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MADRAS RECORD OFFICE

GOVERNMENT OF MADRAS

Revenue DEPARTMENT

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Dated	30.7.1875	196 .

Not to be folded or roughly handled

Read the following :—

No. 705.

No. 418.

MEMORANDUM.

THE damage sustained at the north end of the anicut across the Pooniar, a few miles below Trikalore, in the South Arcot District, was reported to Government in the papers printed in Proceedings of the Madras Government, No. 2,031, dated 28th July 1874, and further damage was sustained during the freshes of the following north-east monsoon, the anicut itself, however, sustaining but little injury. The height to which the river rose indicated that it would be desirable to lengthen the anicut and place the head of the Paumbay channel further to the north, as also to raise the head works to 11 feet above the crest of the anicut.

2. The District Engineer having submitted his proposals for the works, the arrangements were reviewed and detailed instructions given, and with his letter No. 231, 2nd February 1875.
No. 195-A, 16th February. No. 68, of the 19th instant, Mr. Norfor

has submitted an estimate for lengthening the anicut, reconstructing the Paumbay channel head sluice, and raising the other head works.

In some respects the design of the foundations of the works is not quite what was intended, these having been commenced prior to the receipt of the instructions, and consequently the plan exhibits some defects of arrangement, as, for instance, wells narrower than the superstructure they have to carry, &c., but with the large amount of concrete provided for probably the sluices will be perfectly stable.

3. In paragraph 4 of his letter the Officiating District Engineer recommends the raising of the wings and head works to 12 feet above the anicut crest, as, on information obtained from the South Indian Railway Officers, he calculates that 8.60 feet of water would have passed over the crest had an anicut of the intended total length of 1,589 feet existed at the time of the floods. A precaution of this kind costs very little, and may save serious accidents, and these walls may accordingly with advantage be raised 1.60 feet, or to 12.60 above the crest, which will leave a margin of 4 feet. The embankments should be 6 inches higher than the walls.

4. Mr. Norfor reports that the cost of the anicut and its connected works given in the statement appended to the notes of inspection printed in Proceedings of the Madras Government, No. 3,143, of the 5th November 1874, requires correction, and that it should be Rupees 1,33,547 instead of Rupees 1,06,101 there shown. The information given in his letter may be of use to the Controller in preparing the capital account.

Proceedings of the Madras Government, Public Works Department,
16th July 1875.

5. A statement of revenue under the channels has been obtained from the Collector and transmitted, and the following is an abstract of it :—

					Average of 5 years prior to anicut.	* Average of 13 years afterwards.
					RS.	RS.
Ragavien Channel	...	...	...	...	33,804	38,842
Paumbay do.	...	...	...	...	3,766	2,653
Do. do.	...	...	...	...	15,672	16,784
Malattar do.	...	...	...	...	14,057	16,233
Sittilinga Muttam Channel	...	...	...	...	2,591	3,258
Vadahmedur do.	...	...	...	...	2,249	2,509
					72,139	80,279
Difference ..					8,140	

* Up to Fasli 1283 or 1873-74.

The Paumbay channel in Trikalore Taluq exhibits a decrease of revenue since the anicut was built, and the Collector is making inquiries as to the cause. The defects of this channel were noticed in para. 5 of the inspection memorandum, and must have affected its efficiency, but these do not account for decrease of revenue. Altogether a gross increase of revenue, as a result of the large outlay on the works, of only about 6 per cent., is very far from satisfactory, and it is essential that the subject should be fully inquired into and efficient arrangements introduced.

6. The estimate for the extension of the anicut and improvements amounts to Rupees 57,860, and some of the rates appear to be much higher than they should be. Under earthworks, for instance, the mass of this sort of work in the north embankment, and in the filling in between the north wing and the Paumbay channel, will necessarily be sand obtainable close at hand, and only the core or facing of the former and a small part of the latter will be of good soil brought from some distance. Apparently the provision for these should be about 3,000 instead of 3,900 Rupees. The rate for rough-stone aprons in 1859 was 1 Rupee, and is in this estimate Rupees 1-13-0. Data in support of the latter were asked for, and have been furnished but without comment or explanation, and it has to be noticed that the cost of packing aprons and building revetments cannot be the same, and that for the former 9 Annas are twice as much as is needed. Also, that for a cubic yard of apron about $\frac{3}{4}$ to $\frac{7}{8}$ of a solid yard of stone are required, whereas $1\frac{1}{2}$ yards are allowed. One-and-a-quarter rupees a cubic yard for aprons and Rupees 1-6-0 for revetments should be ample. The allowances for excavating foundations would seem to be high.

7. Detailed drawings of the way in which the north embankment is to be formed, and of the revetments, should have been given; the latter certainly need a good backing, and for this there is no item in the estimate.

8. Instructions were given regarding the regulation of the under sluices and Paumbay head sluice. For the former, needle shutters are admissible, but they must be properly supported; for the latter, the sliding shutters prescribed should be provided.

Proceedings of the Madras Government, Public Works Department,
16th July 1875.

9. The estimate should be carefully revised with reference to these remarks, and an abstract with sub-heads clearly shown should be prepared. In the meantime, sanction may be given for Rupees 50,000.

OOTACAMUND,
30th June 1875.

(Signed) JOHN MULLINS, Lieut.-Colonel, R.E.,
Offg. Chief Engineer, P.W.D.

From R. E. NORFOR, Esq., Officiating District Engineer, South Arcot, to Lieutenant-Colonel J. MULLINS, R.E., Chief Engineer for Irrigation, dated Camp at Cuddalore, 19th June 1875, No. 68.

WITH reference to your Memorandum, No. 195-A, of the 16th February last,

- 1 Abstract Estimate.
- 1 Specification.
- 1 Plan of Anicut, &c. (by Banghy).
- 1 Survey.
- 1 Section across river.
- 1 Section of line for new Paumbay Channel head.
- 1 Data.
- 1 Revenue statement.

I have the honor to re-submit the revised plans and estimates prepared as far as possible in conformity with your instructions.

2. In the matter of the arrangement of wells below under sluices of anicut your suggestion could not be exactly followed as the Range Officer had commenced this

work before the receipt of your memorandum.

3. The wing walls of anicut are intended to be 11 feet above crest or body wall as per your instructions, but I would suggest, for consideration, the advisability of having them 12 feet above crest.

4. From cross sections taken by the South Indian Railway authorities a mile above and below the anicut, the sectional area of the river at the time of the October flood was in each case 17,112.17 square feet H.M.D., being in one case 4.57 and the other 6.34, the fall per mile being 7.82 feet.

According to this—

$$\text{H.M.D. } \left\{ \begin{array}{l} 1 \text{ mile west} \\ 1 \text{ ,, east} \end{array} \right\} \text{ of anicut } \dots \dots \dots \left\{ \begin{array}{l} = 4.57 \\ = 6.34 \end{array} \right.$$

$$10.91$$

$$\text{Working H.M.D. } \dots \dots \dots = 5.45$$

$$\text{Slope per mile } \dots \dots \dots = 7.82$$

From formulæ

$$V = .9 \sqrt{2ds}$$

when V = Velocity (mean).

d = Hydraulic mean depth.

s = Slope per mile.

We get for mean velocity

$$V = 8\frac{1}{2} \text{ feet per second nearly, and the discharge} = 142,031 \text{ cubic feet per second.}$$

D

$$\sqrt{d^3} = \frac{D}{3.5 \times 1}$$

$$= \frac{142,031}{3.5 \times 1,589}$$

$$= 25.53$$

$$d^3 = 651.78$$

$$d = 8.6 \text{ feet nearly}$$

leaving the wings only 2.40 above E.F.L.

5. I regret the delay that has occurred in the submission of these papers, but it has been unavoidable owing to press of business.

6. With reference to the original cost of the work noticed in paragraph 12 of your memorandum, I have the honor to inform you that the actual cost of the Pennar anicut alone was Rupees 57,285-11-8. The sum of Rupees 1,06,101 entered in your inspection memorandum was intended to represent the cost of the whole project, inclusive of the expenditure on channels, &c., from the anicut. This figure, however, proves not to be correct; it was taken from the statement of remunerative works submitted to the Controller from the late Superintending Engineer's Office in 1870-71, and the error then made has never been rectified since.

7. The details of outlay on this project are as follow:—

	RS.	A.	P.
1. Pennair anicut completed in 1862-63, at	57,285	11	8
2. Ragavien channel completed in 1848-49	13,602	12	7
3. Aumoor do. do. in 1868-69	9,234	2	1
4. Branch do. to Pennavelem from Aumoor channel completed in 1871-72	548	14	4
5. Four syphon sluices to Radapuram and Aumoor channel completed in 1872-73	708	6	5
6. Four head sluices to branch channel from Aumoor chan- nel completed in 1872-73	533	0	4
7. Paumbay channel completed in 1871-72	51,634	0	9
Total ..	1,33,547	0	2

8. As desired by you, I beg also to submit a statement of revenue derived from this work over a period of eighteen faslis prior and subsequent to the construction of the anicut.

No. 195-A.

MEMORANDUM.

THE undersigned has the honor in acknowledging the receipt of the letter, No. 231, of the 2nd instant, from the District Engineer, South Arcot, to request that the following observations on the details of the design for extending the Pooniar anicut, may receive attention.

Enclosures six, returned.

2. *Anicut Extension.*—The arrangements are approved, except that the outer apron, 27 feet wide, on the lower side, should be placed with its surface 1 foot below* that of the cut-stone apron.

* Vide paragraph 6 of memorandum in Proceedings, Madras Government, 5th November 1874, No. 3,143.

2ndly.—It will be desirable to substitute 6 inches of concrete for the lower 6 inches of the rubble masonry under the cut-stone apron. This apron will then consist of—
6 inches concrete.
2½ feet rubble masonry.
1 foot cut stone.

3rdly.—The very narrow rubble apron on the up-stream side of the crest wall would be of little use; 9 feet width appears to be as little as would be effective.

4thly.—The wells under the crest wall should be sunk as close together as practicable.

The present anicut is 1,200 feet in length, and the extension will be 389, viz., 340 feet exclusive of the under sluices.

As soon as materials may be ready, this part of the work can be gone on with, and the foundations completed as soon as possible.

3. *Under Sluices.*—It will be better to give a slight splay to the south front wing as shown, and this wing should be protected by an apron of rubble as shown. The rear wings should be laid out as indicated; by a gradual increase to the width the velocity of the water will be reduced, and there will be less wear and tear on the outer aprons. The District Engineer has proposed to place the sill 5 feet below anicut crest, and this is much better than a higher level, but it is considered that a foot lower will be still better as giving earlier and better protection to the aprons. The outer apron should be much wider than the 10 feet shown. As laid down in dotted lines, it has been arranged to overlap the end of the south wing by 15 feet, and the curve has been struck from a centre on the point of the cut water of the centre pier. It will be better perhaps to make the overlap 21 feet instead of 15, and to make the curve at this part from the end of the wing as a centre. The transverse section shows that the wells as arranged would not do: the walls built upon them must not come to the outside of the wells, for it is impracticable without large stones to get any support for the masonry overlying the spaces between the curves. The best plan will be to put down either two or three rows of wells placed close together without reference to the position of the piers. Two rows of wells will do very well if the space between them be cleared out to 18 inches below their tops and filled in with concrete. There being no roadway, but only a foot-path over the anicut, the object of the ramp over the sluices is not clear. It would seem to be better to make the top horizontal and to form the pathway with three or four beam stones, or an arch with a rise of 1 foot only and 1 foot thick. The vents would then be 5 feet by 4 feet, and might be regulated by three horizontal planks; the lower one 1 foot wide, the second 1½ feet, and the upper one 1¾ feet wide, the bearing surfaces being angle irons. If needles be used, there must be a rear round iron bar at about 16 inches above sill level, and two shutters of each vent must be wedge-shaped.

4. *Position of Paumbay Head Sluice.*—The District Engineer has not adduced any reasons for placing this head sluice so far away from the under sluices, and it would seem that it would be a considerable improvement both as regards the efficiency of the sluice and as regards the alignment of the embankment below were the south abutment of the head sluice placed 30 feet nearer the anicut. This proposed alteration has been laid down in dotted lines. If, however, there be cogent reasons for keeping the sluice at the greater distance, the connecting wall should be laid out as shown in dotted lines with convex curves, by which arrangement the parting of the waters will be more easily effected, and the approaches to the two sets of sluices improved.

For both arrangements the details of the banks between the anicut north wing and the channel have been shown, and it may be remarked that, with the less distant sluice, it will be easier to avoid erosive return currents.

5. *Paumbay Head Sluice.*—The rear wings should be altered as shown. The wells require re-arrangement. For the body of the sluice two rows of close wells, one in front and the other in rear of the cut waters, may be used, the intermediate space being cleared out to 18 inches below the tops of the wells and filled with concrete. Full supply level in the channel has not been marked. The height of the vents need not exceed this by more than 6 inches; the shutters should be regulated by screw gearing, and should slide on angle iron bearings.

6. The difference in the flood level to the north of the river shows that the water level of a point considerably higher up the river was transferred thereto, and, as this state of things is attended with some risk to the safety of the flood bank, it will be well to get rid of this condition of things as soon as possible. In order to understand the circumstances, a survey of the river for some distance above the anicut will be needed, but it may be remarked that the spur or projecting embankment at right angles to the north flood bank must have a tendency to hold the water up; that the face of the flood bank and its toe can be protected by a nanul plantation extending 25 yards or so to the westward of the toe; and that, moreover, it will be well to extend this plantation ultimately over all the ground beyond the proper alignment of the river which may be liable to inundation.

*Proceedings of the Madras Government, Public Works Department,
16th July 1875.*

7. It is thought that one part of soorkhee (clay burnt in cakes and ground is better than brick dust) to one of lime will be insufficient by hydraulic for work below 16-00, and that 1½ or 2 burnt clay to one lime will then be a better mixture; one part of sand may be used in concrete and also in superstructure; but in setting cut-stone aprons the joints should be of cement without sand.

8. As there will be some delay in revising the designs and estimate, the District Engineer is authorized to go on with the work so soon as he may have prepared working drawings in accordance with these instructions, but it is requested that the least possible delay may be allowed to occur in transmitting the revised papers for the sanction of Government.

9. It has to be remembered that the north flood bank must not be made altogether of sand, but that either its up-stream face or a core in the centre must be of water-tight soil, and this soil must be founded below the sandy soil of the river bed or bye-wash. One or two sections should be put on paper.

10. The length and cost of the guard wall, as it is termed, to the north of the head sluice, are not shown in the abstract estimate; the front wing may be assumed to be of the same length as the rear wing return, and the wall beyond should be a separate item of the estimate, and its length should be marked on the plan.

11. It is noticed that in the estimate* of 1859, the rate for rubble-stone aprons is 1 Rupee a cubic yard, and in the present estimate Rupees 1-13-0. It will be well to append data

* Rupees 61,000.

for the latter rate. Moreover, it is of importance that the stone of these aprons should be of large size, and therefore the specification should note what minimum size will be accepted. If the quarries contain an abundance of stone of 2 cubic feet, that size might be specified.

12. Reference has first been made to an estimate of Rupees 61,000, but in the list appended to the inspection memorandum already alluded to, the cost of the anicut is entered at Rupees 1,06,101, and the undersigned will be glad of information as to any supplemental estimates which may have been sanctioned.

13. Though this should not delay the submission of the estimates, the District Engineer is requested to ascertain what the revenue under the several channels supplied by the anicut was prior to and since its construction, as the Government will be glad of such particulars as will show what the value of the work is, now that a very considerable addition to capital outlay has to be made.

14. The enclosures received with the District Engineer's letter under reply are returned.

CAMP AT VENKATAGHERRY, (Signed) JOHN MULLINS, Lieut.-Colonel, R.E.,
16th February 1875. Chief Engineer.

No. 419. ORDER THEREON, 16th July 1875, No. 2,020.

IRRIGATION, No. 45.

PENDING the revision of the estimate for the extension of the Pooniar anicut near Trikalore, in South Arcot, an

approximate estimate of Rupees 50,000 is sanctioned.

2. The results of past outlay, as indicated by the figures given in paragraph 5 of the foregoing memorandum, are by no means satisfactory, and it is necessary that no time should be lost in ascertaining why the revenue has not increased more considerably, and what causes of inefficiency in the channels require to be remedied. It is to be noticed that the assessment of lands under the anicut is given in the statement forming Appendix A of the inspection memorandum of the Chief Engineer for Irrigation at

Proceedings, Madras Government, 5th November 1874, No. 3,143.

Rupees 1,68,200, whereas the revenue statement, dated 19th June 1875, makes the total revenue Rupees 80,279. This

*Proceedings of the Madras Government, Public Works Department,
16th July 1875.*

latter statement was neither abstracted nor reviewed in any way either by the Collector or Officiating District Engineer, and in the form submitted no information of value was presented. Explanation is manifestly necessary, and should have been afforded in the first instance.

3. A report will also be required as to the probability of a reasonable return being derived from the anicut and its channels. The outlay upon them will probably not fall short of Rupees 2 lakhs, and an increase of Rupees 20,000 in revenue would not be more than sufficient to make them fairly successful.

(True Extract.)

J. H. Astub

Major, R.E.,

Offg. Joint Secretary to Government.

To the Chief Engineer for Irrigation.

„ Revenue Department.

„ District Engineer, South Arcot.

„ Controller of Public Works Accounts.

Exd. A. Grubert.

20 Spare Copies will follow

30 July

Mr. John Boarding, Newbury, Chesapeake