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Public Works DEPARTMENT.

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Dated 11—8—18 57

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No. 91. Read the following letter from Colonel C. E. FABER, Chief Engineer; to H. FORBES, Esq., Acting Secretary to Government, dated 20th May 1857, No. 520.

SIR,

In laying before Government the explanation of the Superintendent Eastern Coast Canal* called for by Government in Extract Minutes Consultation No. 371, of the 26th February 1857, as to the exact meaning of his assertion that "disappointment and dissatisfaction are surely in the future" if the present treatment of the water communication between Shediencoopum and Doogoorauzepatam be continued, I have somewhat departed from the accustomed routine of sending it up, with an accompaniment *nominally* written by the head of the Central office, but which is commonly the production of one or other of his professional associates, although bearing his own signature when he does not substantially dissent from the opinions setforth.

* No. 463, dated 15th April 1857.

2. In the present case, it has seemed advisable that the careful examination of the Superintending Engineer Central Circle should be attributed to its real author, because Captain Collyer whilst Civil Engineer of the 4th Division, was himself for some time in professional charge of the Northern Canal; and he therefore brings minute local knowledge to bear upon the important subjects discussed, (and certainly with ability) by Lieutenant Sankey, in addition to that gained by an impartial consideration of the latter Officer's written and copious exposition of his views.

3. A yet further reason however why a separate Report‖ from the Superintending Engineer Central Circle has been added on the present occasion, is that whilst Captain Collyer has thus had an opportunity of giving his opinions, from which I do not dissent, on the several views propounded by Lieutenant Sankey and thus preparing the subject in the usual manner for the orders of Government, it would in some measure have been out of place in such a paper, whether authenticated by him, or by myself to go into certain other considerations of a more general nature which seem to be called for, and which therefore for convenience sake, it becomes my own personal duty to offer for the favorable consideration of the Right Honorable the Governor in Council.

‖ Dated 11th May 1857.

4. Apart then from its *details*, already minutely examined by the Superintending Engineer, the *prevailing* impression which Lieutenant Sankey's paper appears to me likely to create, is that, however such purpose may be concealed or disguised, the system followed hitherto, and the measures adopted for an inland coast navigation have virtually been *attacked* and are now pronounced to have been faulty in principle, and even defective in details.

5. I can conceive few things likely to cause more dissatisfaction, not to say displeasure, than for the Government to find itself called upon to blame what it has hitherto been recommended to support, and to accept as demonstrated errors, works which have been represented to be both useful and indispensable. I fully believe that Lieutenant Sankey himself would be the first to disavow all intention of directly impugning the ability or sound judgment of his predecessor; and that rather than be the author of a Report which even inferentially can bear the construction of directly calling Lieutenant Chambers' skill and knowledge of his particular business in question, he would have been well contented to withdraw his reply, and to have left the requisition of Government unanswered.

6. Misled however by observations of the defects developed by the violent storms and floods of November and December last, and seduced by the discovery of the causes of the accidents, whose disastrous results on the navigation for the time he himself witnessed, he expresses himself as if it had been reserved for him to detect wants not yet supplied, and in pursuing the investigation to become in fact the originator of a new system of internal navigation; whilst he overlooks that the reforms of which he is the advocate, are not the exponents of new principles properly so called, but resolve themselves simply into questions of degree. I am very far indeed from blaming Lieutenant Sankey that unconsciously to himself he has been betrayed into the very natural mistake of being the supposed discoverer of a correct practice for our Indian water communications on a part of the Coromandel Coast where the lift of the tide is so small; on the contrary the eagerness with which he has sought to pursue his observations to their legitimate

results, and to generalize his recommendations by the constructions of an entirely new line of Canal bespeaks the possession of qualities, which when matured by an enlarged measure of practical experience, would doubtless have been of great value to Government and to the public.

7. But if His Lordship in Council should arrive at the conclusion that the acknowledged still remaining defects of our present Northern Canal are indeed so radical and great (and unhappily Lieutenant Sankey himself was not personally cognizant of the great ameliorations progressively made during the last few years) that effective and uninterrupted navigation is impracticable the great evil will have been accomplished of a destruction of that confidence in the professional Officers of Government, which is essential to the success of our Public Works in the Madras Presidency.

8. So far from regretting that Lieutenant Sankey has dwelt forcibly on the subject of "isolation" as all important in Canal navigation, I have never ceased to regret that the frequent representations from the Central Office on this point have met such little support; and more especially that it has unfortunately been overlooked as yet by Government that where passing through shallow lagoons and across low swampy ground, increased breadth of Canal becomes a practical necessity, not because accommodation for navigation requires it, but because without breadth, earth cannot be obtained for embankments, either to isolate the Canal from inundation surcharged with silt, or to prevent the low dykes procured from the smaller excavations and which are required for towing paths, being bodily melted into the Canal.

9. A very full account of the evils of insufficient embankments (on which isolation depends) is contained in the Superintendent's Report of the 16th January No. 386, forwarded to Government with my letter No. 9949 of 2nd February. The unwillingness of the Government, to carry out the reforms applied for by Lieutenant Chambers is shewn in Extract Minutes Consultation No. 918 of the 15th December 1855 and again in Extract Minutes Consultation No. 155 of the 22nd January 1857.

10. With completeness of isolation, scarcely less strongely advocated by Lieutenant Chambers, with a substitution of flood gates for Locks, and with an habitual avoidance of lagoons instead of preferentially going into and through such basins, all specialties, as it seems to me, of Lieutenant Sankey's recommendations cease.

11. That a capacious basin near the Royapoorum terminus of the Madras Railway would be a great accommodation for the trade when exportable articles are brought from the northern Districts by the Canal, seems to admit of very little doubt; but with the progressive improvement that I have myself witnessed in the Cochrane's Canal branch, and which with the assistance of a Steam Dredge (believed to be now on its way out) can be carried to a much greater extent, I am by no means prepared to advocate Lieutenant Sankey's entirely new Canal.

12. Upon the whole, I cannot divest myself of the apprehension that the general impression created by the consideration of Lieutenant Sankey's Report will be *unfavorable* to Canal navigation. In such unfavorable opinion I do not share; though I fully admit that there has been, and is much to disappoint, especially in the want of uniform depth, and the almost uselessness of the Doogoorauzepatam Canal from the shoal water near Streehurrikottah. Recent financial restrictions have also had their usual adverse influence, and repeated change of Officers, always unfavorable, is particularly so in a nascent undertaking like the Coast Canal.

13. The Superintending Engineer closes his report by expressing a hope that the Government will be pleased to authorize a more liberal expenditure than has hitherto been thought necessary. To this may be added, a greater measure of general support; for although it may commonly be quite true that the public will use whatever it is for their own interest that they should use, there may be very different degrees of enterprize in different publics, even in so short a distance as the North and South of Madras. Unless the Sadras Canal be in the first instance stocked with boats by Government (and they should be of the best models whether for Cargo or Passengers) and unless the Collector of Chingleput, who *formerly* was a strong supporter of the new Canal, be instructed to contribute all in his power to the developement of traffic, as well as to the protection of the banks and young trees, it does not seem likely at present, that the partially completed branch of the Southern Canal will be turned to any very useful

account. But to use a common phrase, if it were once in whatever way, "set well agoing," and a convenient landing place with a cart road leading to it, established on the north bank of the Adyaur, there seems no reason why it should not in time, present as busy a scene, as Cochrane's Canal now does.

Letter from Lieutenant R. H. SANKEY, Engineers, Superintendent of the E. C. Canal; to Colonel C. E. FABER, Chief Engineer, dated 15th April 1857.

SIR,

The Government having called for a distinct explanation, with regard to the statement contained in the concluding para. of my report No. 400 of the 29th January 1857, "that disappointment and dissatisfaction would surely follow" the present system of making that part of the E. C. Canal between Shediencoopum and Doogoorauzepatam, I have the honor to submit my views on the subject.

Canal North of Madras.

2. As the Government has required that this report should be forwarded with your distinct opinion, as to the correctness or otherwise of my views, I hope I shall be pardoned for the length at which I am obliged to enter into them, in defence of an expression which I must admit was strong, but which I trust, with all due allowance for my want of ability and experience, may not be found unjustifiable.

3. My first duty will be to describe the present state of the Canal, afford a clear view of its capacity with reference to the existing trade, show how far it is below the standard recognised in all civilized countries as good Canal navigation, and how impossible to accommodate it to the vast influx of trade, which must undoubtedly be created by the great reduction of price effected by such a means of transport, as well as that due to the lines of road &c. which, either proposed, or under execution, will sooner or later place all the central parts of the Peninsula in direct, and easy communication with the coast.

4. Government having a right to expect that in my position as Superintendent, I should propose a theory of construction, as well as break down the one which may more or less be now considered as recognised, I shall deem it my second duty to show, as far as my limited experience will allow, what principles should be recognised as basis for our future efforts, towards establishing a truly 1st class coastal communication, if not for the whole coast, at least for such a portion, as may for the time be considered distinct and independant.

5. The Eastern Coast Canal is now considered as open between Madras and Doogoorauzepatam, a point 70 miles to the north. The navigation between these termini divides itself naturally into four distinct heads, all of which will need a separate description.

Canal as now existing may be divided into four heads.

1st. The so called Cochrane Canal as far as the Shediencoopum lock, 7 miles.

2nd. The stretch between Shediencoopum and Pulicat—17 miles of improved tidal estuary.

3rd. The portion of lake navigation between Pulicat and Streehurricottah the southern end of the Doogoorauzepatam Canal, 20 miles.

4th. The so called Northern or better Doogoorauzepatam Canal, 24 miles.

6. Mr. Heefke when he commenced the execution of the Cochrane Canal probably in 1802 had in view, simply the connection of Madras with the Ennore backwater, and the formation of a completely 3rd class navigation. On the idea of a Coast Canal being entertained, it became evident that a great improvement in the depth of the Cochrane Canal must be made, in order to fit it in any way for the accession of trade which must follow, and with this object the Shediencoopum lock was built. This work has been now in operation since last August. The repairs and other judicious improvements, which were at the same time carried out under the skilful direction of the late Superintendent, have effected all the improvements of which the Canal is susceptible, short of complete re-construction, still I must express my distinct opinion, that the lock has failed in the main point, which was, to make this portion of the Canal a fit termination of what it must one day be if the project be carried out, at least 600 miles of Coastal navigation. Though in places the depth just now is 4 feet, yet it

The Cochrane Canal.

varies generally from 2½ feet to 3 feet throughout. I shall in another place show how desirable it will be to introduce a cargo boat drawing 3½ feet of water into general use with the E. C. Canal (Colonel Cotton I believe advocates a boat drawing 4½ feet) and as there must be at least 1 foot of clear depth of water below this, to meet such requirements, it stands to reason that the Canal as now existing, is altogether wanting in capacity.

7. On leaving Shediencooppum lock there is a short cut connecting the Cochrane Canal with the Corteliar river, which here débouches into the Ennore backwater. This cut frequently silts up, and will always continue to do so from its position. Boats in finding their way to Ennore 5 miles distant, take one or other of the branches of the Corteliar according to their draught. There are no towing paths along this stretch, and with contrary winds the passing of boats is a very tedious operation.

Navigation between Shediencooppum and Pulicat.

From Ennore to Pulicat there are 15 miles of winding, and indifferent navigation through a backwater, which has been successively improved by three cut offs; viz., one the Southernmost at Pooyeethvakum, hardly half a mile in length; another made by Mr. Heefke shortly after finishing the Cochrane's Canal, called the Catoopally cut, 1½ miles long; and the last called McDowell's cut off, a few hundred yards in length. Immediately opposite the town of Pulicat a cut has also lately been made, which greatly facilitates communication with the lake, but one bank of which was completely swept away last November. In several places where either the backwater has been left in an unimproved state, or silt has been brought in there are only 1½ feet of water, when the level is that of mean tide.

8. At present between Pulicat and Streehurricottah, some 22 miles, the navigation is through the lake. For the first six miles on leaving Pulicat it is rather tortuous in consequence of the form of the shoals, and for the last three generally impracticable, from the rapid silting up of the southern extremity of the Doogoorauzepatam Canal.

Pulicat Lake

9. Lieutenant Chambers forwarded an estimate amounting to Rupees 98,035 on the 2nd June 1855, which provided for considerable improvements throughout the whole distance, from Shediencoopum to Streehurricottah (40 miles) and among other things for the building of a Lock and Calingulah at Pooyeethevakum. This estimate was sanctioned last year to the amount of Rupees 72,800 (why reduced I do not know) and till stopped by the late limitation of funds, materials were being collected for building the lock this season. Dredging, cutting off angles, and in one place making a long shore cut of considerable length, with the lock works abovementioned, are the main features of the project. These are perhaps the very improvements I should have suggested myself, before the storm of November clearly shewed me, that something more was necessary than the removal of obstacles from a backwater, and rendering the passage deep, namely, isolation of the channel itself, and therefore I must include the whole stretch of these 40 miles of Canal, in their present, and even contemplated state under the head of unsatisfactory navigation, and quite unsuited for the great influx of trade which must sooner or later test its capabilities. As is well known the bank which formed in spite of dredging, at the southern extremity of the Doogoorauzepatam Canal, has presented such an obstacle to the trade of those 24 miles of navigation, that it is only when the lake is above mean sea level boats are enabled to make their way to Madras, just at present Mr. Konig, Assistant Civil Engineer, is actively engaged in making along shore cut of 2 miles, which will help the matter, but the cure is not I fear complete or permanent.

10. From Streehurricottah to Doogoorauzepatam (24 miles) a Canal has been cut for Rupees 47,000. The estimate was framed by Major D'Butts in 1849, and the work finished in 1855. The money spent is sufficient index to the result. Rupees 2,000 a mile for a first class Canal can I think scarcely be expected to lead to any thing but disappointment; still the work done in quantity and quality, is surprisingly good and as I shall afterwards show

Doogoorauzepatam Canal.

(though any thing but up to the proper dimensions at present) how it can easily be made of a first class order. The present dimensions of the channel are as follows, 3 feet deep for 20 miles, 1 or 1′ 3″ deep for the last four, being through the unimproved Doogoorauzepatam backwater. For the first 4½ miles north of Streehurricottah the breadth of the channel, originally 12 yards wide at bottom, has been sadly curtailed by the drift brought in by land winds from the west. From that point to the northern termination, its surface breadth is no where less than 12 yards. No bank whatever exists on the western side for 16½ miles north of Streehurricottah, Lieutenant Chambers forwarded an estimate, for widening and deepening the whole 24 miles, amounting to Rupees 77,620 on the 11th October 1855, which was rejected mainly on the ground of excessive dimensions. On taking charge of the Department, in accordance with Lieutenant Chambers' express desire, I framed in connection with others of a similar nature, for entry in the Budget of 1857-58, an estimate for clearing the silt out of the southern end of the channel, and widening the whole for 16½ miles, in order to form a protective bank on the west and thus save the work already done. This estimate was also rejected as not agreeing with the one forwarded before by Lieutenant Chambers, although, I beg most respectfully to submit, the objects proposed were perfectly dissimilar. To class this portion of the Canal as navigation were impossible.

11. I have endeavoured above to convey some idea of the present state of the 70 miles of Canal, between Madras and Doogoorauzepatam. No adequate notion can be gathered, I am quite aware, from such a description; still the broad fact that it is a straggling line of communication, varying in depth from 3½ to 1½ feet below mean sea-level, devoid as a general rule of all facilities for haulage, exposed throughout its entire length to the effects of storms, will be sufficiently evident to suit my present purpose. As a proof that the shallowness of the Canal has not been over-rated by me, I beg to draw your attention to the following Statement from the Toll records, shewing how often Toll has had to be remitted within the last two years, in consequence of the depth of water not allowing of full cargoes being carried; and when it is remembered that the draught of the boats employed in the trade (they are more dishes than boats) hardly ever exceeds 2½ feet, it will be sufficiently clear that no improved style of boats can be introduced in the present state of affairs.

Canal deficient in capacity for even the shallow boats at present used.

In 1855 the Toll had to be in part remitted for 6 months.
In 1856 for 9 months.

Even under reduced Tolls a great deal of hardship, and labour is entailed in forcing the boats over the shallow portion of the Canal, and as the strength of a rope must be tested by that of its weakest strand, there is no doubt the capacity of the Canal ought to be estimated by its minimum depth.

Canal section far below that recognised in all civilized Countries.

12. That the depth of the Canal is far below that recognized in Europe and America, the following table taken from the best authorities will distinctly prove.

	European.			American.				
	General Section of English Canals.	Caledonian Canal.	French Canals.	Erie Canal enlarged dimensions.	Chesapeake and Ohio.	James river Canal.	Welland Canal Canada.	St. Lawrence Canal between Long Sault and Cornwall.
	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.
Surface width.....	40	110	52	70	60	50	56	132
Bottom do.	24	50	36	42	42	30	24	100
Depth.....	5	20	5	7	6	5	8	8

13. It will now be right to consider what will probably be the future of the Coast Canal, for without this knowledge mistakes will be made as to the [illegible] tion, and nothing short of disappointment will follow.

Future of the E. C. Canal.

First,—as to its ultimate length refer to the Committee Memo. [illegible] the Madras Presidency, published in 1854. [illegible] length contemplated for the Canal—its present [illegible] tance.

Its length.

Second,—as to the sources of traffic. [illegible] stration as it stands, [illegible] certainly between the [illegible] and bulky goods, the cost of carriage [illegible] mile, and there is no doubt that on the [illegible] craft, and the introduction of an improved [illegible] easily transported for 2 pie. As a general [illegible] can never be taken under 2 annas per ton [illegible] nal navigation will be just it. If there were [illegible] line, constructed so as to feed the Coast Canal [illegible] tion by road, between the several centres of [illegible] (leaving out the slight charge on transit [illegible] first set of roads, is shorter than that by the sea [illegible] transport to boot. Applying this rule in [illegible] tation, with the exception of places in Malabar, South Arcot and a few on the Coast Canal. Even lized. I believe that by completing a safe [illegible] ed from the dreadful tempests which [illegible] European and American ships would [illegible] pick up cargoes by piecemeal at various ports [illegible] the gradual shallowing of the harbours of Masulipatam, &c., appears to me to have [illegible] thus an easy solution. It is very possible that I may take too [illegible] the Coast Canal, but such is my conviction and [illegible] the magnitude and importance of the work have been completely under estimated. The roads either under improvement or completed which will serve to feed the Canal between Ennore and Madras are [illegible] as follows:

Sources of traffic.

The proposed breakwater at Madras intimately connected with its welfare.

Feeders for the Canal North of Madras.

1st. That between Bairagarh and Hyderabad.
2nd. Ongole and Hyderabad.
3rd. Cauvely, Caleghery, Dharapoor, &c.
4th. Nellore, Sungum, &c.
5th. Gooloor, Chittaral, &c.
6th. A Canal which it is proposed to [illegible] Kistnapatam in Nellore.

Here there are already six lines of direct communication with the outer roadstead of Madras, which at no very distant period may affect the Canal. Allowing these lines a first class traffic on each of them, according to Captain [illegible] list (Chief Engineer Coast Canal No. 9970 of the 2nd February 1857) 200 carts per day, 34,700 tons a year, the total amount that brought down would be upwards of 3,00,000 tons a year. The [illegible] above enumerated will gradually assume the proportions of 2nd class roads, (allowing 50 carts per day) the supposition that at least, 3,00,000 tons a year (the exports of produce of Hyderabad, Kurnool, Bellary, Cuddapah, Guntoor and Nellore) may at no distant period be thrown on the Canal will not appear overdrawn. As the Canal extends further south in addition to the produce of the Deltas of the Kistnah and Godavery, Nagpore may contri-

bute to swell a traffic already of such vast proportions. The expedition, safety of the transport, the ease with which transhipment of goods is effected on a Canal &c. will prevent any successful competition on the part of the native Sea going craft. Taking risk, and cost of transit, I have been given to understand that freights, from different points on the Coast to Madras, by Sea, is not now under 6 or 7 pie per ton per mile; which itself is conclusive. I believe it will be no over estimate to take 5,00,000 tons a year, as the probable quantity gathered gradually from the far north, which must pour into the terminial basin at Madras; and this is the traffic for the reception of which the present Canal is intended! How can any thing but disappointment and dissatisfaction ensue.

Probable amount of traffic in one direction.

14. I now turn to the second division of my report, the proposal of a new theory of construction for the Canal, and in doing so I am quite aware of the difficulties before me, and my own inability to frame such a system, as will probably meet the approbation of those better able from experience, and ability to judge than myself. What I shall state will doubtless lead to discussion, which is most desirable in the present state of affairs, as leading probably to the project being brought much more prominently to notice than has hitherto been the case.

15. In the first place I shall define the present received system of construction. I may be wrong in saying that there is a recognised theory of construction, but though not defined in actual words in any public document, yet from the way in which the Canals north and south of Madras have been executed, and the estimates for extensions framed, I consider myself justified in considering it a recognised theory. It is considered that by excavating a channel $3\frac{1}{2}$ feet below the mean level of the Sea, and by placing Locks at the extremities of such portions of it as are next to a bar, generally open to the Sea, we shall, by admitting water at spring tide, pond-back so much water in the intervals between the locks, as materially to increase the depth, and thus secure free navigation for craft of considerable tonnage. In lieu of this system I beg to propose that the channel shall be excavated much deeper, that the banks on either side be broad and high, that locks be dispensed with, and in their stead simple barrier gates be substituted, to be closed only in times of flood perhaps once or twice each year.

Present recognised theory of construction defined.

Proposed theory construction.

N. B. The theory here advocated I beg to say is only proposed to meet the circumstances of the ground and tide up to Kistnapatam north, and Sadras south of Madras, a stretch of say 130 miles.

16. High banks, and a corresponding section of channel as a principle, has already received the sanction of Government, Extract Minutes of Consultation, No. 370 of the 26th February, so for the present I may pass on to the consideration of the second point of my proposition—the rejection of Locks.

17. 1st, as to the advantage gained by their employment. Throughout the length of coast, between the Ennore and Doogoorauzepatam bars, the difference between high and low water at spring tides does not exceed $2\frac{1}{2}$ feet, in ordinary springs 2 feet, and at neap tide $1\frac{1}{2}$ feet, or in other words the water on an average rises one foot above mean sea level, and falls an equal quantity.

Employment of Locks as a means of gaining depth questionable.

18. From the small opening usually of the bars, the rise and fall in the backwaters will evidently be much less than on the open coast, and it will readily follow that a Canal, 10 miles in length, fed by two small openings at either end, can by no means receive even the same benefit as the backwater. True as each spring tide rises, the gates open for several days consecutively and admit water to the full height of the tide. There is naturally a great loss from the leakage of the Lock and the associated Calingulah, as well as from evaporation and absorption throughout the Canal, the Fort ditch, and Cooum river with which it is connected, to say nothing of the consumption of water in the lockage of boats an item which must increase directly with the trade. Taking one day with another throughout the year, I do not think 6 inches of depth is added by the action of the Lock.

19. Where there no locks, the tide freely flowing and ebbing in the channel, would keep the height of the water as a general rule at mean sea level practically above it.

20. At present I am engaged in making observations on the action of the Shediencoopum Lock, but the attendant circumstances will prevent this from being conclusive.

Ultimate depth gained by the use of Locks.

21. I consider I make a very liberal allowance in assuming one foot of increased depth as due directly to the action of the locks.

22. *Second*, as to the price paid for this one foot of increased depth. The bars which open generally yearly, or continue so from year to year, between Madras and Doogoorauzepatam, (70 miles) are those of Ennore, Pulicat, and Doogoorauzepatam, consequently the following will be the Locks required in following out the present principle to its legitimate conclusion.

Places.	Number of Locks.	Opening to the.	Remarks.
Doogoorauzepatam...	2	1 North. 1 South.	
Jonaghurpalem...	1	North.	
Pulicat...	1	South.	
Pooyeethevaukum.	1	North.	Some materials have already been collected for this.
Shediencoopum...	1	South.	Already built and used for about a year.

Six Locks therefore, with isolated intervals of Canal between them, would have been the ultimate state of these 70 miles of navigation.

23. Attached to each lock must be a powerful escape to provide for any access of water, there must also be an establishment to work the Lock, and quarters built for the establishment. The outlay may therefore be readily computed.

Each Lock with its escape would cost not less than 30,000 Rupees. That at Shediencoopum was built for 29,000 Rupees, but experience has shewn that in some points more expence will have to be gone to in future.

Their cost.

6 Locks at 30,000 Rupees each		1,80,000
Cost of establishment for working each	Rupees.	
1 Goomastah..... @	12	
1 Head Lascar... @	7	
5 Lascars at 5 Rupees...	25	
	44 per month.	
Yearly outlay for each Lock is	Rs. 528	
and for the 6 Locks.....		
Capitalizing this yearly outlay at 5 per cent. we have the real expense of working the Locks.....	3,168	63,360
Quarters for each of these establishments according to the estimate sanctioned for that at the Shediencoopum Lock for each 2,300 Rupees or for the 6 Locks.....		13,800
		2,57,160

In round numbers we would have to pay 2½ lacs for an additional foot of water for 70 miles.

Cost of Locks compared with simple excavation.

24. Taking a section of channel 20 yards wide at bottom, depth 4 feet slopes 2: 1—. the sectional area in square yards will be 81, and supposing 1 anna be the average price of excavation per cubic yard we have

31×1,760×70=2,38,000 Rupees from this it will appear that the contemplated outlay on Locks, by which only one foot of additional depth is secured, would more than suffice for the excavation of a channel of even greater dimensions than that now given to the Canal, and if therefore the argument be correct they cannot be considered as an economical means of gaining depth.

25. Again unless erected in water deeper at least by one foot than the rest of the Canal a stoppage of the trade must occur periodically in low tides, at the entrance into the backwater, that is at the tail of each Lock; and to secure a position low enough for the structure, must of necessity involve very considerable expense, from the quantity of baling required while laying the foundations.

Locks questionable on other grounds.

26. Locks are moreover so many interruptions to trade, to say nothing of the opportunities for roguery afforded to natives in the position of Lock Goomastahs, &c., where on some paltry excuse they may cause frequent delay unless bribed to procure expedition.

Locks hindrances to trade.

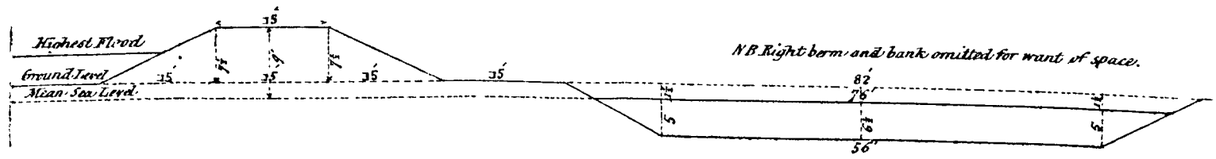
27. In place of gaining depth by means of Locks I think it will now be evident the same advantages could be secured in a much higher degree by expending the money in simple excavation. I therefore now propose examining the section proper for the work.

28. I wish however before passing from the subject of Locks, to explain away an apparent contradiction between what I have above stated, and a remark in my report* No. 386 of the 16th January, that Locks "were works whose necessity could not for a moment be doubted." The necessity there asserted merely applied to the system of shallow channels which at that time I was not prepared to confute, or replace by another. It was only on the admission of the principle then contended for, that I was led to re-consider the whole subject of the Coast Canal.

* Para. 16.

29. Having lately inspected the Canals in Guntoor, and had the advantage of Captain Orr's opinion as to the section proper for channels situated in similar circumstances, I have determined on the following section which will be found slightly different from that given in the report before mentioned as suitable for a bottom breadth of 20 yards. The main difference consists on the depth which I now wish to increase

Section of proposed channel.



from 3½ feet to 5 feet. One foot has also been added to the height of the banks making them 9 feet in the clear above the mean level of the sea, which will secure their being 2½ or 3 feet above the highest flood line. The bottom breadth is 18⅔ yards instead of 20, but, from the additional depth, the surface width in the present instance will be only 4 feet less than the other viz. 76 feet. As the berm is 1½ feet above the mean tide, it will almost always be dry, and well adapted for the towing path. The area of this channel is 50 square yards or double that of each bank.

30. Allowing the average rate of 1 anna per cubic yard (which I think sufficiently liberal, considering, I shall presently propose a means of baling the excavations for the work people employed) the expense of such a channel will be $\frac{50\times1760}{16}$=5,500 Rupees per mile.

31. Two objections may possibly be urged against the section given above, the 1st, is that the height of the banks above mean tide 9 feet is excessive, as it is an expense gone to for the purpose of providing against an access of water which could only occur once in ten or twelve years, and that as no provision is ever made in the construction of tanks inland to provide against such extraordinary freshes, none need be made with the Eastern Coast Canal and that a protection against ordinary floods would suffice. The second objection will probably be that, in excavating to such a depth below mean tide, water will come-in in such quantities as to swamp the works, and render impossible the full excavation.

Two objections which may be made to the proposed section.

32. First then as to the height being excessive. During such extraordinary falls of rain as those of October 1846 and last November, tanks as a common rule burst their bunds. The water which ought to be stored up for cultivation is certainly lost, but very little injury is sustained by the bund itself. A small expenditure in closing the breach makes the tank as good as ever. The District Engineer looks upon it as a matter of course and as no foresight can, with a reasonable expenditure, secure the works against such occasional visitations no provision is made. Every bund that burst however, every inch of rain that falls, hurries the flood more rapidly towards the low-lying lands of the coast, there to heap up behind the long line of sand-hills which follow the sea line from north to south, and check its further progress. These sandy barriers are unfortunately not so easily breached as a tank bank and the accumilated waters must flow off by slow degrees through a small number of river bars, situated at intervals along the coast and which serve as safety-valves to the pent up flood.

1st objection, excessive height of banks.

33. It is right through this great natural trough, as I may so term it, that the Eastern Coast Canal has to be carried. Its banks will have to stand half submerged for days, while the bars are opening and slowly venting the flood. What would then become of them if overtopped? the answer was given last November, dissolved, scattered, hardly a trace left. Left to itself this sketch might lead to the fear that the whole work was insecure, but this is a danger as imaginary as the other is real. With high powerful banks such as those proposed, there is nothing whatever to dread, and once they have grassed themselves, I anticipate no repairs whatever being needed excepting from accidental circumstances. The safety of the banks consists in two facts, one, that after a certain accumulation of water, say to 5 feet above mean tide, every inch of additional rise, from the usually gentle slope of the country towards the coast, requires twice or three times the quantity of rain that the inch immediately preceding did, and I believe under no circumstances could a general rise all along the coast take place of more than 6½ feet, which would still leave 2½ feet of the banks high and dry. The other fact in which consists the safety of the bank, is that the advance of the flood is gradual, forming by degrees vast fields of comparatively still water. The only place where a rush or current occurs, is at those points where it finds its way into the sea and where consequently some abrasion of the banks must ensue if not provided against. At such places I propose securing the ends of the banks by means of rough stone aprons, and masonry retaining walls.

34. The second objection to the proposed section, that in excavating to a depth as 5 feet below mean tide, such quantity of water will have to be contended against as to prevent its accomplishment, may I think be met as follows. Hitherto no difficulty so great at all events as to interfere with the rates, has been found in digging the channel to 3½ feet below mean tide. This has been effected throughout the Sadras Canal 35 miles, also in many places to the north of Madras. Just now a mile of excavation has been finished under circumstances of peculiar difficulty at Streehurricottah, the water standing above the mean level of the sea in the pits; only a trifling present has on this occasion been made to the Contractor above the rate agreed upon, 11 pie per yard.

2nd objection, too great depth of channel.

35. Supposing the excavation be accomplished thus far, (3½ below mean tide) I do not think any very material difficulty will present itself in getting 11 feet lower, if pumps of sufficient magnitude, worked by steam or other power, be employed in keeping down the water. I have lately examined pumps prepared at the Bairah stores, 20 inch diameter, worked by a 10 H. P. water wheel, which Captain Orr calculates

Use of large pumps suggested.

will lift 250 cubic feet per minute, through 3 feet. Say there was half a yard depth of water in the channel, and that in working each stretch of the Canal lengths of a mile from either end were successively put in hand, each succeeding portion being made to receive the baling of that in advance towards the middle, to find how long this double pump would take to empty the Channel.

Supposing there be 1½ deep of water; 88½ square feet = section of water in channel $\frac{88\frac{1}{2}\times 5280}{250} = 1870$ minutes = 31 hours, or the time required for pumping* it out. A day and a half, at the outside two days, would perfectly dry the channel, and the labor of keeping it so would be comparatively easy. Two 10 H. P. engines would thus enable us I should think to have finished up 20 miles each season, the work being supervised by one Executive Officer and two Overseers. There is no reason why double that work or more might not be put in hand as soon as the system is properly organized, and the requisite plant procured.

36. From this I hope the plan of a deep channel will appear feasible; but in estimating the outlay, the expense of baling must be added to that of excavation; to the examination of this I shall therefore now proceed.

37. With a moderate number of Wodders, the remaining 1½ feet in depth could be finished at the rate of a mile a week. Six miles of much more severe work were got over in a month on the Sadras Canal last year under the supervision of an Executive Officer, so I cannot think this too sanguine an estimate. The engine being placed on a flat, could be floated successively from one mile to the other, and thus 10 miles might easily be completed in three months. At a rough calculation I think I may take with a liberal allowance for wear and tear of engine, its working expenses during this time at Rupees 3,000 or Rupees 300 a mile, 5,500 Rupees was the amount estimated for simple excavation, which added to the above, gives Rupees 5,800 for the whole.

Probable working expenses of the Pump

38. The remaining part of my scheme is that of providing the extremities of the Canal, where debouching in estuaries communicating with the sea, with barrier gates, for the purpose of excluding floods when likely to occasion too great a scour on the towing paths, and banks of the Canal; in fact enabling us to isolate completely each portion of the channel whenever it may seem necessary.

Employment of barrier gates to exclude high flood.

39. Lock gates opening inwards must necessarily admit instead of exclude floods; the barriers I propose consist of one simple pair of lock gates opening outwards, which when closed will effectually prevent a drop more than is absolutely needed entering the intervening channel. If they are not shut till a foot or 1½ fect rise has taken place, they will naturally swing open when the flood shall have fallen below that point, and thus they will never as might be supposed require to be opened against a head of water. I think if we allow 5,500 Rupees for each set of these, and the masonry protective walls, and aprons at the extremities of the embankments, it will be sufficient. Their positions would correspond precisely with those of the Locks which under a continuance of the present system would have been successively added.

We have therefore $\frac{6\times 5500}{70} = 471$ Rupees the cost per mile due to these works, say 500 Rupees. No establishment need be kept to work these gates; 3 or 4 Coolies procured by the Goomastah in charge of the Canal will do all that is required on emergency.

Outlay on the two systems directly compared.

40. Summing up the items of expenditure above specified, we have, for excavation and baling per mile.....5,800 Rupees
barriers..... 500 „
or..... 6,300 „
outlay on proposed system without extras of any kind per mile.

Comparing this with the present method, area of section 32 yards, $\frac{32\times 1760}{16} = 3{,}520$ Rupees amount per mile on excavation $\frac{2{,}50{,}000}{70} = 3{,}570$ amount due to lockage (vide para. 23)

* Note.—On examination I find the work of the pump altogether under-estimated which arose probably from an error on my part in entering the figures in my note book 250 cubic feet of water through 3 feet is about equal to 46,500 lbs. through 1 foot per minute, whereas 10 Horses Power is calculated at 3,30,000 lbs in the same period and through a equal lift. A 10 H. P. engine would therefore perform just 7 times the work. I have above calculated which will effectually meet all contingencies of rapid percolation, &c.

Rupees 7,000 per mile without extras, 7000−6500=790 Rupees of saving per mile, which would actually be the case under any circumstances as extras are excluded from both sides of the calculation; and I think I may fairly sum up the advantages in addition to the money saving by saying there will be,

Summary of advantages from proposed new system.

1st. No locks to delay the trade.

2nd. No chances of interference from extortionate or dishonest agency.

3rd. A average of 5 feet depth of water throughout the Canal, sometimes as much as 6—never less than 4 feet.

4th. Security of the banks and towing paths from the effects of floods.

5th. The possibilities of introducing a description of boat which may be worked with a speed and economy now altogether unattainable.

6th. The possibility of improving the navigation at any future period should such a contingency arise *without in the least interfering with the existing trade of the Canal.*

7th. The knowledge on the part of Government of the object before it the work to be done, the expense to be incurred and the probable results.

41. The theory of construction I have above suggested is I beg to repeat confined to the limit of Kistnapatam on one side and Sadras on the other. As the Canal strikes further up the Bay of Bengal, and each hundred miles adds perhaps one foot to the rise and fall of the tides, it will no doubt be right to consider the introduction of Locks in a very different light. The peculiarity of soil too may influence the basis, &c. for all of which careful examination and discussion will be requisite.

42. As to the manner in which the results described in the first part of the report have been brought about, I have no wish to enquire; but one thing is clear, that when the Government formed the present Department it had the express recorded opinion of the leading professional men at the Presidency that 10,000 Rupees a mile would be the probable expenditure on the Canal, and that a general sanction should be given for the sum required, in order to free the Superintendent as much as possible from petty details in the conduct of a work of such magnitude. How therefore it was expected that justice should be done to the views of those who first had the design by expending, as I have shown in a previous Report* ½ of the sum, and giving but little freedom of action to the Superintendent it is difficult to see. This I honestly believe was the main, but not the only cause, why the undertaking while bearing a great name, was in reality reduced to the smallest dimensions.

Principal reason assigned for the present unsatisfactory state of affairs.

* Para. 11 letter No. 400 of 25th January.

43. However I have no wish to dwell on this point of the subject, but shall at once proceed to calculate the expense of the system which I have endeavored to show ought to be substituted and the real profits open to both the Government, and the public, from [illegible] preceding correctly with the work.

44. In uniformity with the opinion advanced in the second part of this report, I shall now investigate the probable expense of constructing the Canal as far as Kistnapatam, 88 miles north of Madras, for until that point be reached, and Nellore be placed in direct communication with Madras, nothing really deserving the name will have been effected. I have in para. 40 shown the probable outlay in constructing the Canal on the principle I propose without extras of kind will probably amount to 6,500 per mile. It will now be necessary to consider these extras.

45. Escapes for drainage east or west of the line will form a principal item, but as the great endeavour will be simply to divert them into neighbouring tidal estuaries the expense will not be very considerable. It would only make this report excessively long to go into the various cases, and nothing after all but a general estimation of the cost could be arrived at. We may on a liberal allowance say that in constructing a Canal from Madras to Kistnapatam backwater, the outlay would average Rupees 9,500 a mile, which would include the erection of [illegible] public bungalows, with choultries on the line of Canal, with the construction of wharfs, basins, planting &c. N. B. The Public Bungalows might be built at once, so as to answer for the residence of the executive Officers during the excavation of the channel, and then transferred to their proper use on its completion and a cessation of their work.

Gives a rough calculation of the extras connected with the proposed system

Not one bridge will be required on this stretch.

46. With an expenditure of Rupees 9,500 per mile, I shall now endeavour to show the direct advantages to the Government and the public in constructing the Canal as far as Kistnapatam.

Advantages to be gained by Government and the Public by constructing the Canal as far as Kistnapatam.

47. Nellore is 108 miles from Madras by road, and taking the cost of carriage as low as 2 annas per ton, per mile, we have the price of conveyance Rupees 13, Annas 8. The termination of the Canal in the Kistnapatam backwater, is about 88 miles from Cochrane's Basin, and the new metalled road already half completed from Nellore to that point Kistnapatam, is 16 miles long. On the Canal at present the usual cost of carriage is 3 pie per ton per mile, but as there will be a transhipment of goods and to prevent any possible doubt being entertained, I shall take it as high as 6 pie or double the real amount, and three times the probable one when a proper system of boat building shall have been adopted.

We have therefore.

1 Ton 16 miles land carriage @ 2 annas	2	0	0
Do. 88 do. water do. @ 6 pie...	2	12	0
	4	12	0

48. Although I have before pointed out that probably at some future day the Canal will bring at least 5,00,000 tons a year to Madras it will here suffice to take the probable trade between Nellore and Madras at 300 tons daily, 1,10,000 tons a year about the amount classed in Captain Johnston's road estimate as 2nd class traffic.

300 Tons daily by the Northern Trunk road would, at the rate before specified cost the community	14,78,250
While the same amount by Kistnapatam and the Canal will only cost it.	5,20,125
Thus saving yearly to the community...	9,58,125

or as the whole calculation is taken on unfavorable grounds for the Canal say 10 lacs.

49. Now to estimate the expense of constructing the Canal thus far. There being 18 miles of the Pulicat lake which may with the occasional use of the steam dredge, be easily retained at such a depth as will suit a first class navigation, we may take (88−18)=70 miles as the length of Canal requiring to be constructed 70 miles at 9500=6,65,000 Rupees.

Amount which must be raised by tolls.

	Rs.
5 per cent. on which is...	33,250
Repairs at 150 Rupees per mile.	13,200
Yearly charge of 2 Toll establishments one as now at Madras, the other as I shall propose at Doogoorauzepatam at 150 Rupees a month each...	3,600
Total.....	50,050

or the least amount which must be raised by tolls on traffic each year.

50. The traffic on the Canal for the current year will more than likely exceed 1,10,000 tons—67,000 tons having been carried in the 1st or worst six months and as we have above assumed the traffic from Nellore at an equal quantity yearly (vide para. 48) the amounts realized by toll will be;

Money advantages from such a Canal to be gained by the Government and the community.

1,10,000 at 8 annas per ton...	55,000
1,10,000 at 4 annas do.	27,500
Toll which will be levied yearly an a moderate computation	82,500

This will leave (82,500—50,050) Rupees 32,450 or just 5 per cent. yearly over and above the interest 5 per cent. on the prime outlay, for the advantage of Government, while the community will only be taxed (Rupees 55,000 on Rupees 10,00,000) to the amount of 5½ per cent. on the gross saving. The favorable results thus shown are manifestly far under what will be the case, on the effects of cheap transit influency the traffic as it has done in all similar cases.

51. Having now explained at considerable length my views as regards the Coast Canal, the faults at present apparent in the system of construction, and the benefits which a really good first class navigation would confer upon Government, (who in addition to the gain of 3 per cent. over and above the interest on the outlay, would participate with others, great advantages in the saving effected on the transfer of Military Stores, &c.) and the community in general, I may venture to suggest the entire remodelling of the Canal, and though it may appear at first strange the rejection of every part of the present existing line between Madras and Pulicat from the Eastern Coast Canal.

Proposes the substitution of a complete by new line between Madras and Pulicat.

The Government has nothing to lose by such a change.

52. In the first place that Government will be no loser by such rejection can be easily demonstrated, although it is true some money lately spent may appear at first sight to be lost.

In continuation of the return of receipts and expenditure on the Canal north of Madras Memorandum on the Cochrane's Canal para 6, 1st Report of Commissioner's on the Public Works of the Presidency, I beg to annex the following Statement which shows very nearly the exact financial position of the work at the present moment, and from which it appears that taking into account all the expenses incurred by Government from 1856, when the Canal became Government property either in regard to establishment repairs or extension and improvements, a net receipt has been effected of nearly 3 lacs of Rupees.

Fuslies.	Annual receipts.	Charges.			Amount expended on new work up to this period.	
		Establishment and Saderward.	Repairs.	Amount paid to Lessee.	Designation.	Amount.
	Rs.	Rs.	Rs.	Rs.		Rs.
1246 to 1260 Report P. W. para. 6.....	4,21,695	35,966	18,959	1,12,852	Northern Canal.....	47,275
1261	31,111	2,076	1,000		Embankment of Mosquito Valley.....	1,285
1262	30,121	2,076	2,000		Cleaning of Sholaput river.....	2,567
1263	28,131	2,076	3,000		Lock and Calingulah at Streehurricottah.....	28,259
1264	29,109	2,039	3,000		Streehurricopum.....	13,302
1265	23,000	1,791	2,812		Bund.....	9,538
1266	20,592	1,791	5,122			
1267	25,080	1,791	6,622			
Total Receipts..	6,21,395	10,525	44,705	1,12,852	Total charges.....	2,36,083
Deduct disbursements.....	3,31,671				Total disbursements.....	3,31,671
Net receipts. ...	2,89,724					

N. B.—Some of these items have been assumed but the amounts themselves are so small as to be of no material consequence.

53. In para. 17 of the Commissioner's Report they say, "It appears to us that the instructions of the Honorable Court on the subject of Ferries, are equally applicable in principle to Canals, and that with reference to those orders and from general considerations, we think that Government ought not to stoop to derive a revenue from works of this kind, any more than they would wish to do so from a road. We think that the tolls should be fixed at a low rate in order to afford the greatest amount of facility to traffic and that the collections should form a separate and distinct fund.

Extract from Commissioner's Report P. W. of the Presidency, Memo. on the Cochrane's Canal.

"1st. For current expenses and repairs.

"2nd. For the improvement and extension of the work.

"3rd. For the formation of new similar works in the same district or vicinity.

"4th. For making or improving roads and bridges, &c. &c."

54. Feeling convinced that the Government hold precisely the same liberal views as the Commissioners, I place below a statement of the several sums already sanctioned—but not expended and the net receipts from the Canal up to the present day, the amount of which might, I should think, be looked upon as a fund at once available for commencing work to the extent, and on the plan, I have endeavoured to show is the one likely to promise the most certain and beneficial results.

Sums which might now be considered as available for the work.

Amount sanctioned for continuing the Canal north from Doogoorauzepatam to Kistnapatam,.....	1,39,664
Do. do. for improving the Canal between Shediencoopum and Streehurricottah.....	72,800
Net receipts as per foregoing table.....	289,724
Total which might now be reasonably considered available for commencing the work *de novo*.....	5,02,188

55. One thing is clear, the opportunity is most favorable for undertaking a change of the proposed nature; if lost, the whole scheme will be hampered by a faulty construction, and as is now the case with the great Western Trunk road, retreat will be sought in vain, when the expense of maintenance will be double what it might have been, and when a change without materially interfering with commerce will be impossible.

The present the proper time for decision.

56. It may now be asked what is the distinct plan of operations which I advocate in regard to the selecting and working out the new line.

How the scheme may be put in practice.

1st. As regards that between Madras and Pulicat. Nothing can be simpler than to lay out a line to the east of the present one, which shall be comparatively straight, hardly touch a backwater, and not be interfered with by any drainage. There is but one point about which there can be a question, and that is as where should the terminal station be placed. As in the other cases I shall give my opinion freely, I think the basin should be placed immediately north of the present Railway station or as near to the beach as circumatances will admit. In rejecting the present line of Canal, I have no intention of recommeding its destruction or even neglect; it would still continue to be as now the mainsupplier of all consumable articles for Madras, and as such would be cared for, and connected with other Canals directly affecting the immediate wants of the community.

From Madras to Pulicat.

57. The Eastern Coast Canal however according to my idea will mainly, if not exclusively, carry articles for exportation and as such its terminus should be as near the beach as possible, to facilitate the direct shipment of goods. Either store houses at the basin or a train road along the beach would offer every facility to trade. If any expedition be used the 1st yard below mean tide could be excavated by this time next year along the whole line to Pulicat.

58. 2nd.—As regards the line north of Pulicat or rather Jonagurpolliam the point which for the future will be considered the southern termination of the Doogoorauzepatam Canal.

As yet the returns from the Doogoorauezpatam Canal have been almost nothing, the terminus itself is unimportant or rather it is no terminus at all, consequently we might shut up these 24 miles of so called navigation, divide it by bunds into sections of one mile each, pump out the water, and in six months from the commencement of the working season next year, be able to open that portion of the line as a first class Canal.

Means of working out the proposed scheme on the Doogoorauzepatam Canal.

59. From Doogoorauzepatam to the Soornamookey will involve somewhat more care, still there is no reason why it should exceed the general estimated sum.

60. Between the Soornamookey and Rampairoo rivers (or Kistnapatam backwater) a careful examination of the ground will be required, and I think a high level channel will have to be adopted.

61. The work as a whole from Madras to Kistnapatam, being almost exclusively confined to simple excavation, European Overseers of good character would be quite equal to the direct supervision, under Officers acting as Assistant Superintendents. A supply of six 10 H. P. pumping engines might at once be ordered from England (costing say at £ 10 the 1 H. P. £ 2,100 or 24,000 Rupees.) The pumps and barrier gates, could be put in hand without delay, and might all be ready by the end of the present year.

Supervision and Machinery.

62. In fine there is nothing whatever to militate against the rapid execution of the project, but the want of a free sanction of the money required, and the freedom of the Superintendent, from much of the small estimating and reporting by which he is at present very much hampered.

63. I do not mean by this that the Superintendent should be a perfectly irresponsible agent, but simply that the general basis having been well laid down either by the Chief Engineer, or by a Committe of Engineer Officers, he should be free to exercise his own judgment, and make expenditures within certain limits which might be determined by the same authority.

64. The Superintendent feeling his complete responsibility for the success of the work, would naturally exert himself to secure success in a much higher degree than is now the case, where the onus of blame or the due meed of praise is distributed over a wide surface.

A thoroughly practised working Engineer recommended as Superintendent.

65. The skill and energy as well as thorough mechanical proficiency of Mr. Kennedy, would be invaluable in conducting the stores, which after all is the only portion of my project needing much scientific direction; still I must confess, though seeing as I believe I do pretty clearly the bearings of the case, that the direction should be confided to more able and practised hands than mine, should the Government decide on carrying out the project at all in the manner suggested. I can only say I shall most willingly resign my position to any other Officer whom the Government may wish to appoint, for the execution of what I believe will prove itself to be one of the greatest blessings to the inhabitants of the Peninsula of India yet designed, an honor to civilization and to the Government under whose auspices it was proposed and brought into being.

66. I had proposed touching on the subject of a new style of cargo as well as passenger boat, but having so much exceeded the limits I had at first intended, I need only say that in almost all respects they would differ from the ones now used, and resemble as much as possible the European models, being long and narrow, and calculated to carry 100 to 150 tons with a draught of 3½ feet.

Letter from Captain G. C. COLLYER, Superintending Engineer Central Circle; to Colonel C. E. FABER, Chief Engineer dated 11th May 1856.

Sir,

I have the honor to offer the following remarks upon the accompanying explanation from the Superintendent of East Coast Canal, called for in Extract Minutes Consultation No. 371, dated 26th February 1857, with reference to the opinion expressed in his report No. 400 dated 27th January last, "that the Canal from Shadiencoopum Lock to Doogarauzpatam requires "thorough revision, otherwise dissatisfaction and disappointment are surely in the future."

2. The Superintendent commences his report in para. 5, by a description of the existing navigable Canal extending from Madras to Doogarauzepatam 70 miles to the north, and for the purpose of illustration he divides this distance into 4 reaches.

1st. The so called Cochrane's Canal as for as Shadiencoopum Lock a distance of 7 miles (Artificial.)

2nd. The reach from Shadiencoopum to Pulicat, 17 miles of improved tidal estuary.

3rd. The portion of Lake navigation between Pulicat and Streehurricottah, which is the southern end of the Doogarauzpatam Canal 20 miles in length.

4th. The so called northern, or Doogoorauzpatam Canal 24 miles.

3. In para. 6, the Superintendent states what he believes to have been Mr. Heefke's object in cutting Cochrane's Canal, but I cannot see why it should be supposed that the Canal was not cut sufficiently deep, or upon what grounds he founds his opinion that it was intended simply for a third class navigation; in the absence of any knowledge to the contrary it might as well have been assumed that the Canal was originally efficient, but that it had, from want of the consideration that it deserved, been allowed gradually to deteriorate a fact which admitted on all sides was attempted to be remedied in the year 1853-54, and for the complete remedy of which Colonel Cotton proposed the Lock at Shediencoopum, since constructed, but it is said by the Superintendent not to answer the purpose, and that "it had failed in the main point which "was to make this portion of the Canal a fit termination of what it must one day be, if the pro-"ject be carried out, at least 600 miles of Canal navigation."

4. Until the Lock can be shewn to have failed in keeping up a head of water it seems to me, that its efficiency should not be condemned, because the Canal is not equally deep throughout, the Canal is in some places only 2½ feet deep while in others it is 4 feet and I apprehend that it may be made 4 feet deep every where, and I can see no reason why it should not be so, or why it should not be cut deeper if required.

5. On leaving Shediencoopum Lock there is a short cut connecting the Canal with the river Cortiliar, which here, the Superintendent states, debouches into the Ennore backwater. This cut, he states, frequently silts up, and will from its position continue to do so.

6. From Ennore to Pulicat the navigation is described as widening and indifferent though attempts have been made to improve it, immediately opposite the town of Pulicat, a cut has been made which greatly facilitates communications with the Lake, but one bank has been swept away, and he adds that in several places where either the back-water has been left in an unimproved state, or silt has been brought in, there are only 1½ feet of water when the level is that of mean tide.

7. In para. 8, he observes that the first six miles of the 22 between Pulicat and Streehurricottah are tortuous, and the last three generally impracticable.

8. In para. 9, he states that the improvements between Shediencoopum and Streehurricottah, recommended by the late Superintendent were the very improvements he should have suggested himself; had not the storm of November clearly shewed him that something more was necessary, than the removal of obstacles from a back-water, and rendering the channel deep, namely the isolation of the channel itself. And as an illustration of this, he points out, the formation of a shoal in spite of dredging, at the southern extremity of the Doogoorauzepatam Canal.

9. In para. 10 he describes the condition of the remaining portion of the Doogoorauzepatam Canal, which he says in its present state is disappointing, but that it can be made into a Canal of first class order, and he sums up the description of the Canal as being a struggling line of communication, varying in depth from 3½ to 1½ feet below mean sea level, devoid as a general rule of all facilities for haulage and exposed throughout its length to the effect of storms.

10. He then shews that in consequence of an insufficiency of depth, Toll had to be remitted in 1855, for 6 months, and in 1856 for 9 months.

11. He then estimates the enormous traffic likely to come upon this line, and shews that the Canal of its present dimensions even supposing it were sufficiently deep is inadequate. Having explained the defects of the Canal he introduces in para. 11 a subject for discussion, viz. the future of the Canal, and first he defines the present principle of construction to be a channel excavated 3½ feet below the mean level of the Sea, which by Locks at the extremities of such portions of it as are next to a bar generally open to the Sea, admits water at spring tides, so as to equalize the depth, and thus secure free navigation for craft of considerable tonnage.

12. His own counterproposition recommends deeper Canals, that the banks on either side be broad and high, that Locks be dispensed with and that in their stead simple barrer gates be substituted, to be closed only in times of flood and for reasons specified in para. 41 he advocates this particular construction only between Kistnapatam and Sadras; a distance of 130 miles.

13. He considers the advantage to be gained by Locks questionable, and states that the difference between high and low water at springs, ordinary and neap tides is only 2¼, 2 and 1¼ feet respectively, he argues that if this be the entire rise on the open coast it is much less in a back-water with a narrow bar, and again much less in its derivative Canal. He maintains that there is great loss by leakage in the Lock, and from evaporation and absorption and in the consumption of water by lockage taking one day with another, he does not value the Locks at more than an additional depth of 6 inches of water, and were there no Locks, the tide freely flowing and ebbing, he consider that the height of the water would as a general rule be at the mean Sea level practicably above it.

14. The Superintendent admitting however the actual gain to be 1 foot by means of the Locks instead of nothing, shews that the cost of obtaining that depth between Doogoorauzepatam and Shediencoopum to be 2¼ lacs of Rupees provided the principle be carried out to its legitimate results, and he then states that a channel 20 yards broad at bottom, depth of water 4 feet and slopes of 2 to 1, would cost at the rate of 1 anna a cubic yard only 2,38,000 Rupees for 70 miles, and thus Lieutenant Sankey boldly seeks to establish the idea, that it would be better to cut a new Canal than to improve the old.

15. The Superintendent after noticing the interruption to trade by Locks, and explaining, that the remark in his report No. 386 of the 16th January last that "they were works whose necessity could not for a moment be doubted, applied to the system of shallow channels which at that time he was not prepared to confute, or re-place by another" proceeds to notice the section proper for Canals under circumstances similar to those of the Eastern Coast line, a section determined after inspecting the Canals in Guntoor, and having had the advantage of Captain Orr's opinion.

16. The section is given in para. 18 of his letter, the width being 56 feet, the depth 5, and height of spoil banks 7½ or 9 feet above the mean level of the Sea which will ensure their being 2½ to 3 feet above the highest flood line, the cost of excavation per mile is given at 5,800 Rupees including baling.

17. In paras. 23 to 25 the Superintendent notices the gates he proposes to substitute for Locks, and estimates their cost at Rupees 5,500 each, or dividing them over the 70 miles of Canal, 500 Rupees a mile which raises the milage cost to Rupees 6,300 or 790 Rupees a mile less than with Locks and he enumerates the advantages as follows.

1st. No Locks to delay traffic.

2nd. No chance of interference from a dishonest and an extortionate agency.

3rd. 9 inches greater depth throughout the channel.

4th. The banks and towing paths secure from the effects of floods.

18. He then in paras. 31 and 32 notices and combats objections which may be urged against his continuous embankments; but they require no particular notice, for he proves that they are not subjected to the rush which he supposes might come against them from the neglect of and impracticability of constructing stable tank banks, which I cannot allow however to be any thing but an exceptional case.

19. The Superintendent of Canals may then be said to advocate a Canal of a certain width and depth entirely separated or isolated by embankments of sufficient height to exceed the highest floods, and of sufficient strength to resist them, but to deprecate the use of Locks, to gain the required depth by ponding up the tidal flood on account partly of their great expense, and partly of their but nominal advantage through the lowness of the tidal wave on the Coromandel Coast. And in advocating the above description of Canal and the excavating an entirely new one he urges it upon the ground of its greater efficiency, and states that it will cost little if any thing more than the cost of the Locks alone.

20. Before discussing the cost of his proposition which I believe to be much under stated, or that of the Locks which I consider equally over-rated, I may as well observe, that the construction of Locks is not as he seems to imagine a normal or indispensable necessity of the Canal, it is not intended that every reach terminating in a tidal river shall have a Lock at either end.

None of the Canals on the Eastern Coast to the South of Sadras have Locks. On the Sadras Canal which was designed by myself, gates were originally planned, but Locks were substituted not primarily to keep up tidal water, but to uphold the water accumulated between Madras and Sadras during the monsoon, and by which means the navigation would probably be kept up till May.

21 The Shediencoopum Lock was constructed primarily to keep up tidal water, and secondly by that means to keep up the water in the river Cooum. It may have in a degree failed to secure this. I believe it only upholds some 9 inches in depth above mean tide which is equivalent to an increased depth of 18 inches, and boats would, were the Canal of the depth of 4 feet which it is in some places, be able to navigate it at all times. It is true that the Lock is an obstacle to speedy traffic, but at high water it may be thrown open, and at low water a boat might be locked up into it from the Ennore back-water, and be able to prosecute its voyage which without the assistance of the Lock it would not do at all.

22. The loss by leakage ought not to be much, but if it be, it is made up by every returning flood tide, and evaporation takes place whether there be a Lock or not, the water expended by lockage at the Shediencoopum Lock is $\frac{150+20+1}{27}=11$ cubic yards, every time a boat passes; a quantity which on the supposition that the Canal is 7 miles long and 25 yards broad, would reduce its level, 1158 of an inch or the Lock must be passed 9 times to reduce the Canal one inch in general level. A boat of 70 feet by 9 feet drawing 2′ 6″ of water will carry 40 tons so that 180 tons might pass the Lock with really a hardly appreciable diminution of depth in the Canal.

23. The Lock proposed to be erected at the Southern end of the reach commencing at the north of the Ennore back-water, was intended to uphold the water of the Pulicat Lake. During the monsoon months the level of that lagoon is raised by the rains to a height of from 2 to 5 feet above mean tide, and so also is the line of back-water, with the exception of that near Ennore, where the accumulated water escapes into the Sea through the open bar. Towards the end of February much of the water stored in the lake has hitherto run off, and from March, the evaporation reduces the level of the residue.

See letter to Government, dated 23rd June 1855, No. 588.

24. In the year 1855 the Lake was reduced to the level of mean tide, in the beginning of April; during this month the Lakes surface rapidly falls *below* mean tide. Should the Ennore bar be open, a supply is received through that estuary, but not sufficient to compensate for the loss by evaporation a quantity taking the lakes reduced surface at 100 square miles to 4 millions of cubic yards a day.

25. When the level of the Lake is above the mean level of the Sea it discharges a greater quantity than it receives at high water; on the other hand, when the surface of the Lake is below the level of the Sea, the width of the Catapully channel is too small to admit of any appreciable addition of water from Ennore during the tide run.

26. If the May and June showers fail, the navigation is brought to a close, and even during October 1854 after a considerable quantity of rain the Pulicat Lake was still 2′ 9″ below mean tide.—There was no provision in the late Superintendent's estimate for Locks at Pulicat itself the bar there it should seem is not often open, nor was there any provision for a Lock at Doogoorauzepatam, the late Superintendent intended to erect one there no doubt, but he wished to keep the other small bars closed, opening them as occasion might require to let off any very great amount of superfluous water.

27. This being the case there will be required but three Locks between Madras and Doogoorauzepatam of which one is constructed and though I admit that they are to a certain extent a hindrance to speed, they are taking all arguments into consideration, in this particular instance less so than the Superintendent seems prepared to admit.

28. The last argument against their use namely: the extortion of the Lock Managers, may be at once met by having only as now a final payment at the terminus.

29. The new Canal as proposed by the present Superintendent must of necessity pass portions of back-water, and therefore it cannot be so completely isolated, as would be desirable, nor would it in short be more isolated than the Canal submitted by the late Superintendent from whose letter No. 154, dated 2nd June 1855. I Extract the following.—"The quantity "of alluvial matter in suspension in the several streams debouching into the back-water which "is deposited here and there in the channel is the great hindrance to a perfect navigation."

"I think it would be much better instead of periodically removing silt from the back-water, "to take an entirely new line of channel from Amalrick's Bend to Coromandel, partly by using "the present bed and partly by cutting through the low grounds skirting it, but in each and "every instance completely *isolating* the new line from the old by throwing up upon the western "side of the channel the whole of the earth excavated. By this arrangement all sediment "brought in by the rivers during the monsoon will be cut off from the Canal and will be de-"posited in the Lake on the western side of the Pulicat island."

30. The late Superintendent's estimates were submitted with recommendation of the Board of Revenue Department Public Works, and his estimates amounting to Rupees 98,095-10-4 were approved, but in a subsequent order No. 86 of the 21st January 1856, the estimate was directed to be reduced from a bottom width of 20 yards to one of 12 yards, a measure which is to be regretted as by this means the embankments and consequent isolation recommended and intended by Lieutenant Chambers, have been weakened in their section and rendered unable to resist the pressure of water against them brought by the floods of last year.

31. I believe that the Canal from Doogoorauzepatam to Shediencoopum may be put into as complete a state of isolation as the new proposed Canal, and at a less cost; and by erecting a Lock at Doogoorauzepatam, making a permanent and workable escape at Pulicat, by a Lock and Calingulah at Pooyeethevaukum, and by clearing out the Canal from Shediencoopum to the basin, it will be as efficient as the other proposed by Lieutenant Sankey. It may however perhaps be advisable to introduce a gate at the Pulicat end of the Catapully cut, to prevent floods pouring down it.

32. I agree with Lieutenant Sankey as to the necessity of having the Canal protected by strong and efficient embankments to isolate it, and I have recommended that it should be so, but I am not prepared to advocate the excavation of an entirely new Canal. The same causes which have proved detrimental to this Canal, as far as filling in from the effects of filtration is concerned, will exist in a greater degree in a Canal of deeper excavation, and in a worse soil, the deposition of silt from tidal influences would be about the same and the effects of wind borne sand equal. Nor do I think judging from the difficulty of keeping Cochrane's Canal sufficiently deep (and it is a fair argument, for it is an isolated work) that a deeper Canal would have a better chance of permanency.

33. The above being the case, I am of opinion that a Canal, with Locks, in the particular localities under discussion, by which water may in the different reaches be kept at nearly high water level is the preferable plan of the two.

34. The estimate is calculated as if the land were level throughout, but I know from personal observation that the ground is broken, intersected by creeks and interrupted by hillocks of the finest sand, and I am, from my own experience in these works, very confident that an excavation of 5 feet below mean tide, could not be made for less than double the rate allowed.

35. There is no doubt that a broad and deep Canal leading to a bar which is permanently open might be kept deep by the influence of the tide, but this cannot be effected in sand on the Superintendent's section, his side slopes would be reduced from 2 to 1 to 3 to 1, shutting up his Canal to a width at bottom of 17 feet and of 5 feet depth of water.

36. The Superintendent states that he does not wish the present Canal to be neglected or destroyed, on the contrary he wishes it to be improved and kept up, as he says in para. 56, "it would still continue to be as now the main supplier of all consumable articles for Madras "and as such would be cared for and connected with other Canals directly affecting the immediate wants of the community."

37. The new Canal he thinks will carry articles for exportation and should therefore have its terminus on the beach somewhere to the north of the Railway terminus, a proposition worthy of consideration, and which might be carried out without effecting in any way the question of *principles* of construction. Ground however is very valuable in Royapoorum, and it is a question I conceive for the Chamber of Commerce as to whether the merchants of Madras are disposed to build goods sheds, &c. in that locality.

38. I do not think that justice has been hitherto done either to the Canal, or to the recommendations of the late Superintendent, and advocated by the late Revenue Board of P. W. and subsequently by yourself. I think that so important a communication should be liberally dealt with and that the recommendations of Lieutenant Chambers and his estimates should be sanctioned with such additions as the nature of the case and the present state of the Canal requires.

39. The attempts made to introduce Steam Navigation have failed from want of the proper carrying out of these remedial measures, and I think it would be better to stop the navigation for three or four months, (if we are not spared the necessity of so doing by its drying up) that he section from Shediencoopum to Madras and that between Ennore and Pulicat may be opened.

40. I may observe that in the Superintendent's estimate a most important item of cost is omitted, viz. all masonry works, and I mention it here particularly because it is necessary in considering the cost of his proposal to bear this in mind.

41. I cannot close this report without stating the pleasure a perusal of Lieutenant Sankey's very able report has given me, a report in which there is much to deserve attention, and which will I trust be productive of much good by bringing prominently forward as it does the present condition of the Canal, and thereby proving the necessity of a more liberal expenditure than the Government have hitherto thought necessary.

No. 92. ORDER THEREON, No. 1560; dated 11th August 1857.

With the letter above recorded, the Chief Engineer submits with reference to Extract Minutes Consultation, dated 26th February 1857, No. 371, a report from the Superintendent of the East Coast Canal on the state of the Cochrane's Canal. Colonel Faber also submits a communication from the Superintending Engineer, Captain Collyer, in which he gives his opinion on Lieutenant Sankey's views and conclusions as set forth in that report.

2. Lieutenant Sankey explains at considerable length the faults at present apparent in the construction of the Canal; the benefits which a really good first class navigation would confer upon Government and the community, and suggests the excavation of a new Canal, and the rejection of every part of the present existing line between Madras and Pulicat, from the East Coast Canal. He estimates the cost of the new cut at Rupees 2,38,000 and that of the Locks which are necessary to improve the present Canal at Rupees 2,57,160; shewing thereby that there would be a saving of expenditure by the adoption of his plan.

3. Captain Collyer terms Lieutenant Sankey's communication an able report and expresses the pleasure he has had in reading it. He as well as Colonel Faber deny, however, the soundness of the conclusions at which that officer has arrived, and declare themselves unable to advocate his views. Captain Collyer also remarks that the Superintendent has under-estimated the cost which his proposition involves, and over-estimated the cost of the construction of the Locks required for the present Canal.

4. The subject discussed in the above papers is an important one, and the Government are not disposed to come to any conclusion before it has been further considered. They resolve therefore to request Colonel A. Cotton, Lieutenant Colonel F. C. Cotton, Major Lawford, and Lieutenant O'Connell, to form themselves into a Committee, and to consider and report on the views set forth by Lieutenant Sankey, both in regard to the state of the present Canal, and the proposed new cut. The papers above recorded will accordingly be transmitted to them, and any other records they may require from the Central Office should be placed at their disposal without delay. The Committee's attention is particularly requested to the question of how and whence water is to be supplied to the Canal, a point on which hitherto the Government have

never had a clear explanation. The Government entertain no doubt that the importance of the question referred to them will lead to the Committee submitting an early report upon it.

5. Colonel Faber and Captain Collyer refer to a want of liberality on the part of Government in dealing with the Canal, but these Officers appear to forget that the success of the work has not justified a larger expenditure than has been hitherto authorized, that this Government has to divide a restricted sum of money over a large extent of country, and that the Government of India has labored under great Financial difficulties. The charge therefore is without point, and ought not to have been made.

6. In the concluding para. Colonel Faber suggests that Government should stock the Adyaur and Palaur Canal with boats, secondly that the Collector of Chingleput who "*formerly*" was a strong supporter of the new Canal should be instructed to contribute all in his power to the development of traffic, as well as to the protection of the banks and young trees, and thirdly, that a convenient landing place, with a cart road leading to it, should be established on the north bank of the Adyaur. The question of supplying boats at public cost, received the consideration and final orders of Government in Extract Minutes Consultation, dated 4th March 1857, No. 421, and the construction of two model boats was authorized in the order dated 22nd May 1857, No. 979. In para. 7 of Extract Minutes Consultation, dated 8th April 1857, No. 659, it was pointed out that the Village Police is as much bound to preserve the banks of the Canal and their plantations from wilful injury, as to prevent wanton damage to the high road and its avenues. The attention of the Collector of Chingleput was also drawn to the subject, and he was requested to issue orders impressing on the Talook and Village Police the necessity of attending to the Canal. In the absence therefore of any specific instances to shew that the Police have not attended to the Canal, and that Mr. Shubrick has not paid due attention to the orders of Government, no action can be taken upon Colonel Faber's remarks. The Government in the last para. of the order of 4th March above referred to, requested Colonel Faber to communicate with the Collector of Chingleput and the Superintendent, on the subject of providing landing places along the Canal and to report upon the subject. This report has not yet been submitted.

(Signed) H. FORBES,
Acting Secretary to Government.

Central Office of P.W.

No. 520 Fort Saint George, 20 May 1857.

From

The Chief Engineer.

To,

The Secretary to Government.

P.W.D.

Sir,

In laying before Government the explanation of the Superintendent Eastern Coast Canals called for by Government in Exc: Mins: Cons: No. 371 of the 26th Febru-ary 1857 as to the exact meaning of his assertion that "disappointment and dissatisfaction are surely in the future" if the present treatment of the water communication between Shadiencoopum and Doogoorawpatam be continued, I have somewhat departed from the accustomed routine of sending it up, with an accompaniment nominally written by the Head of the Central Office, but which is commonly the production of one or other of his professional associates, although bearing his own signature when he does not substantially dissent from the opinions set forth.—

2 Originl letters and 1 Copy of Plan.—
*No. 162 dy 15th Sept/57.

2 In the present case, it has seemed advisable that the

the carefull examination of the Superintending Engenier Central Circle should be attributed to his sole author, because Captain Collyer whilst Civil Engineer of the 4th Division, was himself for some time in professional charge of the Northern Canals; and he therefore brings minute local knowledge to bear upon the important subjects discussed, (and certainly with ability) by Lieutenant Sankey, in addition to that gained by an impartial consideration of the latter Officer's written and copious exposition of his views.—

3 . Apart however from this reason however why a separate Report from the Superintending Engenier Central Circle has been added, on the present occasion, is that whilst Captain Collyer has thus had an opportunity of giving his opinions from which I do not dissent, on the several views propounded by Lieutenant Sankey, and thus preparing the subject in the usual manner for the orders of Government, it would in some measure have been out of place in such a paper, which is authenticated by him, or by myself to go into certain other considerations of a more general nature which seem to be called for, and which therefore for convenience sake, it seems my own personal duty to offer for the favorable consideration of the Right Honorable the Governor in Council.

4 . Apart then from its details already minutely examined by the Superintending Engenier, the first impression which Lieutenant Sankeys paper appears to me likely to create, is that, however that purpose may be

dated 11th Nov 1857.

concealed or disguised, the system followed hitherto, and the measures adopted for an inland coast Navigation have virtually been attacked, and are now pronounced to have been faulty in principle, and even defective in details.

5 . I can conceive few things likely to cause more dissatisfaction, not to say displeasure, than for the Government to find itself called upon to blame what it had hitherto been recommended to support, and to accept as demonstrated errors, works which have been represented to be both useful and indispensable. I fully believe that Lieutenant Sankey himself would be the first to disavow all intention of directly impugning the ability or sound judgement of his predecessor; and that rather than be the author of a Report which even inferentially can bear the construction of directly calling Lieutenant Chambers's skill and knowledge of his particular business in question, he would have been well contented to withdraw his reply, and to have left the requisition of Government unanswered.

6 . Misled however by observations of the defects developed by the violent storms and floods of November and December last, and seduced by the discovery of the causes of the accidents, whose disastrous results on the Navigation for the time he himself witnessed, he expresses himself as if it had been reserved for him to detect wants not yet supplied, and in pursuing the investigation to become in fact the originator of a new system of internal Navigation; whilst he overlooks that the Reforms of which he is the advocate, are not the exponents

of

of new principles properly so called, but resolve themselves simply into questions of degree. I am very far indeed from blaming Lieutenant Sankey that unconsciously to himself he has been betrayed into the very natural mistake of being the supposed discoverer of a correct practice for our Indian water — communications on a part of the Coromandel Coast where the lift of the tide is so small; on the contrary the eagerness with which he has sought to pursue his observations to their legitimate results, and to generalize his recommendations by the construction of an entirely new line of Canal bespeaks the possession of qualities, which when matured by an enlarged measure of practical experience, would doubtless have been of great value to Government and to the public. —

7 But if Their Lordships in Council should arrive at the conclusion that the actions would still remaining defects of our present Northern Canal are indeed so radical and great (and unhappily Lieutenant Sankey himself was not personally cognizant of the great ameliorations progressively made during the last few years) that effective and uninterrupted Navigation is impracticable, the great evil will have been accomplished of a destruction of that confidence in the professional Officers of Government, which is essential to the success of our Civil Works in the Madras Presidency. —

8 So far from regretting that Lieutenant Sankey has dwelt forcibly on the subject of 'water' as all important in Canal navigation, I have never ceased to impress that view in frequent representations from the Central Office on the local but met with such little support, and more especially that it had

unfortunately been overlooked as yet by Government that where passing through shallow lagoons and across low swampy ground, increased breadth of Canal becomes a practical necessity, not because accommodation for navigation requires it, but because without breadth, earth cannot be obtained for embankments, either to isolate the canal from inundation surcharged with silt, or to prevent the low dykes procured from the smaller excavations and which are required for towing paths, being bodily melted into the Canal.

9 A very full account of the evils of insufficient embankments (on which isolation depends) is contained in the Superintendent's Report of the 16th January No. 386, forwarded to Government with my letter No. 9949 of the 2nd February. The unwillingness of the Government, to carry out the reforms applied for by Lieutenant Chambers is shewn in Ex: Mins. Cons: No. 918 of the 15th December 1855 and again in Exc: Mins. Cons: No. 155 of the 22nd January 1857.

10 With completeness of isolation, scarcely less strongly advocated by Lieutenant Chambers, with a substitution of flood gates for Locks, and with an habitual avoidance of lagoons instead of preferentially going into and through such basins all specialties, as it seems to me, of Lieutenant Sankey's Recommendations cease. —

11 That a capacious basin near the Royapooram terminus of the Madras Railway would be a great accommodation for the trade when exportable articles are brought from the Northern Districts by the Canal, seems to admit of very

very little doubt; but with the progressive improvement that I have myself witnessed in the Cochrane's canal branch, and which with the assistance of a Steam Dredge (believed to be now on its way out) can be carried to a much greater extent, I am by no means prepared to advocate Lieutenant Sankey's entirely new Canal.

12 Upon the whole, I cannot divest myself of the apprehension that the general impression created by the consideration of Lieutenant Sankey's Report will be unfavorable to canal Navigation. In such unfavorable opinion I do not share; though I fully admit that there has been, and is much to disappoint, especially in the want of uniform depth, and the almost insufficiency of the Doogooraudputtum canal from the shoal water near Sthuburrikollah. Recent financial restrictions have also had their usual adverse influence, and to paid charge of Officers, always unfavorable, is particularly so in a nascent undertaking like the Coast Canal.

13 The Superintending Engineer closes his report by expressing a hope that the Government will be pleased to authorize a more liberal expenditure than has hitherto been thought necessary. To this may be added a greater measure of general support; for although it may commonly be quite true that the public will use whatever it is for their own interest that they should use, there may be very different degrees of enterprise in different publics, even in so short a distance as the North and South of Madras. Under the Madras Canal Act, in the first instance, clashed with leading Government and

they should be of the best models whether for cargo or passengers and unless the Collector of Chingleput, who formerly was a strong supporter of the new canal, be instructed to contribute all in his power to the development of traffic, as well as to the protection of the banks and young trees, it does not seem likely at present, that the partially completed branch of the Southern Canal will be turned to any very useful account. But to use a common phrase, if it were once in whatever way, set well a going, and a convenient landing place with a cart road leading to it, established on the North bank of the Adyaur, there seems no reason why it should not in time, present as busy a scene, as Cochrane's Canal now does.—

I have the honor to be,
Sir,
Your most Obt Servant,
Arthur Cotton Colonel
Chief Engineer.

Central Office of P. W.
Fort Saint George,
25th May 1857.

GLL

To,
The Secretary to Government P.W.D.

Encl. Chart

P. W. Delhi

No 1529

Extract from the Minutes of Council

Under date the 24th May 1857

Read the following

Letter from the Chief Engineer

Dated under 20th May 1857 No 520

With the letter noted in the

above received the Chief

Engineer submits with

reference to E. M. C. dated

26th February 1857 No 371

a report from the Superintendent

of the Coast Canal

on the state of the Cochrane

Canal - Colonel Faber also

submits an communication

from the Superintending Engineer

Capt Cotlyer in which

Captain Cotlyer is of opinion

to quote his opinion on

Lieut Blackburn's views and

conclusions

6 cm 5 March 57 . 5 5-6 11
— 27 - Jany — 29 - 29 -
- 23 - Jany 56 - 54 -
18 - Dec 55 - 47-15
— 10 March 57 — 47 . 48 -

Copy in G L to C.
of 24 October 57 No 17
Paras 12 to 20
Collection A.

Copy with Dicty and
Sight Plan to Col Colvin
& other — 11 May 57.
No 15 to

No 91.

c5 June R c11 July 16th

Public Works Department
Camp 11th August 1857

From

The Chief Engineer

To

The Secretary to Government

P. W. D.

Date 20
Received 26 } May 1857

No 520

Enclosures 3

1 Returned D. Ch. Engr
& sent D. C. & R. C. for
Forwards with his Remarks, and

accompanied by a letter from the
Supt Engr 1st Circle of P. W.
a Report from Lt Sankey
late Supt E. M. Canal
called for by Government in
E. M. C. No 371 of 26th
February 1857.

conclusions as set forth in that report.

2 Lieutenant Lankey explains at considerable length the faults at present apparent in the construction of the Canal. The benefits which a really good first class navigation would confer upon Government and the community, and suggests the excavation of a new Canal and the rejection of every part of the present existing line between Madras and Pulicat, from the East Coast Canal. He estimates the cost of the new cut at Rs. 2,38,000 and that of the locks which are necessary to improve the present Canal at Rupees 2,57,160; shewing thereby that there would be a saving of expenditure by the adoption of his plan.

3. Captain Colleyer terms Lieutenant Lankey's communication an able report and expresses the pleasure he has had in reading it. He as well as Lt. Taber deny, however, the soundness of the conclusions at which that Officer has arrived, and declare themselves unable to advocate his views. Captain Colleyer also remarks that the Superintendent has under estimated the cost which his proposition involves, and over estimated the cost of the construction of the locks required for the present Canal.

The subject discussed in

in the above papers is an important one, and the Government are not disposed to come to any conclusion before it has been further considered. They resolve therefore to request Colonel A. Cotton, Lieutenant Colonel F. C. Cotton, Major Crawford, and Lieutenant O'Connel, to form themselves into a committee, and to consider and report on the views set forth by Lieutenant Sankey, both in regard to the state of the present Canal, and the proposed new cut. The papers above recorded will accordingly be transmitted to

to them, and any other records they may require from the Central Office should be placed at their disposal without delay.

The Committee are particularly requested to the question of how and where the water is to be supplied to the Canal, a point on which the Government have never had a clear explanation. The Board entertain no doubt that the importance of the question referred to them will lead to the Committee submitting an early report upon it.

Colonel Taber and Captain Collyer refer to a recent act of liberality on the part of Gaekwar in dealing with the Canal

Canal but Mess. Officers or
officers to forget that the
success of the work has neces-
sitated a larger expenditure than
has been hitherto authorized
that Mr. Government has
to decide a restricted system of
irrigation over a large extent
of country, and that the
Government of India has
labored under great finan-
cial difficulties. The charge
therefore is not heavy, and might well be
~~will be defrayed by Government~~
~~but better~~ have been made

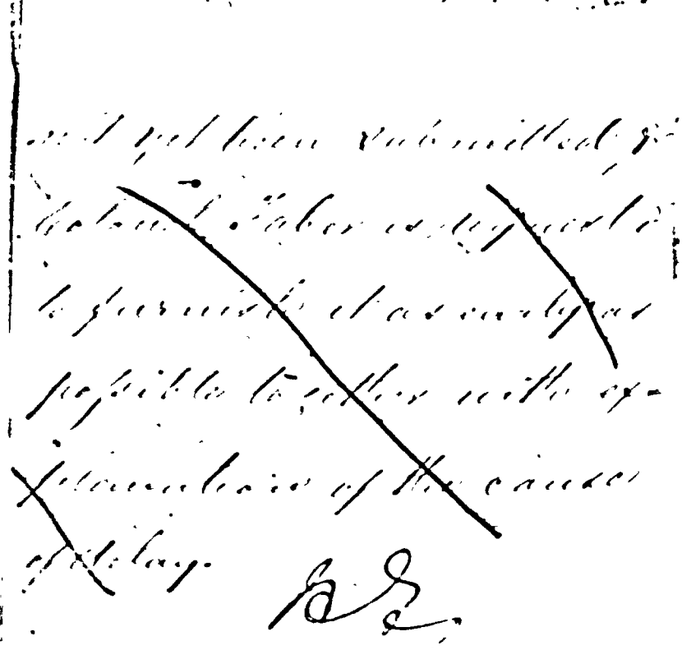
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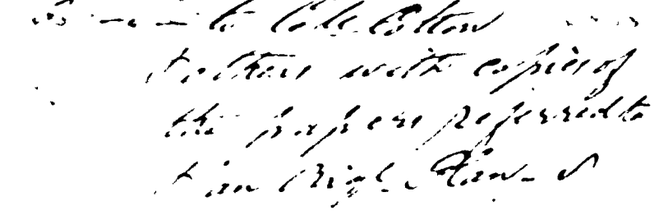
should be entrusted to
contribute all in his power
to the development of traffic,
as well as to the protection
of the banks and planting
trees and thirdly, that a
convenient landing
place with a cart road
leading to it, should be
established on the North
bank of the Adyar. ~~The~~
~~Government do not see~~
~~the utility of the Chief~~
~~Engineer's observations, which~~
~~are irrelevant~~. The question
of supplying boats at
public cost received the
consideration and final
orders of Government in
Select Education Consultation
No. 424
dated 11th March 1857, and
that

the construction of two
Middle-boats was authorized
in the order dated 22d
ulto 1857 folio 9999. In persua-
nce of that order Council
dation was held 8th April
1857 folio 859 it was pointed
out that the Village police
is assumed cannot be persu-
aded the benefit of this
Council and their pleas
sation from civil suits or
injury can be prevented
with an damages &c.
the high road and public avenues.
The attention of the Col.
Leader of Chingleput
was also drawn to the
subject and he was
requested to report whether
suspending are the Salvation
and

and Village Police the necessity
of attending to the Council.
In the absence therefore
of any specific instances
to show that the Police have
not attended to the Council,
and that the Thumbrich
has not paid due attention
to the orders of Government,
no action can be taken
upon Colonel Faber's
remarks. The Government
in the last para of the
order of 11th March above
referred to, requested
Colonel Faber to com-
municate with the
Collector of Chingleput
and the Superintendent
on the subject of providing
landing places along the
canal and to report upon
the subject. This report has

not





I circulate said Survey report on the East Coast Canal & any remarks the Government may wish to make.

Colonel Baker & Captain Collins both term it an able report, and think the Hon Sec Key Law Lord in reading it - with interest being the recommendations at which Dr Lankey has arrived, & declare Executive unable to advocate its views.



[illegible] Hawkey recommandations
[illegible] ment in Framingham to the Mon
[illegible] Reinsel Plaintiff on Dick W.
[illegible] Hawkey is owing Lott in the
[illegible] Estimate and the case of the Defendant
[illegible] and in case [illegible]

[illegible] needed to keep the present
[illegible] cause unsatisfactory. Enemy is
[illegible] much underestimated to
[illegible] me, as to the reasonableness
[illegible] to [illegible].

[illegible] See our Bank Bar the
[illegible] Superintendent of the Widow
[illegible] ~~Insurance Commissioner~~
[illegible] [illegible], as Century and
[illegible] the Court.

[illegible] Edward by W. Hawkey. Mrs
[illegible] Wade be pleased that he has
[illegible] -ley, in Framingham 55, about
[illegible] but the present case and
[illegible] excavation of
[illegible] town one, enclosed "the
[illegible] Public by the enclosure.
[illegible] the article in Madrid".

[illegible] Colonel Baker and
[illegible] Adams called upon after
[illegible] Aug. days from Boston
[illegible] [illegible] Ray went to see
[illegible] Bar. Mr. Wyman by the
[illegible] Said is Lieut. Col., and

Rob. Ruddle Esqr. to Ruddle Son

Referring to the last para-
graph of the Cy. Exp. letter,
I can repeated on the 5th of
March last, in conse-
quence with the Collector of
Customs, on the practica-
ble Economy, there in the
Establishment of the Light,

I have been hopeful I was able
to get a good conception of the
State of this canal.

I should first [illegible] the Shanty
like as to the dimensions of the canal
are correct - & there is much reason
to fear disappointment, I cannot be back.
It also [illegible] of high & strong hands.
I [illegible] Capt. Wolfe
in thinking [illegible] is the necessity for
striking out an entirely [illegible]

[illegible] the canal.
[illegible]
in the opinion of the Engineer [illegible]
[illegible] intended to keep him
safe - [illegible] [illegible]
from [illegible] - this
partial disapproval of the plans simply because it might delay
the confidence of [illegible] in the [illegible]
ment whatever
It is ordered for him to make about

I not having supported the undertaking.
[illegible]
I should attach any [illegible]
from [illegible] - or from have
[illegible] - [illegible]
[illegible] - [illegible]
[illegible] in a subordinate capacity.

but his by Engt is perfectly well acquainted with the financial position of the Dist & Major Hartley is ready to furnish carefully & statistical account of every branch & large extent of working - & further such exaggerated statement, from him are unpardonable & cannot be taken as a reason for not [illegible]

I give up as hopeless any expectation of Engt sending their report from here - & they which they might & paid in the office of our Engineer before their departure - but such discussions details of this kind must be examined -

But Engt may ask how extensive limitations in supplying boilers in Kirri canal - for what is the fact & how much it ! what is the usual duty - & working water & - I shall never get out any Engt & Where are Intakes - that is sufficient supply of water can be secured - let him do that - & not [illegible] have with it no limitations that [illegible]

conclusion -

[illegible]

Engr Dept Engr Lewis Bhawalpur

a proper site for the landing place
on the Panama Canal

St
Gl

defer it I am able to form an
opinion more appears to me much
force in Mr Lankey's general ideas
regarding the construction of the E. & C. Canal
Santee the first project of
Canal has depths from 6 to 5 ft
that for Cooper River depths from 6 to 5 ft
A canal with an average depth
from 5 feet at low water for
Lankey's affords but an inferior means
of communication - Such a canal
as any canal must be liable
to fluctuations in topical climates
of 4 to 5 feet occasionally

the Commander Coast of the action
of the tide, [illegible] taking up a tidy
barrier above high water mark
[illegible] which keeping off the whole
drainage of the country, after a
considerable distance inland, but
at other times close to the sea

Such backwaters are always
seeking to deposit the drainage &
gradually silting up. They are
unequal bearing up breadth with respect
to the formation of the country behind
& must be cause of constant expense
to keep them free of deposit.

I consider therefore that a Harbour
on advocating a new line of canal to be
excavated on a uniform section, has

below the average depth.

How then to throw out this piece until a fresh supply of water can be obtained for it can hardly be expected that a vessel drawing less than 12 feet will venture for the demand of such a trifle as this canal will draw at present the depth for the available is only 8 feet for is a matter of course this depth must be regulated by the minimum depth.

There appears to be a chief source of the [illegible] having been carried through the canal bank which are formed all along

offered a bond & wife satisfaction
[illegible] doubt will have
in respect to the [illegible]
I think the professional gentlemen
Robert Peck before any
any further measures are adopted

Copy in a G.L to C.
of 24th Octr/57 N.17
Paras 12 to 30
Collection of
Rolls 18 December 55 to 4th Feb. 58
Do 2d January 57 — 28 & 29.
Do 7th March 57 Nos 8 & 11
Do 10th — 1 — — 47 & 48

Public Works 1857 Depth.
Cons: 11th August.

C 15 1560

" 6 "

Extract clus: of Cons:
of 11th August 57.

Ex: the Pro: of the King: 21st Nov: 57.
No 2321 Ad Cons: 2 Feb 58.

C.J.L. 29 Sept/59 Nos 74 75

From the Chief Engr. of 25th March/59
No 705 in Cons

Observing that in the answers
to the several inclosures to those
Letters no Witness have not-
been produced to the Allegations
Contained in the Petitions, and
as no action can be taken on
those Petitions, Exhibits & Documents
unless Witnesses be produced
to substantiate the Allegations
contained in the Petitions,
I recommend that the Parties
be informed that they
must produce Witnesses
to prove the
Allegations
contained
in their
Petitions

C. Fig 1 & 2.

C. Subs 216