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MADRAS RECORD OFFICE.

Government of Madras.

Public Works **DEPARTMENT.**

G.O. No. 6846	Press
443-444	Mis.
Dated 20-6-	1867.

Not to be folded or roughly handled

12-4-67

20th June 1867.

No. 443. Read the following letter from the Acting Superintending Engineer, 6th Division, to the Secretary to Government, Public Works Department, dated Tanjore, 1st June 1867, No 312 —

1. I have the honour to report, for the information of Government, that the result of my examination of the Negapatam and Vedarniem Canal, and of my enquiries respecting its utility are, that it must be widened, and its design otherwise considerably altered before it will be in real working order, and that the additional original cost to Government, which these alterations will involve, will effect some saving in the annual expenditure which would otherwise have been required, and will be amply repaid by the gain obtainable by the additional sales of salt.

2 The whole navigation, as at present designed, consists of the tidal portions of the rivers Cuddavayaur, Vellayaur, and Adapaur, and artificial cuts or canals connecting these rivers. No serious fault can be found with the tidal portions of the rivers. That of the Cuddavayaur has, as stated in paragraph 6 of Captain Oakes' letter, No. 960, dated 5th September 1865, and printed with the Proceedings of Government, in the Revenue Department, No. 2,347, dated 28th September, a depth, at low water, of from three to five feet except at one point where a shoal, easily removable by a dredge, forms annually. The Vellayaur is said, in paragraph 7 of Captain Oakes' letter, to be navigable at all seasons by such boats as it is proposed to make use of on the canal, except at shoals which form where two surplus channels meet the river. The state of the tidal portion of this river, it will be observed, is not quite so satisfactory as that of the Cuddavayaur. The Adapaur, as stated in paragraph 15, has a depth of from nine to twelve feet of water at all seasons and states of the tide. This is the most satisfactory portion of the navigation, than which nothing better could be desired.

3. The artificial cuts will not, I fear, be kept clear except at a considerable, though as yet an uncertain cost, and with constant interruption to the navigation. A level cut, connecting two rivers, is most advantageously situated when it crosses no drainage streams capable of filling its bed with silt. Thus placed, it still receives, during the freshes, the silt-laden waters of the two rivers, and, during each tide, these waters are changed; so that some deposit must take place. The deposit will be greatest at some point between the two ends of the cut where the tidal waters meet and cease to flow. The two ends of the cut may, if it is very long, be even scoured out by the flux and reflux of the tide; but the silting up of the central portion will spoil the navigation. These remarks refer to the connection of the silt-bearing rivers of Tanjore, and not so much to canals connecting backwaters or lakes, whose waters are nearly free from sediment. If the cut crosses drainage streams, it is of course still more liable to silt up. If again it joins one of the rivers further up its course from the sea than it does the other, there is certain, during the freshes, to be a steady current of silt-laden water flowing from the higher level of the surface of the first river down to that of the second. The current, too, will be a comparatively slow one, slower, that is than the current of the river from which it branches off. It will therefore undoubtedly deposit a good deal of silt.

4. The above-mentioned causes tend to produce rapid deterioration in a canal, or excessive expenditure for keeping it in working order; and they will be in active

operation upon the cutting between the Cuddavayaur and the Vellayaur. That cutting leaves the Cuddavayaur at three miles from the sea, and joins the Vellayaur at one and a half miles from the sea. At 1,980 yards from its northern extremity it crosses a drainage stream, any interference with which will not only injure the navigation but the drainage also. The stream joins the Cuddavayaur two and a quarter miles lower down than the canal does, so that it has the advantage, for drainage purposes, of the surface fall of the river in this distance. To deprive it of this will simply be to spoil it, and to injure the lands which it now drains. To pass it under the canal by a tunnel will not only be expensive, but the loss of head, required to force the water sufficiently rapid through the tunnel to prevent its choking up, will injure the drainage of lands lying so near the sea, and rising so little above it as these do.

5. The causes tending to produce deterioration in the cutting connecting the Vellayaur and Adapaur rivers are more numerous and powerful than those mentioned above, as affecting the cut between the Cuddavayaur and Vellayaur rivers. Commencing from the Vellayaur, and travelling southwards, there first comes the Chandranadi. It was originally attempted to pass this river through a tunnel under the canal, but it burst the tunnel. The present arrangement may be considered a compromise. A portion only of the waters of the Chandranadi, during freshes, are to pass through the under-tunnel; the remainder is to pass into the canal, which it will tend to silt up. The next large stream which the canal meets nearly at right angles is the Coopien voical, which joins at about one thousand yards to the south of the Chandranadi. The bed of this stream is four and a half feet higher than the bed of the canal, and when I proposed to the Tahsildar to deepen its bed for some distance up from its junction with the canal, he objected on the ground that the Coopien voical, being an irrigation canal, its waters, when low, would be spoilt by intermixture with the salt-water of the canal, and be rendered unfit for irrigation. I have, therefore, sanctioned a proposal made by Mr. Donaghue to turn the course of the Coopien voical, and to carry it parallel to the canal southwards into the Paupan voical. This is necessary to prevent injury to the Coopien voical. A reference to the survey returned to Government with my letter No. 265, dated 28th ultimo, will explain the nature of this alteration. The above-mentioned streams enter the canal on its western side. Some drainage has to find its way into it from the lands to the eastward also. This also will bring silt with it. The southern course of the canal is formed by a trench partly cut, partly to be cut along the beds, of the Paupan voical, and the Koothrichittiyaur; but as no provision is made for deepening, at the same time, the upper portions of the beds of these streams, they will of course tend to silt up the canal.

6. That the canal is too narrow Captain Oakes was fully aware of, as he draws attention to this fact in paragraph 20 of his letter already quoted; he was also, to some extent, aware of the deteriorating causes to which I have alluded, and he estimated that Rupees 10,000 per annum would be required at first to maintain the canal in an efficient state; but he seemed to think that, after some years, this sum might be reduced. In my opinion, so long as this small canal is allowed to be a receptacle for the comparatively large streams which it now meets, it will have to be cleared annually by excavations approaching in quantity to those required for its original formation. Its banks also will be constantly liable to be

breached, and it will never be in a really efficient state. The first thing to be done is to provide two channels for all drainage streams; one running parallel to the canal on the west, and another on the east. The next is to assimilate its condition to that of the tidal portions of the rivers which it connects and to increase its section.

7. The state of the bed of a tidal portion of a river depends chiefly upon the materials of which it consists, the directness of its course, and the velocity with which the tidal waters flow up and down it. The velocity of the flow of the tidal waters again depends upon the greater or less ratio of the volume of water passed up every tide into what may not inaptly be termed the tidal reservoir of a tidal portion of a river to its cross section. The larger the reservoir and the smaller the section of the river, through which its contents are poured during each ebb of the tide, the greater will be the velocity of the stream and its power to scour its bed.

8. I have already drawn attention to the very satisfactory state of the navigation along the tidal portion of the Adapaur river, and I append a copy of a report on this river, obtained from the Range Officer, Mr. Donaghue, who I learnt had on a previous occasion surveyed it. The statements made in this report and the map of the district, have enabled me to calculate approximately the capacity of that portion of the tidal reservoir of the Adapaur which lies above its junction with the canal, and have sufficed to indicate the capacity of the tidal reservoir which should be provided artificially in order that the canal may be duly scoured. Each section of the canal should be provided with such a reservoir. The canal being a small one, the size of the reservoir required is not great. As the Vellayaur river, into which the canal runs, has not however a clear bed, it will be desirable to be a little more liberal in providing for reservoir capacity, than would be necessary were the Vellayaur in as good a condition even as the Cuddavayaur. The section of the canal should, however, be enlarged by doubling its bottom breadth. This will not of course double the total area of that section, nor the cost of its excavation. This particular item of expenditure would only be increased 50 per cent. in a five feet cutting, and 38.5 per cent. in an eight feet cutting.

9. The cost of the proposed alterations and improvements in the design of this work, which I have been led to suggest, can only be ascertained correctly after the levels of the country on either side of the canal have been taken, and the amounts of drainage to be carried off by the channels proposed to be excavated parallel to the canal have been ascertained. For this work either a special officer, or, at all events, a competent Surveyor, working under the orders of the Superintending Engineer, should be nominated.

10. I will close this report by drawing attention to a letter from Mr. G. Lee Morris, Collector of Tanjore, No. 143, dated 17th May 1867. He there states that, if the canal be in good working order, the actual gain to Government will be Rupees 2,47,500, so that even if it be found that the alterations and improvements which I have proposed would cost 2½ lacs of Rupees, the gain to Government would not fall far short of 100 per cent., after suitable deductions are made for the cost of maintenance. I am confident that, if these improvements are properly carried out, the canal will be put into good working order, and that a moderate annual expenditure for dredging in the Vellayaur and in the reservoirs will suffice to keep the canal clear, and that this will be done without obstructing the navigation.

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11. The proposal to provide tidal reservoirs for scouring a navigation may appear a novelty in India. It is not so, however, in Great Britain. A tidal river is there improved by Engineers doing all they can to increase its capacity to hold tidal water, and my proposition is consistent with English practice as well as with the actual state of the lower portions of the Tanjore rivers. The calculations which I have submitted are, however, only meant to illustrate a principle, and to be looked upon as approximations, subject to check after the rivers Adapaur, Chandranadi, and Vellayaur have been examined in greater detail, and a few cross-sections of them, especially of the Adapaur, have been carefully taken.

P. S.—The direction of the northern portion of the canal, between the Cuddavayaur and Vellayaur river, must be altered so as to prevent interference with the drainage stream alluded to in paragraph 4. This stream should be straightened and cleared, and the junction of the canal with Cuddavayaur should be placed below it.

From the Officer in charge of No 4 Range, Tanjore, to the Superintending Engineer, 6th Division, dated Camp, Caroonguny, 4th May 1867, No. 36.

I beg to submit the following report on the Negapatam and Vedarniem Canal now under progress

1. The principal masonry works, viz, three large under-tunnels, one small under-slucce, a surplus sluice, and the completion of the Caroonguny bridge over the canal were completed in the middle of last year.

2. The excavation of the canal from the Cuddavayaur to the Vellayaur at Valangunny was commenced with in the early part of this year, immediately after the monsoon. The length of this portion of the canal is 6,300 yards, and the average depth of cutting about 8½ feet, the bottom breadth 10 feet, with side slopes of 2 to 1. The work in this reach was divided into nine sections, and given over to as many contractors, from whom agreements have been obtained and securities received for the fulfilment of their contracts. The time for completion expires on the 16th instant. In most of the sections full depths are reached, but the side-slopes and the banks still remain unfinished in several places. I beg, therefore, you will be good enough to inspect the work about the 16th idem, in order that it may be decided whether the penalties for non-fulfilment of contracts should be rigorously exacted. The security money deposited in the Range Office amounts to Rupees 898. The saving on the estimate for this portion of the excavation will be about Rupees 1,300.

3. South of Valangunny for a distance of or about 2½ miles, the Vellayaur will be the line of communication, the deep stream being about 6 or 7 feet in depth at mean tide.

Almost due south of a bend in the Vellayaur, near the village of Mugary, a canal was excavated on the original estimate in 1863. Between the bend and the Ramanaden head, near the Karoonguny bridge, the length of the piece of canal is 2,050 yards, it is much silted, and I find that on the average two feet of deposit mud must be removed, in order to obtain three feet water at low tide. This additional work will be carried out at an early date; no provision was made for this item in the estimate lately sanctioned for the canal.

4. The excavation of the Ramanaden and Paupan voicals was commenced on the 21st ultimo, the slopes of the banks and the proper sectioning of the channels here and there only remains to be finished. This excavation has been energetically carried out, and great praise is due to the Tahsildar for the number of coolies he placed at my disposal, and for the assistance received from Overseer Appathorai Mudaly and Munnesay Mudaly. I regret to add that owing to deaths from cholera, and the prevalence of rain during the last three days, the coolies have dispersed, the number having fallen from 8,000 to 1,500. But I expect within Wednesday next to have 4,000 men employed between the tail of the Koduchuti, or its junction with the Adapaur,

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and the head of the Ramanaden voical, and with this number I expect to have the whole of the work brought to a close within the month

The saving that will be effected in this reach is calculated at Rupees 17,000

5. The calingulah for diverting the Chandranady water and excavating the channel from the Chandranady to the canal are nearly completed.

The improvements to the Chandranady syphon sluice, as well as the excavation of the catch-drain west of the canal, south of the Vellayaur, are in progress

Materials for the two 6-feet and two 3-feet surplus sluices for the Ramanaden and Paupan voicals are in readiness. Those sluices are for the small surplus streams that discharge into the canal

6. The Coopien voical is a large surplus that empties itself into the Ramanaden channel, and its bed now is about four feet above the present bed of the Ramanaden

I propose that this channel be carried southwards, by excavating a new channel two yards wide at bottom with side slopes of 1½ to 1 parallel to the west bank of the Ramanaden channel, and discharged into it at a point 3,500 yards lower down, where a six feet surplus sluice has been provided for in the estimate, the dimensions of the sluice will of course have to be increased to about 12 feet by this arrangement, a 3-feet surplus sluice allowed in the estimate for the Tirmanagoody channel may be dispensed with, also the excavation of an irrigating channel for the Karapadagay under-slucce, and, moreover, the profit to Government by bringing fifty or sixty velies of Turcy land under cultivation will amount to 1,000 Rupees a year

The supply to the Coopien voical, for the cultivation of the waste land above alluded to, will be more certain if the improvements to the Vellayaur anicut are sanctioned, an estimate for this work was submitted in the early part of April

7. If the above suggestion meets your approval, I will prepare estimates and illustrate the project which appears feasible and profitable; the additional expense may be covered from the savings* pointed out in paragraphs 2 and 4 of the Report

* 17,000
1,300
18,300

8. A plan and estimate of a bridge proposed for the Rattailady crossing over the canal are submitted,† with reference to Memorandums Nos 17 and 65, dated 4th and 15th April

† Per banghy

respectively, for early sanction; materials are being prepared for this work, which is not included in the estimate, but the savings will be sufficient to cover the expense

9. If the estimate and plan of the spoil boat are returned, I will get the boats made up at once in Negapatam

10. In conclusion, I beg to request the favour of an early visit to my works.

Memorandum on the tidal portion of the Adapaur river in Tanjore

The following facts respecting the tidal portion of this river have been obtained from measurements of the engraved Map and from Mr Donaghue's Report, dated 3rd May 1867

Tidal portion of the Adapaur river

Distance from Wombalachairy, where spring tides end at the foot of an earthen bank	Probable breadth of river	Depth of water at low tide	Remarks
Miles.	Feet.	Feet	
0	120		
6 5	180		
7	450		
Canal Junction 8 5	530	*9 to 12	From the engraved Map the Adapaur appears to have about the same breadth for the first 6½ miles below Wombalachairy, and then widens out suddenly to nearly the width it has at the proposed junction of the canal.

* Vide paragraph 15 of Captain Oakes' letter, No 960, dated 5th September 1865

20th June 1867

The mean breadth of the surface of the water of the Adapaur, from the point where tide ends near Wombalachair down to the proposed junction of the Negapatam and Vedarniem Canal is 219 707 feet—*vide* margin †

$$\begin{array}{r} \dagger 6.5 \times 150 = 975 \\ 5 \times 315 = 1575 \\ 1.5 \times 490 = 735 \end{array}$$

1867 5

$$219\,707 = 85$$

For every foot in breadth of the river's surface at the junction of the canal with the Adapaur, there is therefore an average breadth between the junction and the point where tide ends of $\frac{219\,707}{530} = 414$ of a foot

The volume of water passed into the river above the junction during a tide may be said to have a mean depth of 1½ feet, the rise and fall of the tide being 2 feet at the junction. This volume is therefore 85 miles $\times$ 5280 feet $\times$ 125 feet $\times$ 414 = 23,236 cubic feet per foot in breadth of the river's surface at the junction, which gives a mean discharge per second of $\frac{23,236}{21,600} = 1.075$ cubic feet. The mean depth of the Adapaur at the junction is probably about 6 feet, and the mean velocity about $\frac{1.075}{6} = 179$ feet or 2 15 inches per second. In the deepest part of the Adapaur at the junction, the mean velocity during a tide is probably 3 inches, and the maximum 6 inches per second. From the canal junction to the sea opposite Topetoray the distance is between 9 and 10 miles.

According to Neville's tables a velocity of 6 inches per second is obtainable with the hydraulic mean depths, and falls per mile entered in the margin, so that for a greater hydraulic mean depth than 3.5 feet less fall than 1 inch per mile would be required.

H M D Feet	Fall per Mile Ft Inchs
3 5 1 5	0 1 0 2

This calculation tends to show that if reservoir room be provided in the new canal between the Vellayaur and the Adapaur rivers, the rise and fall of tide of 2 feet will be quite sufficient to furnish the necessary head of water and surface slope required by the canal to enable it to flow at the rate of 6 inches per second. The previous remarks on the Adapaur further tend to show that a mean velocity of 2 or 3 inches per second will suffice to keep the channel clear. Taking 3 inches per second, and allowing 4 feet to be the mean depth of water in the canal, the reservoir room required per foot in the breadth of the canal will be 21,600 cubic feet. The mean breadth of the surface of the canal, as at present designed, will be 25 feet. The total capacity of the tidal reservoir required by the canal, as at present designed, will therefore equal 21,600 $\times$ 25 = 540,000 cubic feet = 20,000 cubic yards, for each half or 40,000 cubic yards for the whole canal. This could be excavated 510 $\times$ 250 $\times$ 2, leaving a reservoir room of 500 $\times$ 250 $\times$ 4 = 41,000½ cubic yards.

From the Collector of Tanjore, to the Acting Superintending Engineer, 6th Division, dated Negapatam, 17th May 1867, No. 143

1. I have the honour to reply to your letter, No. 196, dated 13th May 1867, in which you ask what would probably be the annual gain to Government if the canal between Negapatam and Vedarniem were in thorough working order.

2. The actual monthly salt sales hitherto at Negapatam, when there has been a plentiful supply of salt there, have been on an average 250 garce, and as we may fairly and reasonably expect that the monthly demand will in future reach this average after the Railway is completed from Negapatam to Errode, the total amount of salt which will be hereafter required annually at Negapatam will be 3,000 garce.

3. The average annual quantity of salt manufactured at Negapatam during the past five years has been 1,250 garce. We shall therefore be obliged to bring 1,750 garce per annum from Vedarniem to Negapatam to meet the demand at the latter place.

4. The cost to Government of manufacturing and collecting salt at Vedarniem will never exceed 8 Rupees a garce, and if we add to this the boat-hire for bringing it from hence to Negapatam at Rs. 14-0-6 per garce (which is a very liberal allowance), we shall have Rupees 170* as the gain to Government from each garce of Vedarniem salt sold at Negapatam.

The wholesale price of Salt The cost of manufacture
• Rupees 192 6 0 (8)
The cost of boat hire
X 14 0 6 = 170.

5. The Government are at present, as you are aware, making up the difference between the earnings of the Great Southern India Railway and a dividend of 5 per cent on its capital the actual profit which will be derived by taking salt from Negapatam inland by rail may therefore be fairly credited to Government. In the present instance the annual profits of carrying 1,750 garce by rail to Trichinopoly, Caroor, and Errode, in the proportion of one-half to the former place and one-quarter to the two latter, are stated by Mr. Betts, the Agent and Traffic Manager, to be about 40,000 Rupees.

6. The account will then stand thus —

Garce of Salt	Rs	Rs
1,750 $\times$ 170	=	2,97,500
Gain by Railway earnings	=	40,000
		3,37,500

7. Hitherto about 500 garce of salt per annum has been imported from Adrampatam to Trichinopoly, but as this will naturally cease when there is a constant supply from Negapatam by rail to Trichinopoly, the annual gain to Government by the sale of this 500 garce or 90,000 Rupees in round numbers, must be set off against the gain from the canal.

8. The actual gain to Government, if the canal is in good working order, will consequently be Rupees 2,47,500. Thus Rupees 3,37,500 — Rupees 90,000 = Rupees 2,47,500.

9. You will perceive that in paragraph 4 I have stated that Rupees 14-6-0 will be a liberal allowance on account of boat-hire for bringing one garce of salt from Vedarniem to Negapatam. My calculation has been based on the supposition that the canal will be wide enough and deep enough to allow of boats which can each carry one garce of salt, passing freely up and down at all times of the year. If it will be necessary to use smaller boats on account of the narrowness or shallowness of the canal, the cost of bringing the salt will, of course, not only be largely increased, but the trouble of getting it all up to Negapatam will be so great that I much doubt if the scheme will succeed. I beg, therefore, that this very important point may not be lost sight of.

No. 444. ORDER THEREON, 20th June 1867, No. 1,846.

CIVIL WORKS, No. 56.

1. The Government regret to learn from this report that, owing to the excessive deposition of silt which now takes place, the maintenance of the canal from Negapatam to Vedarniem in a working condition, will, it is anticipated, be so difficult as annually to require an outlay upon it approaching in amount to the original cost of the work; unless certain preventive measures be taken at considerable additional present expense.

2. The cuttings connecting the tidal portions of the Cuddavayaur, Vellayaur, and Adapaur rivers, which form the navigation, are represented to intercept large drainage streams, and the beds of some of these streams being higher than that of the canal, the tendency of the latter to silt up is considerably increased. The means already provided are stated to be ineffective for securing the perfect scouring of the bed of the canal during the flux and reflux of the tides, and the measures which Colonel O'Connell proposes to adopt to remedy the evil are (1) cutting two side

channels for all the drainage streams, one on the east and the other on the west of the canal, (2) assimilating the condition of the canal to that of the tidal portions of the rivers it connects, (3) increasing its section by doubling its bottom width, and (4) providing each portion of the canal with a tidal reservoir like that of the Adapaur above its junction with the work. Colonel O'Connell adds that it will further be necessary to alter the direction of the northern portion of the canal between the Cuddavayaur and Vellayaur rivers to prevent interference with the drainage stream which it crosses in that section, and which stream will require to be straightened and cleared.

3. The Acting Superintending Engineer reports being unable to state with any accuracy what the cost of these works will be until the levels of the country on either side of the canal have been taken, and the amount of drainage to be carried off by the proposed side channels has been ascertained. The Government authorize the necessary surveys and levels to be now taken, and they will anxiously await a further report, as the value of the canal to the Salt trade is so great as to render it of the utmost importance that it should be placed in efficient working order as early as practicable.

4. His Excellency in Council sanctions the appointment of a competent Surveyor for the duty specified in paragraph 9, and Colonel O'Connell will report the salary proposed to be granted and the period for which his services will be required.

(True Extract.)

(Signed) CHARLES A. ORR, Colonel, R. E.,
Secretary to Government.

To the Superintending Engineer, 6th Division.
" Revenue Department
" Controller of Public Works Accounts.

Ed S. T. Augustin.

914
Memo on the Tidal portion of the
Adapaur River in Tanjore -

The following facts respecting
the tidal portion of this River have been
obtained from measurements of the
engraved map and from Mr. Donaghue's
Report dated 3rd May 1867 -

Tidal Portion of the Adapaur River

Distance from Wambaluchary where spring tides end at the foot of an Eastern bank.	Probable breadth of River.	Depth of water at low tide.	Remarks.
miles.	Feet	Feet	
0	120		From the engraved map the Adapaur ap- pears to have about the same breadth for the first $6\frac{1}{2}$ mile below Wambaluchary & then widens out and leads to nearly the width it has at the proposed junction of the Canal.
6.5	180		
7	450		
Canal junction 8.5	530	9* to 12.	

* vide para 15 of Captain Oake's letter
No 960, dated 5th September 1865. -

The mean breadth of the surface
of the water of the Adapaur from the
point where tide ends near Wambala-
chary down to the proposed junction
of

of the Agapatan & Adarnian Canal
is 219.707 feet. wide margin.

$$\begin{array}{r} 6.5 \times 150 = 975. \\ 5 \times 315 = 1575. \\ 1.5 \times 490 = 735. \\ \hline 219.707 = \frac{1867.5}{8.5} \end{array}$$

For every foot in breadth of the River's surface at the junction of the Canal with the Adapann there is therefore an average breadth between the junction & the point where tide runs of $\frac{219.707}{530} = 4.14$ of a foot.

The volume of water passed into the River above the junction during a tide may be said to have a mean depth of $1\frac{1}{4}$ feet, the rise & fall of the tide being 2 feet at the junction. This volume is therefore $8.5 \times 5280 \times 1.25 \times 4.14 = 23,236$ Cubic feet per foot in breadth of the River's surface at the junction which gives a mean discharge per second of $\frac{23,236}{21.600} = 1.075$ Cubic feet. The mean depth of the Adapann at the junction is probably about 6 feet, and the mean velocity about $\frac{1.075}{6} = .179$ feet or 2.15 inches per second. In the deepest part of the Adapann at the junction, the mean velocity during a tide is probably 3 inches & the maximum 6 inches per second.

From

From the Canal junction to the Se opposite Lopetoray the distance is between 9 and 10 miles.

According to Newell's Tables a velocity of 6 inches per second is obtainable with the hydraulic mean depths & falls per mile entered in the

H.M.D. Feet	Fall per mile. Feet inches
3.5	0.1
1.5	0.2

margin. so that for a greater hydraulic mean depth than 3.5 feet less fall than 1 inch per mile would be required.

This Calculation tends to show that if reservoir room be provided in the new Canal between the Vellyan & the Adapann Rivers, the rise & fall of tide of 2 feet will be quite sufficient to furnish the necessary head of water & surface slope required by the Canal to enable it to flow at the rate of 6 inches per second. The previous remarks on the Adapann further tend to show that a mean velocity of 2 or 3 inches per second will suffice to keep the channel clear. Taking 3 inches

per

per second & allowing 4 feet to be the mean depth of water in the Canal the reservoir room required per foot in breadth of the Canal will be 21,600 cubic feet. The mean breadth of the surface of the Canal, as at present designed, will be 25 feet. The total capacity of the tidal reservoir required by the Canal as at present designed will therefore equal $21,600 \times 25 = 540,000$ cubic feet = 20,000 cubic yards for each half or 40,000 cubic yards for the whole Canal. This could be excavated $510 \times 250 \times 2 =$ leaving a reservoir room of $500 \times 250 \times \frac{1}{3} = 41,000 \frac{1}{3}$ cubic yards.

Wm. Smith Lieut Col. R.E.
 Ag. Super. Engr. 6th Div.

Planned on the side
 position of the
 Cadizian River
 in Singapore

18th 21/11/67

Enclosure in a letter
 from the Acting Chief
 Engineer 6th Div 21031
 dated 1st June 1867 -

No 36 of 18⁶⁷/₆₈

4th Range Office
 Camp Carroonsing
 14th May 1867.

From, 13M
 The Officer in Charge of
 No 4 Range - Singapore
 To, The Super Engineer.
 6th Division.
 Sir,

I beg to submit the following
 report on the Negapatam & Vadamam
 Canal now under progress.

1 - The principal masonry works
 viz: three large masonry tunnels, one
 small masonry sluice, a surplus sluice, &
 the completion of the Carroonsing bridge
 over the Canal were completed in the
 middle of last year.

2 - The excavation of the Canal from
 the Carroonsing, to the Valliam, at
 Valangummi was commenced with
 in the early part of this year imme-
 diately after the monsoon. The length
 of this portion of the Canal is 6300
 yards, and the average depth of cutting
 about 8½ feet, the bottom breadth
 10 feet with side slopes of 2 to 1. The
 work in this reach was divided into
 9 sections & given over to as many
 Contractors

Contractors, from whom agreements have been obtained & securities received for the fulfilment of their contracts. The time for completion expires on the 16th Instant - In most of the sections full depths are reached, but the side slopes & the banks still remain unfinished in several places - I beg therefore you will be good enough to inspect the work about the 16th idem in order that it may be decided whether the penalties for non-fulfilment of contracts should be rigorously exacted. The security money deposited in the Range Office amounts to Rs 898 - The saving on the Estimate for this portion of the excavation will be about Rs 1300 - 0 - 0. -

3 — South of Talangpuri for a distance of or about $2\frac{1}{2}$ miles, the Valliam will be the line of communication, the deep stream being about 6 or 7 feet in depth at mean tide. -

Almost due south of a bend in the Valliam near the Village of Marari, a Canal was excavated on the original Estimate in 1863 -

Between

1571 8
Between the bend & the Ramanaadu head near the Ramupuram Bridge the length of the piece of Canal is 2050 yards, it is much silted and I find that on the average two feet of deposit mud, must be removed, in order to obtain three feet water at low tide. This additional work will be carried out at an early date, no provision was made for this item in the Estimate lately sanctioned for the Canal -

4 — The excavation of the Ramanaadu & Paupan Toikals was commenced on the 21st ultimo, the slopes of the banks & the proper sectioning of the channels here & there only remains to be finished - This excavation has been energetically carried out, & great praise is due to the Sahildan for the number of Coolies he placed at my disposal & for the assistance received from Overseen Appathorai Mudali & Annamuni Mudali -

I regret to add that owing to a dearth from Cholera & the prevalence of rain during the last three days, the Coolies have dispersed, the number having fallen from 8000 to 1500 - But I expect within wednesday

24th

next to have 4000 men employed between the tail of the Kodachuti or its junction with the Adapur, and the head of the Ramnadu Voikal & with this number I expect to have the whole of the work brought to a close within the month.

The saving that will be effected in this reach is calculated at Rs 17,000-0-0

5 — The Kalingula for diverting the Chendramudi Water & excavating the Channel from the Chendramadu to the Canal are nearly completed.

The improvements to the Chendramudi Siphon Sluice as well as the excavation of the Catch drain west of the Canal South of the Vallian are in progress.

Materials for the two 6 feet & two 3 feet surplus sluices for the Ramnadu & Panpan Voikals are in readiness. These sluices are for the small surplus streams that discharge into the Canal.

6 — The Coorian Voikal is a large surplus that empties itself into

17M
into the Ramnadu Channel & its bed now is about four feet above the present bed of the Ramnadu.

I propose that this Channel be carried Southwards by excavating a new Channel two yards wide at bottom with side slopes of $1\frac{1}{2}$ to 1 parallel to the west bank of the Ramnadu Channel & discharged into it at a point 3500 yards lower down where a six feet surplus sluice has been provided for in the Estimate. The dimensions of the sluice will of course have to be increased to about 12 feet by this arrangement a 3 feet surplus sluice allowed in the Estimate for the Simanagoodu Channel may be dispensed with also the excavation of an irrigating Channel for the Rapadagay under sluice & moreover the profit to Government by bringing 50 or 60 Taluks of Surry land under cultivation will amount to 10,000 Rupees a year.

The supply to the Coorian Voikal for the cultivation of the waste land above alluded to will be more certain if the improvements to the Vallian Amicut are sanctioned, are

an Estimate for this work was submitted in the early part of April.

7 — If the above suggestion meets your approval I will prepare Estimate & illustrate the project which appears feasible & profitable; The additional expenses may be covered from the savings pointed out in paras 2 & 4 of the report.

* 17,000
1300
18,300

8 — A Plan & Estimate of a bridge proposed for the Pittaia Ladi Crossing over the Canal are submitted with reference to Memor Nos 17 & 65 dated 4th & 15th April respectively for early sanction. Materials are being prepared for this work which is not included in the Estimate but the savings will be sufficient to cover the expense.

9 — If the Estimate & plan of the Spoil boat are returned I will get the boats made up at once in Rajapattam.

10 — In Conclusion I beg to request the favour of an early visit to my works.

I beg to remain
Your most obed^t servant
Signed (W. D. Donaghy)
Supervisor & P. M.

/ True Copy /

W. D. Donaghy Lieut. Col. R.E.
Sr. Super Engineer

312

1911

312-

Supg Engineer's Office 6th D^r /
Tanjore 1st June 1867. 9114

From

Lieut Col P. P. L. O'Connell - 17th D.
Acting Supg Engineer 6th D^r

To

Colonel C. A. Orr. R. E.
Secretary to Government P. W. D.

Sir,

I have the honor to report for the information of Government that the result of my examination of the Nagapattam and Veeraraniam Canal and of my inquiries respecting its utility are - that it must be widened, and its design otherwise considerably altered before it will be in real working order - and that the additional original cost to Government which these alterations will involve will effect some saving in the annual expenditure which would otherwise have been required and will be amply repaid by the gain obtainable by the additional sales of salt.

2 The whole navigation, as at present designed, consists of the tidal portions of the Rivers Cuddavayam, Vellayam and Adavayam, and artificial cuts or Canals connecting these Rivers - No serious fault can be found with the tidal portions of the Rivers - That of the Cuddavayam

Enclosure in a letter
from the Acting Supg
Engineer 6th D^r 312
dated 1st June 1867.

312/1/1/67

Copy of Letter No 36
dated 4th May from
the Bengal Officer,
relative to the
Veeraraniam
Canal Works

Cuddavayam has, as stated in para 6 of Captain Oakes' Letter No 960 dated 5th September 1865, and printed with the Proceedings of Government in the Revenue Department No 2347 dated 28th September, a depth, at low water, of from 3 to 5 feet except at one point where a shoal, easily removable by a Dredge, forms annually. The Vallayam is said in para 7 of Captain Oakes' Letter to be navigable at all seasons by such boats as it is proposed to make use of on the Canal, except at shoals which form where two surplus channels meet the River. The state of the tidal portion of this River, it will be observed, is not quite so satisfactory as that of the Cuddavayam. The Adappam, as stated in para 15, has a depth of from 9 to 12 feet of water at all seasons and states of the tide. This is the most satisfactory portion of the navigation, than which nothing better could be desired.

3 The artificial Cuts will not, I fear, be kept clear except at a considerable, though as yet an uncertain cost, and with constant interruption to the navigation. A level Cut, connecting two Rivers, is most advantageously situated when it crosses no drainage streams capable of filling its bed with silt. Thus placed, it still receives, during the freshes, the silt laden waters of

of the two rivers, and, during each tide, these waters are changed; so that some deposit must take place. The deposit will be greatest at some point between the two ends of the Cut where the tidal waters meet and cease to flow. The two ends of the Cut may, if it is very long, be even scourd out by the flux and reflux of the tide; but the silting up of the central portion will spoil the navigation. These remarks refer to the connection of the silt bearing rivers of Tanjore and not so much to canals connecting backwaters or lakes, whose waters are nearly free from sediment. If the Cut crosses drainage streams, it is of course still more liable to silt up. If again it joins one of the rivers further up its course from the sea than it does the other, there is certain, during the freshes, to be a steady current of silt laden water flowing from the higher level of the surface of the first river down to that of the second. The current too will be a comparatively slow one, slower, that is, than the current of the river from which it branches off. It will therefore undoubtedly deposit a good deal of silt.

4 The above mentioned causes tend to produce rapid deterioration in a Canal.

Canal or excessive expenditure for keeping it in working order, and they will be in active operation upon the cutting between the Cuddawayan and the Vellayan - That cutting leaves the Cuddawayan at 3 miles from the Sea and joins the Vellayan at $1\frac{1}{2}$ miles from the sea - At 1980 yards from its northern extremity it crosses a drainage stream, any interference with which will not only injure the navigation but the drainage also - The stream joins the Cuddawayan $2\frac{1}{4}$ miles lower down than the Canal does, so that it has the advantage, for drainage purposes, of the surface fall of the river in this distance - To deprive it of this will simply be to spoil it and to injure the lands which it now drains - To pass it under the Canal by a Tunnel will not only be expensive, but the loss of head, required to force the water sufficiently rapidly through the Tunnel to prevent its choking up, will injure the drainage of lands lying so near the sea, and rising so little above it as these do -

5 The Causes tending to produce deterioration in the cutting connecting the Vellayan and Adapam rivers are more numerous and powerful than those mentioned above as affecting the

the cut between the Cuddawayan and Vellayan rivers - Commencing from the Vellayan and travelling southwards, there first comes the Chandranadi - It was originally attempted to pass this river through a Tunnel under the Canal but it burst the Tunnel - The present arrangement may be considered a compromise - A portion only of the waters of the Chandranadi, during freshes, are to pass through the Undertunnel, the remainder is to pass into the Canal, which it will tend to silt up - The next large stream which the Canal meets nearly at right angles is the Coipien voical, which joins at about 1000 yards to the south of the Chandranadi - The bed of this stream is $\frac{1}{2}$ feet higher than the bed of the Canal, and when I proposed to the Sahildar to deepen its bed for some distance up from its junction with the Canal, he objected on the ground, that the Coipien voical, being an irrigation Canal, its waters, when low, would be spoiled by intermixture with the salt water of the Canal, and be rendered unfit for irrigation - I have therefore sanctioned a proposal made by Mr Donaghue to turn the course of the Coipien voical and to carry it parallel to the Canal.

Canal Southward into the Paupan voical.
This is necessary to prevent injury to the
Coasian voical - A reference to the Survey
returned to Government with my letter
No 265 dated 28th Ultimo, will explain the
nature of this alteration - The above men-
tioned streams enter the Canal on its western
side - Some drainage has to find its way
into it from the lands to the eastward also.
This also will bring silt with it - The
Southern Course of the Canal is formed
by a trench partly cut, partly to be cut,
along the beds of the Paupan voical
and the Kootrichittiyans; but, as no
provision is made for deepening at
the same time the upper portions of
the beds of these streams, they will
of course tend to silt up the Canal.

6 That the Canal is too narrow,
Captain Pa has was fully aware of, as
he draws attention to this fact, in
para 20 of his letter already quoted;
he was also to some extent aware of
the deteriorating causes to which I
have alluded, and he estimated that
Rs 10,000 per annum would be required
at first to maintain the Canal in
an efficient state, but he seemed to
think that, after some years, this
sum might be reduced - In my
opinion

opinion, so long as this small Canal
is allowed to be a receptacle for the
Comparatively large streams which it
now meets, it will have to be cleared
annually by excavations approaching
in quantity to those required for its
original formation - Its banks also
will be constantly liable to be breached
and it will never be in a really effi-
cient state - The first thing to be
done is to provide two channels for
all drainage streams; one running
parallel to the Canal on the west,
and another on the East - The next
is to assimilate its condition to that
of the tidal portions of the rivers
which it connects and to increase its
section -

7 The state of the bed of a tidal
portion of a river depends chiefly upon
the materials of which it consists -
the direction of its course and the
velocity with which the tidal waters
flow up and down it - The velocity of
the flow of the tidal waters again
depends upon the greater or less ratio
of the volume of water passed up
every tide into what may not inaptly
be termed the tidal reservoir of a
tidal portion of a river to its cross
section - The larger the reservoir and
the

the smaller the section of the river through which its contents are poured during each ebb of the tide the greater will be the velocity of the stream and its power to scour its bed.

8. I have already drawn attention to the very satisfactory state of the navigation along the tidal portion of the Adappan river, and I append a copy of a report on this river obtained from the Range Officer Mr. Donaghue who I learnt had on a previous occasion surveyed it. The statement made in this report and the Map of the District have enabled me to calculate approximately the Capacity of that portion of the tidal reservoir of the Adappan which lies above its junction with the Canal, and have sufficed to indicate the Capacity of the tidal reservoir which should be provided artificially in order that the Canal may be duly scoured. Each section of the Canal should be provided with such a reservoir. The Canal being a small one, the size of the reservoir required is not great. As the Vellayann river into which the Canal joins has not however a clear bed it will be desirable to be a little more liberal in providing for

for reservoir Capacity than would be necessary were the Vellayann in as good a Condition even as the Cudda-²²¹vayann. The section of the Canal should however be enlarged by doubling its bottom breadth. This will not of course double the total area of that section nor the Cost of its excavation - This particular item of expenditure would only be increased 50 per cent in a five feet cutting and 38.5 per cent in an eight feet cutting.

9. The Cost of the proposed alterations and improvements in the design of this work, which I have been led to suggest, can only be ascertained correctly after the levels of the Country on either side of the Canal have been taken and the amounts of drainage to be carried off by the Channels proposed to be excavated parallel to the Canal have been ascertained. For this work either a special Officer, or, at all events, a Competent Surveyor working under the orders of the Superintending Engineer should be nominated.

10. I will close this report by drawing attention to a letter from

M^r.

Mr. G. Lee Morris, Collector of
Saugor, No 143 dated 17th May 1864. He
there states that, if the Canal be in
good working order, the actual gain
to Government will be Rs 2,47,500-
so that even if it be found that the
alterations and improvements which
I have proposed would cost 2½
lacs of Rupees, the gain to Govern-
ment would not fall far short
of 100 per Cent, after suitable de-
ductions are made for the cost of
maintenance. I am confident
that, if these improvements are pro-
perly carried out, the Canal will
be put into good working order
and that a moderate annual ex-
penditure for dredging in the
Vellayam and in the reservoirs
will suffice to keep the Canal
clear, and that this will be done
without obstructing the navigation.
!! The proposal to provide
tidal reservoirs for scouring a
Navigation may appear a novelty
in India - It is not so however in
Great Britain. A tidal river is
there improved by Engineers doing
all they can to increase its capacity
to hold tidal water, and my proposition

is consistent with English practice
as well as with the actual state of the
lower portions of the Saugor river.
The calculations which I have sub-
mitted are however only meant to
illustrate a principle, and to be
looked upon as approximations,
subject to check after the Rivers
Adapaur, Chandramadi and Vellayam
have been examined in greater detail
and a few cross sections of them,
especially of the Adapaur, have
been carefully taken.

I have the honor to be
Sir
Your most obed^t servant.
Wm. H. P. R.
Asst. Secy. to Govt. C. S. D.

P.S. The direction of the Northern portion
of the Canal between the Cuddavayam
and Vellayam rivers must be altered
so as to prevent interference with the
drainage stream alluded to in para 4 -
This stream should be straightened and
cleared, and the junction of the Canal
with the Cuddavayam, should be
placed below it. M

33M

PROCEEDINGS of the MADRAS GOVERNMENT.

Under date the 20th June 1867
Read the following

From the actg: Supt Engineer
of the 1st Div.

(Here enter No. 312 dated 1 June 1947)

ORDER THEREON,

186 , No.

The Government regret to learn from this report that owing to the excessive deposit of silt which now takes place, the maintenance of the Canal from Negapatnam to Nedamien in a working condition, will it is anticipated, be as difficult as to annually require an outlay upon it approaching an amount to the original cost of the work, unless certain is.

The cuttings connecting the tidal portions of the Andamayan, Vellayanur and Adak

Identified by the Captain in
O'Connor's report. He says that
he was seen to be "in the
line of the line" and
he mentioned the "line" with
he asked in the line. —
preventive measures be taken
at considerable additional
great expense. —

to
The Secretary to Govt.
Washington D.C.

Dated 1st
 Dec Dec 3 June 1863.
 Dr. 3
Rs 312

Dec 1846-Jan 1847

Dependy upon certain
independent articles
until we are ready to
take the necessary
steps to secure the
peace of the world.

443

Q. 12 June 1679. 13th

Q. 12 June 1870 C. A. B. 1211

rivers, which form the navigation, are represented to intercept large drainage streams, and the beds of some of these streams being higher than that of the Canal, the tendency of the latter to silt up is considerably increased. The means already provided are stated to be ineffective for securing the perfect scouring of the bed of the Canal during the flux and reflux of the tides, and the measures which Colonel O'Connell ^{to adopt} proposes as a remedy for the evil are (1) cutting two side channels for all the drainage streams, one on the east and the other on the west of the Canal; (2) assimilating the condition of the Canal to that of the tidal portions

34 15
of the rivers it connects, (3) increasing its section by doubling its bottom width, and (4) providing each portion of the Canal with a tidal reservoir like that of the Adaper above its junction with the water. Col. O'Connell adds that it will further be necessary to alter the direction of the northern portion of the Canal between the Cuddavazur & Vellayur rivers to prevent interference with the drainage stream which it crosses in that section and which stream will require to be straightened and cleared.

The Ag. Engineer reports being unable to state with any accuracy what the cost of these works will be until the levels of the country on either side of the Canal

have been taken, and the amount of drainage to be carried off by the proposed side Channels has been ascertained. The Government authorize the necessary surveys and levels to be now taken, and they will anxiously await a further report as the value of the Canal to the Salt Trade is as great as to render it of the utmost importance that it should be placed in efficient working order as early as practicable.

His Excellency in Council sanctions the appointment of a Competent Surveyor for the duty specified in Para 9, & Col. O'Connell will report the salary proposed to be granted and the period for which his services will be required.

Wb

6 To The Secy of Dist. & Dist. Secy
21 " " " " " "
4 " " " " " "

41
11

original letter

1/2/1861
3711

Public Works 1867 Depart^{ts}

Pro of Govt. for June

No. 1846

Pro of the Madras Govt.

D^d 20th June 1867

Passing orders on a
report on the Vedarnirra
canal in the Tanjore
District, by the Sup^r
Engineer of the 6th Division.

No. 443-444