canal
to relieve it when it was necessary to close the An-
napur canal. A channel of from 1 1/2 to 2 miles
in length would have to be excavated from the Sur-
plus weir in the Annapur channel to the Gorn-
khala drain and the latter, which is a very small
stream at its head, would have to be considerably
enlarged. These works would cost far more
than the construction of a Lock at Ralli.

with

with a Lock at Ralli the port bank Canal could be kept open for navigation without any risk and any wastage of water. When the Amalapuram Canal was closed for repair and vice versa and this is of no small advantage where the Canals afford the only means of communication. The Ralli Lock should therefore be rebuilt as the existing is a Cutcha work and its levels are not suitable to the Canals as now to be arranged.

Western bank Canal

1. The Lock at Ramachandrapuram is a Cutcha lock and the Surplus weir appears to have yielded somewhat, though no cracks are visible. Provision should therefore be made in the estimate for reconstructing these works, as however the Lock and weir are situated in the 15th mile and if it becomes necessary to divert the channel owing to the serious set of the Viceroy's Guidavay in these limits, the diversion will extend for a distance of 4 miles or from the 13th to the 17th mile, it is not desirable that the new work should be built

built till it has been ascertained whether the encroachment of the River can be averted & if there is any doubt on this point when all the other works have been completed the Lock should be placed at 13 miles but provision should now be made in the estimate for improving the existing channel so as to meet its proposed requirements and the provision made for the 4 miles of new channel should be excluded from the estimate 5. The level of the side walls of the Ganam aqueduct is at 18.4 and the floor is very uneven the spandrels between the arches of the aqueduct never having been filled in, the consequence has been that in some places, large holes have been formed in the masonry work of the arches. The spandrels between the arches should be filled up but in order that the surface fall over the aqueduct may be reduced as much as possible the floor may be given a slope of 1.7 feet over the aqueduct the level of the floor at the upper end being 13.4 at the lower end 11.3 the side walls should be of a uniform slope from 20.25 at the upper

with upper to 19.5 at the lower end and the water level could well be 18.5 at the upper & 17.75 at the lower end of the aqueduct, as indicated in the Section A, lapine when the aqueduct is carrying 1.7 cubic yards and per hour per acre for the land to be supplied below it; with the water at 19.5 at the upper end of the aqueduct 2 cubic yards per hour per acre may be passed over the lock leaving a clear margin of 9 inches.

At Palampudi in the 26 mile of the West bank Canal there is a surplus flow of 2 units of 9' 6" by which the quantity of water which passes over the Ganarum aqueduct has hitherto been regulated, the work is not very substantially built and the Superintending Engineer proposes to rebuild it, the work is not however in bad order with the side walls of the aqueduct raised as proposed it is doubtful whether any relief here need be provided; the existing work may for the present be retained and if when the aqueduct has been altered as proposed it is deemed advisable to rebuild the weir at Palampudi this may be done from ordinary funds the work may therefore be

be omitted from the estimate. The Madapalunka lock is now at about mile 29. The Lock is a Cutcha work and in tolerable order; the levels however are not suitable for the proposed arrangements and the surplus now is roughly built with only rings of 3'. It is proposed therefore to build a new Lock and to place it at 28 miles or within $\frac{1}{2}$ a mile of the aqueduct that the surface fall over the ^{aqueduct} may be the more easily regulated by the weir at Madapalunka. There is now a new fine Stone wall at Rajole at 36 miles, it is proposed to place a Lock and weir at 38 $\frac{1}{2}$ miles in its stead the water level above the lock will be at 9.27 and the sill at 8.27 here the channel will cease to be navigable; but the navigation will be carried into a creek or back water, in which there is always deep water, by a lock with its lowest sill at 6.75; this creek falls into the River at Sakinatapilly and hence the Central Delta will be connected with the Sea with Kinsapne with the Coputani and eventually with Maunipatani as proposed by Major Smith: all Locks on this Canal should

should therefore be of the 2nd & not of the 3rd class.
The cutting for the Canal from the 38 1/2
miles to the backwater at about 40 3/4 miles will
be heavy and it may be found cheaper or more
advantageous to place locks both at 38 1/2 & 40 3/4
miles rather than to place a lock at 38 1/2 miles.
It would have been well if the West Bank Canal
could have been made navigable to the 41st mile but
if a lock placed here instead of at 38 1/2 miles the
surface level of the water at 41 miles would be
about 5' above the level of the Country to carry
water at this level between artificial embankments
would be a hazardous undertaking - suggestions how-
ever have here been thrown out and it can only
be determined definitely how communication can
be carried from the West Bank Canal to the
River when levels have been taken from the 38
mile to the backwater near the 41st mile.

9. Amalapore Canal. The reasons given in
para 3 the Ralli lock should be rebuilt
by its construction the conditions supposed by
Major Mullins will be changed in the upper
part of the Canal while in the lower part

para 23

33
of the Canal the conditions he supposed do not
exist for he supposed that the levels of the works
shown in the Sections submitted by the Superin-
tending Engineer are those of the existing works, they
are not however but are those of the new works
proposed by the Superintending Engineer: the Chunda-
lapudi Lock which Major Mullins suggests may
probably be rendered efficient by a small outlay
does not exist. It is useless therefore to attempt
to follow Major Mullins' suggestions relative to
this Canal.

10. The Pillenli Lock at 19 1/2 miles
is in good order but under the proposed arrangements
the Upper Sill will have to be lowered from 21.21 to
20' the lower Sill remaining as it is at 14.86. The
Surplus weir is in good order - it has two bays
of 10' each with the crest at 23.19 - the crest
should be lowered to 22.5 and 3 1/2 shutters with
Screw gearing be provided and a basin may be
formed in rear by building a rough stone wall
across the surplus.

11. Between the Pillenli and Mukamala
locks

locks the canal follows the course of an old
drain the section of which is far larger than
is necessary and the water levels will not be
as indicated by the section submitted by the
Superintending Engineer. The Mithamala lock
is cutcha & as its levels are not suited to the
new arrangements proposed a new lock should
be built in its stead. The lock now has two
bays of $15\frac{1}{2}$ each the crest being at 15.03. the
lunes are very short and the work could not
easily be adapted for shutters worked by
screw gearing. A new pier should be built with
its crest at 17.1.

12 The Nadupudi lock may be retained
as Major Mullins suggests. the gates will have
to be renewed and the side walls to be carried
up to 16 they are now 15.13. The pier is 18 long
with its crest at 8.63 the crest may be raised
to 11 and be provided with 2 vents of 9' each
with 3' shutters raised by screw gearing. The
Chintalapudi dam should be placed near the
34 mile where the country begins to fall
rapidly

para 31

rapidly. East Bank Canal
13 Major Mullins proposes that the Lolla
lock at the head of this canal should be retained
with the level of water as proposed by him by
lowering the bed of the main canal this work might
have been retained but with the arrangements as
now proposed the water level would be above the
top of the lock walls and as the lock is cutcha
it is as well that it should be rebuilt. At
present this canal is not navigable it is proposed
to make it pass as far as the 35 mile & to connect
it from the 22 mile with the Annalapore Chan-
nel at the 26 mile by a still water canal
the level of the surface of the water in which will
be 20.1. Major Mullins proposes not to build
a lock at the 18 mile but to build one at the
25 mile and arrange his water surfaces according
to this he has done, however, without ascertaining
whether the water level would be as he proposes to
with reference to the capacity of the existing chan-
nels. At the 22 mile he arranges a further sup-
pose that the water level will be at 22.16.
from

para 34

from this point the Billacura junction canal branches & joins the Anjalapore Channel above the Mukama Lock, where the water level as arranged by him is at 19.36 there would thus be a fall of 28 feet in 40 miles - a very heavy fall for a navigable canal and by means of which a large volume of water would be drawn from the East Bank Canal.

14. By the arrangements now proposed this Channel will be a still water Canal and all the locks proposed by the ^{Engineer} Superintendent in the East Bank Canal will be necessary their positions may however be altered as per margin with advantage thus

Mandapilly Lock	at 20	instead of 18
Mada Julla	" 26 1/2	" 26
Hondakuduru	" 35	" 32

providing navigation 3 miles.

further than is proposed by the Superintendent.

15. The Pandania Linka Canal branches at 30 miles from the Anjalapore Canal the

para 26

canal follows the old course of a drain and its capacity is far greater than is necessary & as Major Mullins remarks the surface fall of .24 per mile proposed in the Superintending Engineer's scheme could not be maintained. The actual surface falls have been carefully calculated and are recorded in statement B. The Superintending Engineer proposes a Lock at 37 miles; by placing the Lock at 32 1/2 miles saving banking between the 32 1/2 & 37 miles will be reduced to a minimum and the draught from the Anjalapore Channel can be regulated by the surplus weir at 32 1/2 for the fall of the surface channel in the first reach will be only .06 per mile - 2nd instead of 3rd Class Locks should be provided in this canal as Major Mullins proposes at 32 1/2 & 42 3/4 miles and a Surplus weir must be provided in connection with the Lock at Pandamaluha to pass any water not drawn off above the Lock.

The

16. The ^{Drainage} ~~Gornikala~~ drain taps the country lying between the West bank Canal on the one side and the Annapurna Canal and Ambagapatta main branch on the other. The Upper Ennsica drains the land between the 2 last channels and by a cut called the Sakunni drain joins the Gornikala just before it reaches the Vanisthara Godavary - by these channels the drainage will be sufficiently provided for but a sluice is required where the united channels join the Vanisthara Godavary to exclude flood water. The estimate provides for a Sluice of 5 Vents 5×11 with an area of 110 square feet. The area drained is about 75 square miles and the discharge according to Ryves formula might be 10000 cubic feet per second. Considering however that a great part of the land is under wet cultivation and that water would be retained in the fields while the supply from the river would be cut off during the fall of heavy rain, it will probably be sufficient to provide for the discharge of 2500 cubic feet per second ordinarily, with a head of about 2' when the back water in the River is at its highest;

an

* Approved
in G.O. No 1286
dated 14 May
1872

39
an area of 360 square feet will then be required for the Vents and through them 6624 cubic feet per second may be discharged when the water in the River is at high tide level and the water above the Sluice 2' above the highest River flood. 8 Vents similar to those proposed for the Sluice over the Thongedda drain will provide the waterway required and a Bridge for the passage of Bandies may be provided by turning the upper arches for a length of 13' thus leaving 10' between parapets; this will be an improvement upon the Sluice proposed and will be not more costly than providing the same area in that Sluice.

17. The Nagaram Island drainage finds its way into a deep tidal creek which passes near the Village of Sirkaragupturn - this creek is now navigable for boats drawing 5' of water at low water, by improving it & connecting it with a creek running into the Varista Godavary it is probable that inland tidal navigation could be provided between the Varista & Vaintayam Branch of the Godavary and the drainage of the Nagaram Island

island would probably be much improved thereby.
18. The Lower Anzica drains the land
lying between the Anzalapoe and the Pinda
malunka Canals and is to be extended into a
tidal creek.

19. The lands below the Vela main branch
and between the Anzalapoe & East bank canals
are drained by natural drainage streams, which
find their way into the swamp across which
it is proposed to cut two channels to carry the
drainage into a tidal creek. These drainages
have not been levelled but pump pumps are cut
for them in the estimate.

20. From the Plan it would appear that the Vela
channel branched from the East bank canal at
2 1/2 miles, but, from the statement, it would ap-
pear to branch at 25 1/2 miles where the water level
will be at 18.85 - it joins the Anzalapoe chan-
nel at 32 miles where the water level will be 8.26.
It is presumed therefore that the channel is pro-
vided with a head sluice - if not it should be so
provided.

The

21. The original estimates appear to have
been prepared with great care by Mr Super-
visor Ellis. The duty however which he was called
upon to undertake viz arranging for the improv-
ment of the Canals in the Central Delta of the
Godavary to admit of their carrying a larger
supply, rendering some of the Canals navigable
and improving the navigation in others, was by no
means an easy one and in carefully examining
the Falls and Sections he has proposed for the
various Canals it has been found, that, owing
to the sections of some of the Canals being far larger
than are required merely for the conveyance of water
for Irrigation with the ordinary surface slope pro-
vided for such Canals, the surface level of the
water will not be as he supposed & hence it has
been necessary to revise the whole project. State-
ment B is the result of this revision: the surface
and bed falls in the Canals have been indicated
by blue dotted lines in the Sections, while the
levels of the Upper and Lower Sills of all Weirs
have been given relative to the datum and the
positions

island positions the Locks are to occupy have been made.
18. There as regards the new Locks in the Eastern
Bank and Bendamalunka canals differ
somewhat from the positions assigned to them
by Mr. Ellis. The Sections of the Locks now
existing have been shown in Barut Siema
19. with the ordinary high water level as it now is.
and These sections should have been shown in sub-
mitting the Project, to admit of its being
ascertained at a glance what alterations were
really being made in the water levels and
what existing works might be retained, had
there been given Major Mullins would not have
been led into error relative to the works which might
20. be retained and his suggestions admitted to in
para 9 would not have been made.
21. The points kept in view in pre-
paring the scheme now proposed have been
will. 1st to maintain a velocity not exceeding $\frac{1}{2}$ per second
and 2nd to admit of the canals carrying the quantities
it is required for irrigation with the surface slope
arranged for navigation as stated in N. 1. This
will prevent wastage of water & difficulties in navigation

43
3rd to admit of the canals being used as still water
canals when the cultivating season is over and
when the water supply in the River is small and
is but little in excess of what is required to pre-
vent waste by Lockage & by evaporation
4th to admit of canals being provided with the
same regime in the reaches below the points of
separation as where this is impossible to provide
for the regulation of the supply to the open channel
by means of the dam connected with a lock
as in the case of the Lock and dam at 32 $\frac{1}{2}$
miles in the Bendamalunka Canal
5th to provide for as little excavation as possible
by increasing the depth of the canals to 7 feet
where an enlarged section due to a depth of 6
would entail the removal of spoil banks or of
large portions of the existing high margins or
paduagay
It has not been possible to adhere to Point
143 in its integrity relative to the reach in which
the Ganaram Aqueduct is situated, but there
the surface fall has been reduced as far as possible
a

23. As it is proposed to provide only 2 cubic yards of water per hour per acre through the Delta generally & 1.7 cubic yards for the area supplied by the West bank Canal a high coefficient (1.3) should not be used in calculating the velocity as Mr Ellis has done for low falls such as those generally in the canals. The Borda formula is $V = 1.1 \sqrt{fs}$ and this formula has been used in computing the entries in Statement B.

24. It is necessary that the Plans and Sections should be returned to the Superintending Engineer for the preparation of the estimate for the arrangements now proposed for owing to the inaccuracy of the plotting of some of the Sections it is impossible in some instances to ascertain what the area of the existing Sections is.

25. In the estimate for the Central Delta the compensation required for land is given at Rs 9816 a statement from the Collector should be submitted verifying this estimate as required by L.O.

O.B. Canal	Rs 2260
W.B. "	1314
Amalapur	2260
Pandamillur	981
	<u>9815</u>

45
N^o 341 dated 5th February 1872. As the diversion proposed is not to be made at Rama Chendrapuram it is probable that little or nothing will be required for land in connection with the W.B. Canal.

26. In a note on the general Abstract estimate for the 3 Deltas the Superintending Engineer states "It is expected that 200,000 acres of land will be brought under irrigation by this expenditure a Revenue of 8 lacs a year or something more than 22 per cent in the outlay." In examining the figures given by the Superintending Engineer in his Report this would not appear to be correct.

Major Cyren originally estimated the probable increase as follows:

	present cult. irrigation	Estimated ultimate cultivation
Western Delta	208,000	300,000
Central "	81,000	135,000
Eastern "	147,000	190,000
	<u>436,000</u>	<u>625,000</u>

The present and expected cultivation as estimated by the Executive Engineer and by the Collectors

23. Collectors appear to be as follows.
by Executive Engineer

Area	Present Cultivation	Expected Increase
Western	* 189 796	* 60 664
Central	* 86 998	50 24
Eastern	* 123 007	* 65 163
	<u>399 801</u>	<u>130 841</u>
	130 841	
	<u>530 642</u>	
by Revenue Department		
Western	* 243 186	* 71 021
Central	* 86 998	11 326
Eastern	* 105 093	* 58 782
	<u>435 277</u>	<u>141 049</u>
	141 049	
	<u>576 326</u>	

* See Appendix
Am Co 71894
March 1871
Actual cultivation
of March 1871
See Appendix
2 of Co 40233
7/28 September 71

11,326 acres

From a recent return received from the Collector it would appear that the irrigated area in the Godavari Delta is 459 795 acres, if this is correct the Executive Engineer's estimate of extra cultivation is reduced to 70 847 and that of the Revenue Department to 116 531 acres. The difference shown for the above should be reconciled or explained if possible.
9.8.16.27. It will be observed that in the Central Godavari more particularly, the increase anticipated from

5 April 1871

both by the Revenue Department and the Executive Engineer falls very much below Major Mullins' original estimate. The estimate for the Central Delta may be stated roughly to amount to 1,60,000 acres if the area irrigated is increased by only 50,24 acres as estimated by the Executive Engineer the direct return from the Project will be only 3 1/3 per cent and according to the estimate of the Revenue Department the return will be 7 1/2 per cent - it is therefore necessary that some definite conclusion should be arrived at relative to the actual increase of cultivation likely to take place. The canals are now designed to carry water for the area estimated by the Executive Engineer but could be made to carry considerably more as a margin of 2' is provided in the masonry works above the proposed water level but the shutters of the piers would have to be increased from 3 to 3 1/2 or perhaps 4' in height in some of the piers.

In his note dated 4 January 1871 Major Mullins refers to the severe sets in the Varsa Godavari at Chandavally should

G.O. 10377 dated 7 February 1871

(should be Kattapuzha) on the west bank
and at Ramachandrapuram on the East bank;
steps have been taken to prevent these banks from
further encroachment and these have been to a
great extent effective - a very large area has
however to be recovered before the River can be
said to be in a satisfactory condition & this can only
be done by commencing operations higher up the
River led by the two Range officers working
in concert. The Survey of the Western bank of the
River had been completed in January last the
right bank should be completed as early as possible
and the proposed course to be given to the River
having been carefully laid down in the plan all
future works should be designed with a view of
forcing the River into the course proposed for
it: no general plan, it is believed, if laid down
to attain the desired object, could be carried out
in its integrity, but the main features of the works
proposed will have to be carefully considered
and the joint report of the Executive Engineer
in charge of the Central & Western Deltas with
the Survey called for on 10th 1877 of 7th Febry
1871

1871 should be submitted at an early date.
29. Nothing but the greatest neglect
for a considerable period could have brought the
River into the condition in which it now is; the
present Superintending Engineer and Executive
officers are however hardly vitiated to the urgency
of the case and the works already carried out by
them have proved to be beneficial; so much so that
it seems unnecessary present to divert the
Western Bank Channel of the Central Delta
near Ramachandrapuram as the Superintend-
ing Engineer proposed.
30. Just below the Ganaram aqueduct
there is a branch of the River which sets upon
& shunts the West bank Canal near Mandapa
lunka; this branch is gradually becoming silted
but it should be aided by planting across
the bed and when a considerable shoal has been
formed a bank should be thrown across the
branch so as to close it entirely and to prevent
the possibility of one high flood destroying the
accumulations and the work of years - the new
Lock should be placed beyond the influence of

(short of danger) below the point where the River
 and ceases to hug the Canal bank.
 steps. Several works were in progress in the
 further Eastern and Western Deltas & were being carried
 out satisfactorily. There was only one work in
 which it was desirable to make some alteration
 in the original design viz. in the basin which
 was being constructed below the Pimavaram
 Aqueduct. A stone retaining wall $3\frac{1}{2}$ broad
 was found along the rear of the work the fact
 beyond the cutwaters of the River cutting away
 the retaining wall and excavating for the foundation
 of the basin wall would probably have endangered
 the work. The wall was therefore retained.
 The bed of the Channel consists of hard gravel
 and as the outfall is somewhat contracted in
 its natural basin actually exists and it is doubtful
 whether any artificial basin was necessary; as
 the work had been commenced however and as
 it may under exceptional circumstances prove
 a safe guard to the Aqueduct it was not stopped
 but a considerable saving will be effected owing
 to there being no necessity to lower the floor
 under

under the Aqueduct owing to the existence of
 the retaining wall adjacent to it. S. T. 1888
 Eastern Delta

32. In para 23 of his note on the estimates
 for the Eastern Delta Major
 In G.O. 12335
 of 28 September 70
 Mullins objected to the arrange-
 ments for the Pimavaram Canal proposed
 by the Superintending Engineer because his
 estimates exceeded the original estimate sub-
 mitted by Major Ryrie by a
 * Rs 214 900
 " 115 310
 99 590
 & clause of
 Ganam extension
 very large amount and sufficient
 explanation had not been afforded
 relative to the changes proposed.
 The difference between the estimates
 was due chiefly to the fact that Major Ryrie
 proposed to retain the three existing Locks while
 the Superintending Engineer proposed to build
 new locks in their stead. After inspecting
 the Canal Major Mullins recognized the
 necessity of rebuilding
 two of the Locks but he
 proposed to retain the
 existing Lock at Hadiyapalunka & if the
 details

detailed instructions relative to the new arrange-
ment for the Canal and proposed to extend
navigation to Yamam & then to connect the west
bank Canal with Coringa River & with the
navigation generally in the Delta.

Yamam and the Coringa River are
already connected with the general navigation
in the Delta by means of the Munjaer lock in
the Coringa Canal and the Superintending
Engineer's proposition to lock from the Injuran
canal into the Taku main drain, at a point
up to which the latter is always navigable, would
afford an alternative line of communication.

between Coringa Dowlahshimmin and Cocanada
when Coast traffic is impracticable & would
render it unnecessary to connect the west bank
canal with the Coringa River at Yamam.

The navigation in the west bank Canal will
then terminate at the 30 mile but the produce
of the land lying between the west bank canal
from the 30 to the 39 mile at Yamam, the
Coringa River and the Taku main drain
can

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can be carried by the two latter streams which
are always navigable & which are, or, will be con-
nected with the general navigation of the Delta
when the Eastern Delta works are completed.
Under the circumstances I would recommend that the
Superintending Engineer's rather than Major
Mullins' proposition should be approved and
that the Injuran Canal should be locked into
the Taku main drain rather than that the west bank
canal should be connected with the Coringa
River at Yamam.

34
From the Superintending Engineer's letter
of 29/12 of 1871 it will be observed
that Major Mullins' arrangements (details of the cost
of which in juxtaposition with that of those
recommended by the Superintending Engineer are
given below) are not costlier than those proposed
by the Superintending Engineer; if, however, the former
are to be adopted it will be necessary to obtain
permission from the Chef-de-service at Yamam
for survey being carried into the French Territory
and to negotiate with him for the acquisition of the land

Land required for the Canal

Statement showing the approximate cost of the proposed arrangements relative to the West bank Canal of the Eastern Delta

	by Engr. G. S. S. S.	by Major Mullins
Earthwork	Rs 117,790	Rs 162,790
Slight alterations to Lock at Kadapalunka	500	
New Lock & weir at 1/2 mile at Molcutanum	29,800	
do do at Howlaushuram out 16 mile	25,140	25,140
do do at Horla at 1/2 mile	28,050	28,050
Weir at Dlungar Bram	2260	220
Weir at 30 mile	2260	
Lock & weir at 30 mile		30,000
Tidal Lock at Yanam at 30 mile		32,500
New Channel		
15 miles of Minor Channels	6600	15,000
16 Distribution Sluices	3000	6600
		3000
Tidal Lock in Sijeram of Canal into Lake main ficham, retaining cutch lock at Genapoolam	214,900	
		30,600
		245,400

35 If a permanent Lock be eventually placed at Genapoolam its cost will be Rs 220,400 and the Superintending Engineer's estimate will be the cheap one by Rs 36,360 and this irrespective of the reconstruction of the Kadapalunka Lock which will some or later have to be rebuilt for its side walls are at present kept up by cross walls 2 feet above sill level, its reconstruction would add Rs 20,600 to Major Mullins estimate.

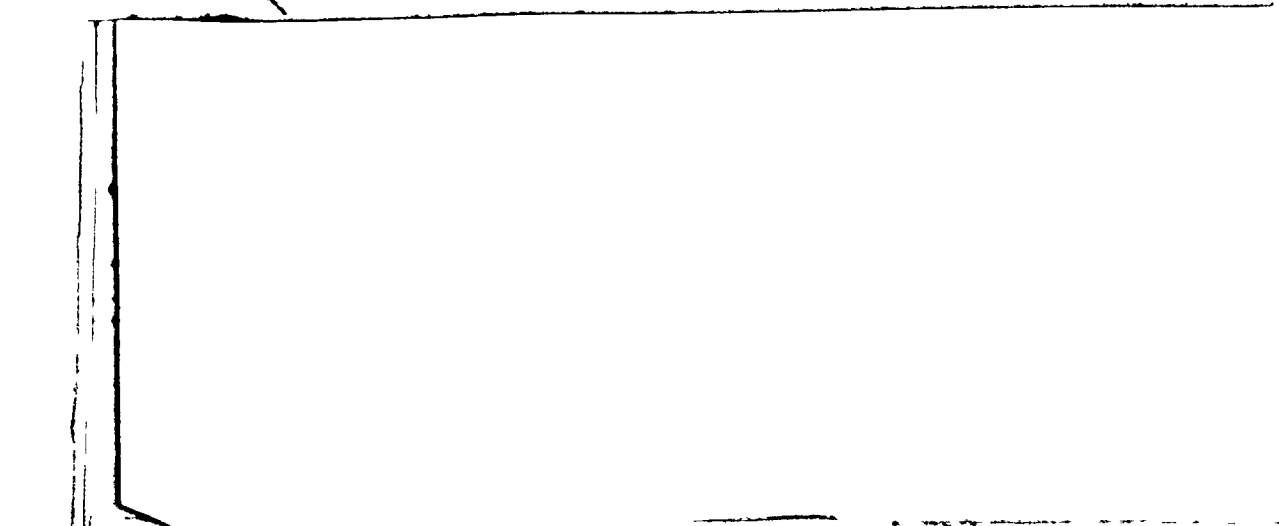
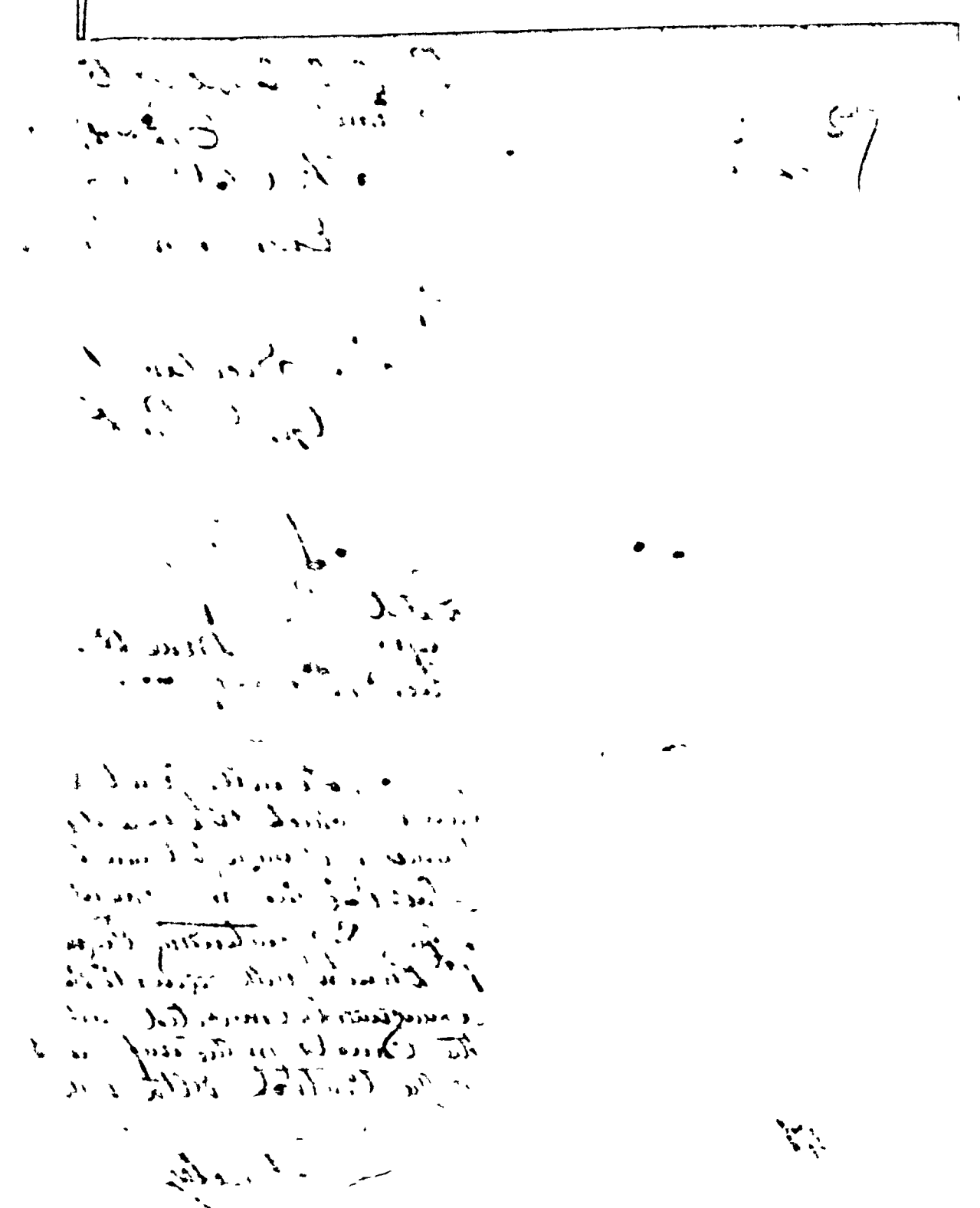
36 Major Mullins takes exception to the Superintending Engineer's proposition to abandon part of the 2nd, 3rd, 4th & part of the 5th mile of the present main canal this however is a very judicious proposition. The present canal hugs the foot of the River bank and in the 2nd mile a loop channel is taken off and enters the canal below the Lock in the 3rd mile, in this channel the surplus water is situated and the 3rd & 1/2 miles of the Canal below the loop form, as it were, a Cul-de-sac & would do so were it not for the existence of 2 small Vents 3 x 4, about 200 yards above the Kadapalunka Lock. These were designed to afford a scour to keep the bed clear

clear but they appear to have no appreciable effect
 in so doing and hence the Canal here is always
 much silted and under existing arrangements can-
 not be so the new Canal should be placed
 along the bed of the lake and the river be
 placed close to the Lock at Morlauxton
 The course of the old canal should be left open
 in order that it may become silted up this will
 afford protection to the River bank and will
 prevent percolation

Intd St George W. Bates Captain R
 23rd June 1872 Chief Engineer for Irrigation

The Secretary, Govt
 P. H. D.

Enclosures
 Longitudinal Section of West Bank Canal
 East
 Annalapur
 Pandamalakka
 Gurnarain Aqueduct (A)
 Sketch Map of Eastern Delta
 Central
 Statement (B)
 QO 2335 of 23 September 1872
 QO 377 of 7 February 1871
 QO 1077 of 18 April 1871
 Compd



No 4872 Report
 The Chief Engineer for England

The Secretary to
 Govt of India

Dated 3rd June 1872
 Recd 18 July 1872
 No 4872

Note on the joint re-
 lation which has been dif-
 ferences of opinion between the
 Chief Engineer for England
 & the Superintending Engineer
 of the Government of India
 with regard to the
 arrangements connected with
 the Canals for the improvement
 of the Central Delta of the
 Godavari

Noted 26 July 1872

No 476

Godavari District
Central Delta

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Letter papers sent to Eng-
 Division with file No 1756
 dated 26 July 1872

Main Duet

- 1- Plan of Lock
- 1- Estimate of - do -
- 1- Plan of Lock Gate
- 1- do - Iron fixtures
- 1- Statement of Hydraulic calcu-
 lations with abstract estimate &c
- 1- Sketch of Main Canal at the 8th
 mile stage with its sub. canals -
- 1- Book of Long & Cross Sections

Total

7

East Bank Canal

- 1- Sheet of Long Sections
- 1- Book of Cross Sections
- 1- Statement of Hydraulic calcu-
 lations with abstract estimate &c
- 1- Detail & cost estimate of Masonry
 works

Total

West Bank Canal

- 1- Sheet of Long Sections

7. Statement of Hydranthidial in-
lations with dark Porter and

Page 2

Deane's

1. Book of Long & Grim Sec -
2. Plans of Sakaine Drains &c
1. Plan of Tidal Sluice
7. Site of — do —
1. Drawing sketch of Drains

Jul. 4

Miscellaneous

- 2 - 1. General Plan and i.de.
tailed lists of main irri-
gation sluices -
1. Plan of Range Office
1 - do do
1 - do do
1 - Statement of Compensation
for land -
1 - Statement of Water distri-
bution -
1. General Plan of 3rd class
Lock -
1 - Plan of Gates for - do -
1 - do of weir at - do -

Benda inggil banget banget

1. Shot of Long sections
- 1.2. Book of Crinoids
- 1.3. Statement of Hydraulic calculations with abstract 8 to 10
- 1.4. Detail and abstract 8 to 10

Mail 4/

~~original~~
~~original~~
~~original~~

1. Sheet of longitudinal section
1. Book of cross-sections
1. Statement of hydraulic calculations with estimate
1. Detail and assembly drawings

74

Billie Marie Smith

1. Book of Long's complete

- 1- Specifications for 3 class lock
 1- General Plan of 2 do do
 2. Plans of gates for do do
 1- Specifications for do do
 1- Plan of weir
 1- Specification for do do

1- Static Map of Eastern Delta

1- Section of the West Bank Canal showing water level at and above and below the Ganarian Aqueduct

Total 19

Grand Total 57

Madras

8th Aug 72

RAILWAY DEPARTMENT.

CONSULTING ENGINEER'S OFFICE.

No. 350

From

Lieut Colonel J. H. M. Shaw Stewart R.E.
 Consulting Engineer for Railways,

To

Colonel G. W. Walker R.E.

Secretary to Government,
 Public Works Department,
 Fort Saint George.

SIR,

Upon receipt of the order of Government dated the 8th June 1872, No 1423, a copy was sent to the Agent of the Madras Railway for his information; and with reference thereto Mr. Elwin has addressed to me a letter which I have the honour to request you will be so good as to lay before the Government, for such action as they may see fit to take.

* No 456 dated 1st July 1872 with enclosure.

The

The letter in question is the most extraordinary one which it has ever been my lot, as a servant of, Government, to receive.

2. It will be seen that the Agent and the Chief Engineers both take exception to the language contained in the 4th paragraph of my letter to you dated the 11th May 1872; and Mr. Elwin says,

"I feel that in justice to
"the Chief Engineers and to myself
"I should be wanting in common
"respect were I not to object in
"the strongest terms possible to

73
65
the unjust insinuation con-
tained in that paragraph
"The Officers of this
Company desire neither praise
nor censure at your hands,
"all they desire being that their
actions may be correctly repre-
sented to the Government.
"I hold that it is quite
beyond your province to blame
the Officers of the Railway.
"It is for you to report to
Government what transpire
leaving it to His Excellency
in Council to impute blame
or not as they may think fit.
"All

"All that the Chief
 Engineer and I did in the
 matter of the alterations and
 improvements at the Beulah
 station was done in good
 faith with the knowledge and
 consent of the Acting Consulting
 Engineer and was plain and
 above board and on Mr
 Anderson's behalf and on my
 own I rebut the allegations
 you have thought fit to make."

3. In the first place
 I must most distinctly deny that the
 paragraph in my letter, to which
 Mr Elwin alludes, was intended
 to contain any insinuation, just or
 unjust

* In letter
 No 320 dated
 3rd May 1872
 Vide G. R. 8th
 June 1872
 Ch 14 23.

No 299.

7th 3
 67 69
 unjust, against any of the Railway
 Officers. Whether the words of
 which I made use of can be so, as
 construed as to imply an insinuation, I
 leave it for the Government to
 decide. The words were almost
 identical with those which I had
 employed in writing on the subject
 to the Agent, eight days previously, if
 and no objection was then raised
 by him. In his reply, dated the
 9th May 1872, the Agent expressed
 a hope that I would agree with
 him in thinking that the Chief
 Engineer was perfectly justified
 in acting as he did. I was in
 fact invited to approve of the
 Chief

Chief Engineer's proceedings, but it is held by the Agent that I am not at liberty to express my disapproval.

4. In the paragraph to which objection is now taken, it meant to state, as plainly as possible, that two irregularities had taken place with reference to the small work at Bellary alluded to, for which the Railway Authorities were, in my opinion, somewhat to blame. I maintain that I should have neglected my duty if in laying the matter before Government, I had failed to point out those irregularities.

irregularities.

The Government of India had declined to sanction, as a charge upon Capital, the cost of certain proposed alterations in the signals and sidings at

Vide G. O.
7th January
1872. to 52.

Bellary, suggesting that the former should be removed, and the latter eased, at the cost of Revenue, if a charge was absolutely necessary. This order was communicated to the Agent on the 11th January. It is scarcely necessary to observe that there were then three courses open to the Railway Officials, any one of which would have been perfectly

perfectly regular:

(1) to drop the proposal for

the work in question, as being

not absolutely necessary;

(2) to carry the work out at

the cost of Revenue, as

suggested by the Government

of India;

(3) to make a further repre-

sentation with regard to

the necessity for the work,

and with regard to the

allocation of the expenditure.

The course actually followed by the

Railway Officers was a combination

of the last two. The work was

carried out on the strength of the

conditional

7771

conditional sanction from Revenue

conveyed in the above-quoted extract

from the Government of India's

letter; and a revised estimate

was submitted for sanction, with

a request that the Government

of India might be fit to reconsider

their previous order; but no intima-

tion was given to this office

that the conditional Revenue

sanction given by the Government

of India had been acted on, and

that the work was then actually in

progress. Under the circumstances

I hold that the submission of the

revised estimate for sanction, with-

out any such intimation, was

tantamount

tantamount to an assurance that the Revenue sanction would be held in abeyance; and that the orders of the Government of India would be awaited before carrying out the work. As a matter of fact, no one in this Office knew that the work had been carried out, until the receipt of the Agents' letter dated the 2nd May 1872, in which it was stated to have long since been effected.

By this action in the matter, the facts of which were undisputed, the Railway Authorities seemed to me to have ~~acted~~ acted irregularly; and I hold

that

X No 271
Vide G.O.
8th June 1872
No 1423.

73
that I should have been wanting in the performance of my duty had I failed to lay my opinion before the Government. I need hardly assure the Government that nothing was further from my intention than to make any imputation against any Officer of the Company, or to bring against any one a charge of want of good faith. It is stated by the Railway Authorities that the subject was discussed at a Meeting held at Royapuram on the 5th February, at which the ~~respective~~ Consulting Engineer was present; and that all that was subsequently done was with his knowledge and consent. In this letter

latter statement I think Messrs
 Elwin and Anderson must be mis-
 taken. Major Prendergast is
 in England, and the discussion
 referred to is not upon record; but
 the Deputy Consulting Engineer
 was present at the meeting, and
 I learn from Lieutenant Christie
 that, to the best of his recollection,
 the only point discussed was the
 question as to the necessity for the
 work, upon which all present were
 agreed. I beg to draw the special
 attention of the Government to the
 remarks made by Major Prendergast,
 when forwarding the revised estimate
 for the work. It seems impossible
 to conceive that Major Prendergast,
 with the ruling of the Government
 of India before him, could have sent

up

* Vide G. O.
 21st March
 1872. to 801

275
 up the revised estimate with those
 remarks, if he had been aware of
 the fact that the work in question
 was then being executed, on the strength
 of the sanction supposed to have been
 conveyed in the previous letter from
 the Government of India. In
 paragraph 6 of his remarks, Major
 Prendergast states that provision
 for the expenditure need not be
 made in 1871-72: he could not have
 written this if he had known that
 the work was then being carried
 out.

8. I do not know what
 Mr Elwin refers to when he says,
 "the Officers of the Company desire
 neither praise nor censure at
 your hands." Excepting in my
 confidential reports to the
 Government, it forms no part of
 my

my duty to pass any opinion upon
the works of the Company, or
upon its Officers; and I
have never attempted to do
so. When Mr. Elwin says
that all that the officers of
the Company desire is that their
actions may be correctly represented
to the Government, I do not know
whether he wishes it to be
understood that I have been
in the habit of incorrectly
representing their actions.

I must leave it
to the Government to deal
with that part of Mr. Elwin's
letter, in which he dictates the duties
of the Office which I have the
honour

85-77
honour to hold. I trust that
the Government will consider
that the substance of that portion
of the Agents letter, and the
language contained in it, are
unbecoming to the respective
positions held by us as Agent of
the Madras Railway Company and
Consulting Engineer to the Madras
Government.
As to the duties
which devolve upon the Consulting
Engineer, it seems superfluous
to remark that the very nature of
the post contradicts the views which
Mr. Elwin has so authoritatively
laid down, and that every instruction
which

which the Consulting Engineer has
 ever received from the Government
 is based on the theory that it
 is his duty, when laying any
 matter before Government, to
 state his own opinion fully and
 clearly.

Recent orders of
 the Government of India, and the
 extremely close scrutiny into the
 expenditure and the establishments
 of the Guaranteed Railway Com-
 panies which is now required
 from this Office, have added
 greatly to the difficulties of the
 Consulting Engineer's position,
 and it is submitted that the
 discharge of my duties will become

almost

almost impossible if, from time to
 time, I am to receive letters such
 as the one which I have now the
 honour to enclose.

Looking to the
 possibility of similar letters,
 founded on my communications
 with the Government, being ad-
 dressed to me, it is perhaps ad-
 visable to recur to the practice
 which was in force some years
 ago, and to furnish the Agent with
 the decision of the Government
 upon all subjects with regard
 to which there has been a difference
 of opinion, withholding from him
 the papers which may have led
 to the

* Vide Extract
 Minutes of
 Consultation.
 " June 1856
 No 178.

No. 456

MADRAS RAILWAY.

AGENT AND MANAGERS' OFFICE

Madras, 1st July 1872

From

Robert D. Elwin Esq
Agent and Manager. C.B. & Co.

To

Mr J. H. Shaw Stewart, Esq
Consulting Engineer for Railways.

SIR,

11th July - dated
Upon receipt of order of
Government No 1423 dated the 8th ultimo,
I placed myself in communication
with the Chief Engineer and I have now
the honour to submit for the information
of His Excellency the Governor in Council
a copy of Mr Beresford Anderson's reply.

The Government will observe
that Mr Anderson very properly takes
exception to the language made use of
by you in the 14th paragraph of your letter
to the Secretary to Government, Public
Works Department dated the 11th of May
1872 No 1235, and I feel that in justice
to the Chief Engineer and to myself I
should be wanting in common respect
were I not to object in the strongest
terms possible to the unjust insinuation
contained in that paragraph.

The officers of this Company
desire neither praise nor censure at

the Government to form the basis
of their decision.

I have the honour to be,
Sir, your most obedient servant

Madras 1st July 1872
R. D. Elwin
Agent and Manager. C.B. & Co.

Chief Engineer for Railways

to be given, I am, Sir, your obedient servant

and I am, Sir, your obedient servant

and I am, Sir, your obedient servant

and I am, Sir, your obedient servant

and I am, Sir, your obedient servant

and I am, Sir, your obedient servant

and I am, Sir, your obedient servant

and I am, Sir, your obedient servant

and I am, Sir, your obedient servant

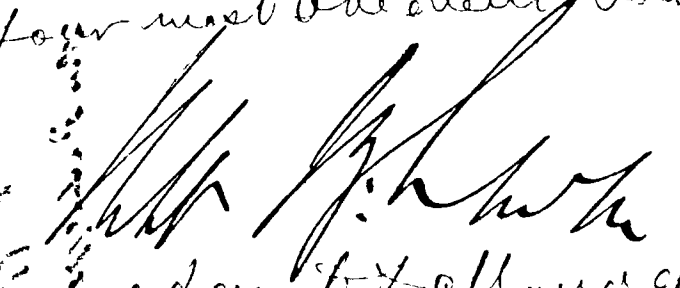
and I am, Sir, your obedient servant

9/1/83

you have done, all they deserve - being that
their actions may be honestly represented
by you to the Government - I hold that it
is quite beyond your province to hinder
the Office of the Railway. It is for you
to report to Government what transpires
concerning it - to His Excellency in Council
to impute blame or merit as they may
think fit

" I tell that the Chief Engineer
and I did in the matter of the alterations
and improvements at the Bellamy Station
and have in good faith with the knowledge
and consent of the Acting Consulting
Engineer and his plan and above
board and on all explanations - he half -
and on my own I rebut the all-
trans you have thought fit to make.

5 I have to request that you
will be good enough to submit the
letter to the Government

I have the honour to be
Sir
Your most obedient servant

Agent & Manager.

Madras Railway Company
Chief Engineer's Office
Madras 1st July 1872.

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The Agent and Manager,
Dear Sir,

Your endorsement dated 13th ultimo on
G.O. No. 1423 of 8th idem

I have read with much surprise the
letter No. 235 of 11th May 1872 from the Government
Consulting Engineer to the Secretary to Government
P.W.D. on the subject of the alterations and
additions to the Bellary station recommended
in my letter No. 530 dated 27th September 1871

I am quite at a loss to imagine on
what grounds the Consulting Engineer felt him-
self justified in making the remarks contained
in the 4th para

The facts of the case are extremely
plain, and my action in the matter was
perfectly straight-forward

On the 27th September 1871 I sub-
mitted an Estimate for alterations and additions
in the Bellary station yards and in G.O. No. 52
of 9th January 1872 it is stated "as regards
the signals and sidings I am directed to
suggest that the former should be removed
and the latter should be saved at the cost of
revenue, if a change is absolutely necessary."
The question was discussed at Stores Committee
and the necessity for the alteration was
fully recognized. The Acting Consulting
Engineer was present and fully concurred.

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MADRAS RAILWAY.

From

The Agent and Manager.

To

The Consulting Engineer

for Railways.

Date 1st July 1872
Recd 2nd July 1872

No. 456

Replying to Govt Engineer's
letter No. 235 of 11th May 1872
= once to certain remarks
made by him in course
= then with the alterations
and improvements at
the Bellary Station.

P. M. 3276/72.
Am. 3 July 1872 L. 1872

in the necessity for at once carrying out the alterations. There can be no question raised therefore as regards sanction to go on with the work.

5. It appears to me however that it was quite open to me to seek for a reconsideration of the allocation of the charges, and I therefore forwarded a revised Estimate with my letter of 30 dated 31st January 1892. In this Estimate I struck out all charges for labor, but asked that the cost of the extra Permanent way material, Ballast and Carriage of materials should be charged to Capital.

6. It is true that the work was executed at the time my revised estimate was sent in but the Government Consulting Engineer cannot surely suppose that I was ignorant of the channel through which it would be forwarded to Government.

7. The Acting Consulting Engineer was in possession of all the facts of the case and any attempt on my part to hoodwink the Government, apart from its being utterly foreign to my mode of conducting my duties, would have been open to immediate detection.

Yours faithfully,
J. B. Richardson
Chief Engineer.

True Copy
W. J. [Signature]
Agent & Manager

original
[illegible]

Para 9. The Board observe that in your letter to Mr. —, acknowledging the receipt of these letters, you remark on the tone of Mr. —'s, which, you correctly observe, is wanting in respect to Government and its Officers; but the Board wish that you had not confined yourself to the expression of your disapproval of letters written in so improper and unbecoming spirit, but had declined to forward them, which, as head of the Indian establishment of the Company it was quite within your province and duty to do.

Para 11. The Government has a right to exercise complete supervision and control over all the Departments of the Railway: its observations must therefore be always received with respect and its instructions

P. M. 3276/72.
Musty to the Board.

9-15
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RAILWAY DEPARTMENT.

CONSULTING ENGINEER'S OFFICE.

No. 365.

From

Lieut. Colonel J. H. M. Shaw Stewart R.E.

Consulting Engineer for Railways,

To

Colonel C. W. Walker R.E.

Secretary to Government,

Public Works Department,

Fort Saint George.

SIR,

In my letter to you dated the 4th instant, No 350, I find that I omitted to allude, as I had intended, to the fact that the Board of Directors of the Madras Railway Company have repeatedly recognised the right of criticising the Company's observations in India which is vested in the Consulting Engineer to Government.

2.

I should have considered it unnecessary to mention this, but it

J. H. M. S. S. 1/2

instructions obeyed and carried out with willingness and zeal. This is perfectly consistent with the privilege on the part of the Railway Servants (the use of which, within proper limits, it would be unwise to discourage) when any part of their work, or duty, is found fault with, of explaining in their own justification difficulties which they think may not have been fully understood or allowed for. But in doing so they must be careful not to lose sight of the respect due to Government and its Officers; and there can be no doubt that explanations offered in a proper spirit and becoming language will always meet with indulgent consideration from Government.

True Extract.

Manthorpe Lieut. Col. R.E.

Consulting Engineer for Railways

is desirable to show that the views
which have been laid down by the
Agent in so extraordinary a manner
are not shared by the Board of
Directors.

3. As an instance of what I refer to, I beg to append an extract from one of the early letters of instructions sent by the Board to their Agent. This letter has been printed among the standing orders of the Railway Department in this Presidency. It will show that the Board recognise the right of criticism on the part of the Officers of this Department, and the necessity for it; and it will also show that the language

x 1044
29 March 1855

* Page 182-3

Modras 3
15 July 3
1872 3

in which the Agent has expressed
his opinion is not in consonance
with the views of the Board.

I have the honour to be,
Sir,

Your most obedient servant
 Wm. Stewart Lieut. Col. R. E.

Cous: Engineer for Railways

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95

Encl. No. 1872 Negotiated
Am. & Eng. Co.
88-8830

RAILWAY DEPARTMENT
1872

From
The Consulting Engineer
for Railways,
To
The Secretary to Government,
P. W. Department,
Fort Saint George.

Dated 16th Aug 1872.
Recd 17th Aug 1872.
Encl. No. 1872
No. 365.

Regarding

The right of entering
the Company's operations
in India, as well as
vested in the Govt;
Enquiry to Govt
of 1826. 2nd Aug 1872

25 29
August 20 1872

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A. A.
L. A.

P. M. 1872
 Geo. J. Johnson Esq.
 No. 327 B.
 RAILWAY DEPARTMENT

1872

From

The Consulting Engineer
for Railways,

To

The Secretary to Government,
P W Department,
Fort Saint George.

Dated 4 July 1872
Recd 5 }

Sen. L.

No. 3511

So I will then pay for
the order of goods in
the letter from the agent
of the Union Co. as
relating to the
loss of the car
in your opinion. As you
can load and use of
No. 1423 of 8 March 1878
O/A 1826-2" March 1878

John

Dec 22^d 1872.
Wm. H. Hall, Jr. 1872.

with regard to the arrange-
ments connected with
the Canals for the im-
provement of the Central
Delta of the Godavari.

The Acting Chief
Engineer for Irrigation
has prepared a statement
in which the levels of
the various Masonry
works, the dimensions
of the Canals, the water
level as it will be if
have been laid down.
his views on the subject
accord rather with those
of the Superintending
Engineer than with those
of the Chief Engineer
for Irrigation. The
Government

Government resolve to
adopt his proposals
and the Superintending
Engineer will revise
and submit Estimates
accordingly with the
least possible delay.

As regards
the Western bank
Canal of the Eastern
Delta the Government
are of opinion that it
is unnecessary to con-
nect that Canal with
the Poringa River at
Yanam and that the
alternative scheme of
connecting the Ingeram
Channel with the Lake
main drain is preferable
and

and for the reasons stated
by the Acting Chief
Engineer for Irrigation
they approve of the aban-
donment of a portion of
the West bank Canal
and of the Canal being
carried along the existing
surplus channel. The
Superintending Engineer
should therefore re-sub-
mit the Estimate for
the Western bank ^{Canal} with
such modifications as
may be necessary rela-
tive to the water level
at the head of the Corrigee
Canal and to the
points adverted to in
paras. 22 and 23 of
the

101 to 20.
The Acting Chief Engi-
neer's Note. His spe-
cial attention is also
called to paras 25 and
26 of the Note and
he will afford the infor-
mation required rela-
tive to the actual in-
crease of area of culti-
vation which may be
expected in the Deltas
generally, as it is not
satisfactory that Estimates
varying so largely as
those of the Revenue
Department and the
Executive Engineer should
be submitted without
any explanation or any
apparent attempt to
reconcile

Not to be signed
by the Superintendent
of the Canal
1/10/20
The Superintendent

6103

reconcile the differences.
The survey called
for in I.O. No 37 dated
7th February 1874 with
the Executive Engineer's
proposals for the recti-
fication of the River
bed should be submitted
with the least possible
delay.

A. F. 10/8/72

G.M.W. 29.6.72

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To the Sup^r Engineer of the ...
At Chief Engineer of ...

Recd 9/8/72
Enclosure sent by ... 10/8/72

C/23477

Govt. of 1872: Madras.

PUBLIC WORKS.

To the Superintendent, Eng. Dept.
P. H. Harrison

Dated

Recd

Final 1/

G O. 26th Sept 1872, No 1756

Recd 17/4/77

Central Water of the Madras

Supply of water in the
city of the Madras for the
improvement on certain points.

~~connected with the~~
the report of the committee
for the improvement
of the Central
Water of the Madras.