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MADRAS RECORD OFFICE

Government of Madras

Public Works DEPARTMENT

G.O. No.	34 55-56	Press
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Dated	16. 12.	1957
		1876

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Read the following papers :—

No. 268-W.

No. 417. NOTE BY THE CHIEF ENGINEER FOR IRRIGATION.

Pennair Anicut Extension Revised Estimate.

The sanctioned estimate amount is Rupees 1,59,150, viz. :—

Works.	Tools and Plant.	Establishment.
RS.	RS.	RS.
1,15,610	8,860	34,680

and the revised estimate amounts to Rupees 2,07,245, viz. :—

Works.	Tools and Plant.	Establishment.
RS.	RS.	RS.
1,47,500	11,500	44,245
Difference 31,890	6,640	9,565

2. The causes of excess on works are—

1st.—Deviations from sanctioned designs of works.

2nd.—Higher rates.

3rd.—Additional works.

3. The papers submitted by the District Engineer afford very full information regarding every item of the revised estimate, and the present District Engineer who has had comparatively little to do with the extension work has gone carefully through the report of the Executive Officer, so that but very few remarks need be added here. The comparative statement, Lieutenant Henderson's memorandum in connection therewith explaining the differences item by item, and in the margin of which the work referred to and the estimate and work rates have been added to save repeated reference to the statement, that officer's general remarks and his explanations

No. 102, 20th September.

regarding deviations will, together with the District Engineer's letter, afford any information that may be desired.

4. *Deviations.*—As regards deviations, some especially those which have been made in the direction of shallower foundations are to be regretted, and this remark applies more particularly to the retaining wall at the foot of the sloping apron. Most of the deviations of importance at the work in the bed of the river were occasioned by difficulties experienced in carrying on such work owing to freshes, but some of the difficulty might have been easily obviated and a good deal of expense saved, had it not been thought necessary to unwater wells before filling with concrete; at Nellore the lime when mixed with burnt clay makes such an excellent hydraulic mortar, that concrete can be laid as satisfactorily in still water as out of water.

The arrangements for connecting the north wing with the flood embankment do not correspond with those considered most suitable when the estimate was sanctioned. The upstream connecting flood bank has been made on the alignment

Note paragraph 7 in Proceedings of the Madras Government, 19th June 1875, No. 1,738.

then stated to be objectionable, and it has not been mentioned why the preferable alignment laid down on the survey has not

been adhered to. Even had the line for the west flood bank been suitable, the cross section of this and of the approach show that a good deal of unnecessary expense will

result. There was no need of a high retaining wall on the west side of the roadway ramp, or for filling in the whole space between that wall and the rear face of the flood bank to 4 feet above M.W.L. The east revetment wall and earthwork behind is correct except that the masonry revetment should not extend beyond the section IV, seeing that it is neither necessary nor desirable to found masonry on made earth, and revetment (dry) should be substituted for masonry beyond section IV. Some reduction of expense may still be possible seeing that the revetment walls had not been carried up to their full height. It is questionable also whether the revetment (dry) on the

Date of plan, 20th September 1876.
east face of the east connecting bank is requisite.

5. Rates.—The impression which the undersigned has formed from a careful perusal of the Executive Officer's memoranda is that a good deal of the extra cost due to increase of rates might have been avoided, had

1st.—The work been commenced earlier as it should have been;

2nd.—The arrangements essential to carrying on extensive operations vigorously and without confusion been made in anticipation of the commencement of work in the bed of the river;

3rd.—The quarry plant been put to rights earlier and supplemented to the extent required.

In order that the very great variations in rates for the same description of work at different times during the progress of the extension works may be the more easily seen, the following abstract of the rates shown in the comparative statement has been prepared, from which it will be noticed that some of the work was done at very moderate rates and well within those provided in the estimate, while other has cost so very much more as to make it difficult to understand how any sufficient cause could be shown.

Statement showing the rates on which the Pennair anicut works have been constructed:

Description of Work.	EXTENSION RATES.		Repair Rates, Estimate Rs. 59,500, sanctioned in G.O., No. 544, dated 24th February 1871, Estimate.	Restoration of 1859, Estimate.	Remarks.
	Estimate.	Work.			
CONCRETE.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	
Body wall.					
Concrete for wells under body wall C. yd.	2 3 0	4 2 5			
Retaining wall.					
Concrete for wells C. yd.	2 3 0	3 13 5	2 3 0	2 13 0	
Do. for breach Do.	..	3 13 5			
Apron between body and first binding wall.					
Concrete for filling interstices .. C. yd.	2 3 0	2 13 7			
Apron between first and second binding walls.					
Concrete for filling interstices .. C. yd.	2 3 0	4 6 8			
Apron between second and third binding walls.					
Concrete for filling interstices .. C. yd.	2 3 0	2 7 7			
Between third binding wall and retaining wall.					
Concrete for filling interstices .. C. yd.	2 3 0	1 14 9			

Description of Work.	EXTENSION RATES.		Repair Rates, Estimate Rs. 59,500, sanctioned in G.O., No. 544, dated 24th February 1871, Estimate.	Restoration of 1859, Estimate.	Remarks.
	Estimate.	Work.			
CONCRETE—(Contd.)	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	
Beyond retaining wall.					
Concrete for filling interstices .. C. yd.	2 3 0	..			
Front wing wall.					
Concrete for wells.. .. C. yd.	2 3 0	3 2 10	2 3 0	2 13 0	
Abutment.					
Concrete for wells.. .. C. yd.	2 3 0	2 15 9			
Rear wing wall.					
Concrete for wells.. .. C. yd.	2 3 0	3 4 7			
Rear return.					
Concrete for wells.. .. C. yd.	2 3 0	3 7 4			
Revetment walls road approach.					
Concrete C. yd.	2 3 0	3 14 9			
Do. under flooring "	2 3 0	2 4 8			
Temporary wall over body wall.					
Concrete C. yd.	..	9 1 2			
BRICKWORK IN MORTAR.					
Body wall.					
Brick in chunam wells .. C. ft.	0 3 0	0 3 4			
Retaining wall.					
Brick in chunam wells .. C. ft.	0 3 0	0 3 6			
Do. for breach "	..	0 3 6			
Front wing wall.					
Brick in chunam wells .. C. ft.	0 3 0	0 3 3			
Do. for foundations .. C. yd.	..	4 11 8			
Abutment.					
Brick in chunam wells .. C. ft.	0 3 0	0 2 8		2 8 0	Cubic yard.
Do. above foundation .. C. yd.	..	5 0 0			
Rear wing wall.					
Brick in chunam wells .. C. ft.	0 3 0	0 3 6			
Do. for foundation .. C. yd.	..	5 1 6			
Rear return.					
Brick in chunam wells .. C. ft.	0 3 0	0 2 11			
Temporary wall over body wall.					
Brick in chunam C. ft.	..	0 4 7 1			
RUBBLE MASONRY.					
Body wall.					
Rubble in chunam for foundations .. C. yd.	3 8 0	3 15 10 1			
Do. breach "	..	3 15 10 1			
Do. above foundation "	3 8 0	4 2 2			
Do. breach "	..	4 2 2			
First binding wall.					
Rubble in chunam for foundation .. C. yd.	3 8 0	4 7 11			
Do. breach "	..	4 7 11			
Do. above foundation "	3 8 0	4 0 0			
Second binding wall.					
Rubble in chunam for foundation .. C. yd.	3 8 0	4 7 1			
Do. above do. "	3 8 0	3 14 1			
Do. for breach "	..	3 14 1			
Third binding wall.					
Rubble in chunam for foundation .. C. yd.	3 8 0	3 11 6			
Do. above do. "	3 8 0	3 12 9			
Do. for breach "	..	3 12 9			

Proceedings of the Madras Government, Public Works Department,
16th December 1876. No. 3,455.

Description of Work.	EXTENSION RATES.		Repair Rates, Estimate Rs. 59,500, sanctioned in G.O., No. 544, dated 24th February 1871, Estimate.	Restoration of 1859, Estimate.	Remarks.
	Estimate.	Work.			
RUBBLE MASONRY—(Contd).					
Retaining wall.					
Rubble stone in chunam C. yd.	3 8 0	5 6 7½			
Do. do. for breach "	..	5 6 7½			
Front wing wall.					
Rubble in chunam for foundation .. C. yd.	3 8 0	4 9 6	3 5 0	2 0 0	
Do. above do. "	3 8 0	4 3 8			
Abutment.					
Rubble in chunam for foundation .. C. yd.	3 8 0	4 7 1			
Do. above do. "	3 8 0	3 8 0			
Rear wing wall.					
Rubble in chunam for foundation .. C. yd.	3 8 0	3 13 2½			
Do. above do. "	3 8 0	4 4 0			
Rear return.					
Rubble in chunam C. yd.	3 8 0	4 3 5			
Do. above do. "	3 8 0	3 11 8			
Revetment walls road approach.					
Rubble in chunam for foundation .. C. yd.	3 8 0	3 2 5			
Do. above do. "	3 8 0	3 1 6			
Extra binding wall.					
Rubble in chunam for foundation and super-structure C. yd.	..	2 11 4	3 5 0	2 0 0	
RUBBLE STONE WORK.					
Body wall.					
Rubble stone for foundation of groynes C. yd.	1 5 0	1 0 0			
Do. do. groynes above foundation ..	1 5 0	1 1 3			
First binding wall.					
Rubble C. yd.	1 5 0	2 1 4			
First and second binding walls.					
Rubble C. yd.	1 5 0	1 12 0			
Second and third binding walls.					
Rubble C. yd.	1 5 0	1 5 5			
Third binding and retaining wall.					
Rubble C. yd.	1 5 0	1 0 8			
Apron beyond retaining wall.					
Rubble C. yd.	1 5 0	1 3 4		1 5 0	
Apron beyond second portion.					
Rubble C. yd.	1 5 0	1 1 2			
Revetment walls road approach.					
Packed rubble flooring C. yd.	1 5 0	0 13 9			
Do. do. "	1 5 0	0 14 5½			
RUBBLE WITH PORTLAND CEMENT.					
Body wall.					
Rubble with Portland cement for breach C. yd.	..	7 1 9½			
RUBBLE WITHOUT MORTAR.					
First binding wall.					
Rubble without mortar for breach .. C. yd.	..	1 14 0			
Second binding wall.					
Rubble as above C. yd.	..	2 10 3		1 5 0	
Third binding wall.					
Rubble as above C. yd.	..	2 5 10½			

The rate in the column of restoration is per solid yard of rough stone. The corresponding rate for stone measured in situ would be about 1 Rupee.

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Description of Work.	EXTENSION RATES.		Repair Rates, Estimate Rs. 59,500, sanctioned in G.O., No. 544, dated 24th February 1871, Estimate.	Restoration of 1859, Estimate.	Remarks.
	Estimate.	Work.			
CYCLOPEAN RUBBLE.					
Apron between body and first binding wall.	RS. A. P.	RS. L. P.	RS. A. P.	RS. A. P.	
Cyclopean rubble C. yd.	1 8 0	1 14 9	}		
First and second binding walls.					
Cyclopean rubble C. yd.	1 8 0	2 1 8			
Second and third binding walls.					
Cyclopean rubble C. yd.	1 8 0	1 4 4			
Third binding wall and retaining wall.					
Cyclopean rubble C. yd.	1 8 0	1 5 2			
Apron beyond retaining wall.					
Cyclopean rubble C. yd.	1 8 0	1 0 5			
Pitching adjacent to rear return.					
Cyclopean do. for foundation .. C. yd.	1 8 0	1 2 8			1 5 0
Do. above do. "	1 8 0				
Pitching adjacent to front wing.					
Cyclopean rubble for foundation .. C. yd.	1 8 0				
Do. above do. "	1 8 0				
Pitching of outer face of up stream approach.					
Cyclopean rubble for foundation .. C. yd.	1 8 0				
Do. above do. "	1 8 0				
Pitching of outer slope of down stream approach.					
Cyclopean rubble for foundation .. C. yd.	1 8 0				
Do. above do. "	1 8 0				
LATERITE MASONRY.					
Body wall.					
Laterite on edge in chunam .. C. yd.	6 12 0	7 6 8	}		
Do. for breach "		7 6 8			
First binding wall.					
Laterite on edge in do. .. C. yd.	6 12 0	7 8 0			
Second binding wall.					
Laterite as above C. yd.	6 12 0	6 12 1			
Third binding wall.					
Laterite as above C. yd.	6 12 0	6 6 5		4 0 0	3 8 0 and 4 0 0
Retaining wall.					
Laterite as above C. yd.	6 12 0	5 12 4			
Front wing wall.					
Laterite in chunam C. yd.	5 0 0	6 2 1			
Abutment.					
Laterite in chunam C. yd.	5 0 0	7 2 1			
Revetment walls road approach.					
Laterite flooring on edge.. .. C. yd.	5 0 0	3 14 6	}	3 8 0 and 4 0 0	
Temporary wall over body wall.					
Laterite in chunam C. yd.		3 14 8	4 0 0		

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Description of Work.	EXTENSION RATES.		Repair Rates, Estimate No. 59,500, sanctioned in G.O., No. 544, dated 24th February 1871, Estimate.	Restoration of 1859, Estimate.	Remarks.	
	Estimate.	Work.				
GRAVEL BACKING.						
Pitching adjacent to rear return.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.		
Gravel backing C. yd.	0 8 0	..	}			
Pitching adjacent to front wing.	0 8 0	..				
Gravel backing C. yd.	0 8 0	..		..	0 4 0	
Pitching outer face of up stream approach.	0 8 0	..				
Gravel backing C. yd.	0 8 0	..	}			
Pitching outer slope of down stream approach.	0 8 0	..				
Gravel backing C. yd.	0 8 0	..				
POINTING.						
Body wall.						
Pointing front face and top of body wall Sqs.	2 0 0	..	}			
First binding wall.						
Pointing at top of binding wall .. Sqs.	2 0 0	..				
Do. second do. .. "	2 0 0	..				
Do. third do. .. "	2 0 0	..				
Do. retaining wall .. "	2 0 0	..		2 0 0	..	
Do. front wing do. .. "	2 0 0	2 3 8				
Do. abutments .. "	2 0 0	1 14 7				
Pointing at rear wing wall .. "	2 0 0	..				
Do. rear return .. "	2 0 0	..				
Do. revetment wall and road approach Sqs.	2 0 0	..				
SINKING WALLS.						
Under body wall Each.	10 0 0	5 4 3	}			
Do. last retaining wall "	10 0 0	4 7 5				
Do. front do. "	10 0 0	11 4 6				
Do. abutments "	10 0 0	4 3 0				
Do. rear wing wall "	10 0 0	5 3 1		..	10 0 0	
Do. rear return "	10 0 0	7 9 1				
Turfing S. yd.	0 0 6	..			The rate given in the column of restoration is for wells of brick in chunam filled with stone and cement.	

The rate given in the column of restoration is for wells of brick in chunam filled with stone and cement.

The reasons adduced are given in paragraph 10 of the District Engineer's letter; that marked

(a) really means that a great deal of work had to be done in a short time, and this reason might hold good were the work done hurriedly and in all weathers. anicut work compared with work more favorably circumstanced, but it can hardly be of much importance when rates based upon work done at the anicut previously and under not dissimilar circumstances are in question.

The reasons (b) and (c) are cause and effect; they apply equally to the rates of former work at the anicut, on which the rates of the extension estimate were presumably based.

Insufficiency of rate for concrete. (d) here again the cost of some of this description of work indicates that the estimate rates might have sufficed.

(e) Frequent freshes which would necessarily keep much of the labor either unemployed or render it impracticable to employ such labor in the best way is a Labor unproductive from floods and sickness.

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legitimate reason for excess expenditure. The diagram of the river for 1858 is not in this office, and in that year there was much work done. In 1859-60 when the anicut was restored on Sir Arthur Cotton's section there were high freshes in July and August, a considerable rise in the river in September and a heavy fresh in November. In 1875 up to the middle of May the state of the river was favorable. In June and July, at the end of August, and of September, and in the last week of October the river rose considerably above the crest of the anicut, but on the whole there do not appear to have been unusual difficulties from freshes.

Sickness would have the effect of delaying work, and might also by interfering with its regular progress tend to enhance the rates somewhat, though not very materially. It was responsible directly for one District Engineer's letter, paragraph 6, item 22. item of the expenditure, viz., the cost Do. do. item 16. Rupees 3,224-5-4 of feeding coolies, a measure which had good results and was approved at the time. Part of the excess of Rupees 2,941-14-3 on sundries was also due to this cause, various sanitary measures having been rendered necessary—Vide Executive Officer's memorandum on item No. 101 of comparative statement. Rupees 4,000 may perhaps be taken as the extra cost due to the outbreak of cholera in July 1875.

6. The items amount to Rupees 11,40-5-7,

First, embankment at north approach ... Rupees 2,185-2-4.

The District Engineer supposes this to have been an omission by mistake from the original estimate, but it is in part at least Additional work District Engineer's letter, paragraph 6, items 17 to 21. deviation from the intended arrangements, and it is hoped some of this item

may still be saved. Instructions have been sent to the District Engineer.

Second, closing breach ... Rupees 4,408-12-6.

No single item of this amount appears in the comparative statement, but the charge appears to be made up of a number of small items shown as appertaining to the breach, which was caused by a fresh during the progress of the work. The particulars are given in enclosure No. 7 of the District Engineer's letter.

Third, rubble dam ... Rupees 2,326.

Explanation will be found in paragraphs 24 and 25 of the District Engineer's letter. The dam was constructed long before the sanctioned estimate was submitted, and whatever expenditure on its account had to be adjusted should have been provided for therein. The dam was in the nature of a ring bund connecting the north bank of the river with the uninjured part of the anicut.

Fourth, temporary wall on body or crest wall ... Rupees 2,125-13-4.

District Engineer's letter, paragraph 26. This wall was to prevent water passing over the extended crest until the masonry had set and hardened sufficiently.

Fifth, extra binding wall ... Rupees 356-3-5.

This is a petty work and is noticed in paragraph 27 of the District Engineer's letter.

7. The value of tools and plant after completion of the work is estimated by the District Engineer at Rupees 7,000, and he suggests their transfer to stock. Such

Tools and Plant.

as are not likely to be required in the district should be disposed of if practicable.

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8. The Executive Officer, Lieutenant Henderson, worked throughout with great zeal and devotion, and the successful progress of the work without serious accident from the freshes of 1875 was mainly due to his exertions. It is considered that very little responsibility can attach to him for the excess cost, seeing that his experience in such operations was necessarily limited, and he worked under the immediate orders and control of the late District Engineer who died in January last.

9. It will be seen that, at the beginning of September, work estimated to cost Rupees 18,500 remained to be done to complete the extension, and of this sum Rupees 6,000 were needed to place the work in a safe state and to meet due bills. Enclosure No. 8 of the District Engineer's letter gives the particulars of the former, amounting to Rupees 3,000.

The undersigned is unable to make any suggestion as to how the Rupees 6,000 required can be provided, no money for reappropriation from Major Works under Ordinary being available. If possible the whole sum required to complete should be allotted, for the postponement of the completion will probably involve extra outlay in the end.

FORT ST. GEORGE, (Signed) JOHN MULLINS, Lt.-Col., R.E.,
24th November 1876. Chief Engineer for Irrigation.
To the Secretary to Government, Public Works Department.

No. 417-A. From J. O'SHAUGHNESSY, Esq., District Engineer, Nellore, to Lieut.-Colonel J. MULLINS, R.E., Chief Engineer for Irrigation, dated Nellore, 20th September 1876, No. 102

In reference to the orders noted in the margin, I have the honor to submit a revised estimate of the cost of the Pennair anicut extension.

G.O., No. 3,628, dated 27th December 1875.
" " 1,888, " 25th July 1876.
" " 2,196, " 21st August 1876.
Chief Engineer's memorandum, No. 190, dated 12th July 1876.

2. The original estimate sanctioned in G.O., No. 1,738, dated the 19th June 1875, amounts to Rupees 1,59,150.

The revised estimate amounts to Rupees 2,07,245, exceeding the original estimate by Rupees 48,095, or 30½ per cent. nearly.

3. The following abstract shows how the excess is distributed against the main heads of the estimate:—

Main heads of Estimate.	Amount of Original Estimate.	Amount of Revised Estimate.	Excess.	Centage.
Works	RS. 1,15,610	RS. 1,47,500	RS. 31,890	27½
Tools and Plant	8,860	15,500	6,640	75
General Establishment... ..	28,900	36,870	7,970	24
Direction and Accounts	5,780	7,375	1,595	27½
Total ...	1,59,150	2,07,245	48,095	30-22

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4. The accompanying comparative statement (enclosure No. 3) shows the excess and saving on every item of the original estimate, as well as the cost of work not included in the original estimate.

A memorandum* by the Executive Officer (Lieutenant Henderson, R.E.,) is attached to this statement explaining in detail the cause of excess or saving in each case.

* No. 4.

5. The statement just referred to, as well as the explanatory memorandum attached to it, being of necessity rather voluminous, I have prepared a more condensed statement (enclosure No. 5) by grouping the several items of the same description of work under one head and calculating on average rates. This statement will show at a glance the particular descriptions of work on which an excess or saving of expenditure occurs.

6. The following abstract gives almost the same information in a still more condensed form and will save the trouble of repeated reference to the statements above referred to:—

PENNAIR ANICUT EXTENSION.

Abstract of Original and Revised Estimates.

No.	Item of Work.	Original Estimate.	Revised Estimate.	Saving.	Excess.
		RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.
1	Concrete	4,461 5 4	7,328 4 7	.. ..	2,866 8 3
2	Brick in chunam	12,659 2 3	15,538 1 11	.. ..	2,878 15 8
3	Rubble in chunam	23,707 1 0	25,817 0 3	.. ..	2,109 15 3
4	Laterite in do.	8,468 0 8	8,731 5 6	.. ..	263 4 10
5	Pointing	560 14 10	645 6 1	.. ..	84 6 3
6	Rubble (dry)	34,148 12 2	35,193 11 11	.. ..	1,044 15 9
7	Gravel backing	724 10 8	615 6 8	109 4 0	.. ..
8	Excavating foundation	6,000 0 0	8,500 0 0	.. ..	2,500 0 0
9	Filling in old breach	1,500 0 0	2,290 14 6	.. ..	790 14 6
10	Wells	3,150 0 0	1,792 3 4	1,357 12 8	.. ..
11	Turfing	118 12 0	118 12 0	.. ..	.. ..
12	Filling in front of anicut	250 0 0	2,000 0 0	.. ..	1,750 0 0
13	Tramway	6,500 0 0	8,000 0 0	.. ..	1,500 0 0
14	Baling	3,000 0 0	5,000 0 0	.. ..	2,000 0 0
15	Land	3,000 0 0	1,000 0 0	2,000 0 0	.. ..
16	Superintendence and sundries	7,361 5 1	10,303 3 4	.. ..	2,941 14 3
17	Embankment at north approach .. ..	.. ..	2,165 2 4	.. ..	2,165 2 4
18	Closing breach .. ..	.. ..	4,408 12 6	.. ..	4,408 12 6
19	Rubble dam .. ..	.. ..	2,326 0 0	.. ..	2,326 0 0
20	Temporary wall on body .. ..	.. ..	2,125 3 4	.. ..	2,125 3 4
21	Extra binding wall .. ..	.. ..	356 3 5	.. ..	356 3 5
22	Feeding coolies .. ..	.. ..	3,224 5 4	.. ..	3,224 5 4
	Total, Works	1,15,610 0 0	1,47,500 0 0	3,467 0 8	35,357 0 8
23	Tools and plant	8,860 0 0	15,500 0 0	.. ..	6,640 0 0
	Total, Estimate	1,24,470 0 0	1,63,000 0 0	3,467 0 8	41,997 0 8
24	General Establishment	28,900 0 0	36,870 0 0	.. ..	7,970 0 0
25	Direction and Accounts	5,780 0 0	7,375 0 0	.. ..	1,595 0 0
	Grand Total	1,59,150 0 0	2,07,245 0 0	3,467 0 8	51,562 0 8

7. Items Nos. 1 to 16 of the above abstract include all the items of the original estimate which come under the head "Works."

The excess on these items amounts to 20,731 5 9
The saving amounts to 3,467 0 8

Which leaves a net excess on the items originally estimated of 17,264 5 1
or about 15 per cent.

8. The first six items were estimated and are accounted for in detail by rates and measured quantities. The excess on these six items amounts to Rupees 9,248-9-0, of which Rupees 6,192-0-8½ or 7·36 per cent. is due to increased rates, and Rs. 3,056-8-3½ or 3·64 per cent. is due to increased quantities.

9. Items 7 to 16 were estimated in lump sums, and the excess on those items in this group which cost more than the estimated amount is Rupees 11,482-12-9 or 46·6 per cent.

10. In regard to the first six items, which constitute the principal part of the work, the excess in rates is attributed—

- (a) To the hurried manner in which the work had to be carried out in all weathers.
- (b) To the confined space in which the work was executed.
- (c) To the consequent difficulty of getting a proper amount of work from the work people.
- (d) To the insufficiency of the rate allowed in the original estimate for concrete; and
- (e) To the necessity for keeping a large staff of artisans and laborers on pay during floods and during an unfortunate outbreak of epidemic cholera when no work could be done.

11. The excess due to quantities on these six items was caused by deviations, which are said to have been authorized by the late District Engineer, in the arrangements and dimensions of portions of the original design, the amount is comparatively trifling and seems to call for no further explanation, though the deviations, as will be seen from the plan, are of considerable extent.

12. The excess on the items, Nos. 8, 9, 12, 13, 14 and 16, appears comparatively high, but it is in some cases at least owing to insufficient provision in the original estimate. Item No. 8 for instance, "excavating foundation," cost only 2 Annas 1½ Pies per cubic yard, and considering the distance and the height to which the soil had to be carried, the rate is cheap, and the quantity must have been very much underestimated. Item No. 9 "filling in deep pool in old breach" to level up for well-sinking cost 1 Anna 11 Pies a cubic yard. The material used for this purpose was principally sand, which had to be brought a considerable distance; the cost of the work is therefore moderate and must have been under-estimated originally. The very great excess in item No. 12, "filling in front of anicut," is attributed to the scour caused by the flood of June 1875, which enlarged the pit and rendered much additional work necessary.

13. The excess on item No. 13 "tramways" is owing to an expenditure of Rupees 1,541-14-2 incurred during the emergent repair of damages after the great flood of 1874, having been charged to the extension estimate. The hurried work done to the tramway in that emergency had all to be done over again, and if it was right to charge it to this estimate, it should have been specially provided for.

14. "Baling," item No. 14, had to be carried on through the monsoon. Under these circumstances the cost is not excessive, and the work was not sufficiently provided for in the original estimate.

15. Item No. 16 comprises temporary superintendence, sundries, sanitation, hospitals and ferry charges and other contingencies. Many of these charges should

perhaps have been more properly charged to other items of the work. The expenditure under this head amounts to 10½ per cent. of the revised estimate for works, and considering the multifarious demands which it must have supplied, the amount, it is hoped, will not be considered excessive.

16. Before leaving this part of the subject, it will be as well to explain the "savings" on items 7, 10 and 15 of the abstract of the original estimate.

17. The saving on item No. 7 is caused by an alteration made by me in the section of the pitching below the rear wing of the anicut; this alteration is shown on the accompanying plan and will, I hope, be approved.

18. The saving, Rupees 1,357-12-8, on wells 'item No. 10' is caused by less dimensions. The reduced dimensions of the wells is in some cases owing to clay having been reached at a less depth than was anticipated, and in other cases to the solid foundation having been carried down lower than it was supposed the level of the water would permit. Fifteen of "Bull's" dredgers were purchased for this work, but they were very little used; they were, however, the means of causing a portion of the saving on this item, because the well-sinkers undertook the work at very low rates, rather than have it taken out of their hands by ordinary coolies with the dredgers.

19. The cost of the dredgers was charged to Tools and Plant.

20. The saving on item No. 15 "land" is caused by no demand having been made for compensation. The owners of the land taken up have, it is said, in some cases accepted Government waste instead. The arrangements are in the hands of the Revenue Department and appear to be still unsettled. The amount (Rupees 1,000) retained for this purpose will be ample to meet the demands that are likely to be made on this account.

21. I now come to those items 17 to 22 for which no provision was made in the original estimate. The excess on these items amounts to Rupees 14,625-10-11, and, with the exception of item No. 17, the necessity for this outlay was quite unforeseen and unexpected, and therefore it could not possibly be provided for in the original estimate.

22. Item No. 17, embankment for north approach to the anicut, amounts to Rupees 2,185-2-4, and its omission in the original estimate must have been an oversight.

23. Item No. 18, restoring the work destroyed by the floods of June 1875, cost Rupees 4,408-12-6—*Vide* enclosure No. 7. This was reported in due time, and the report upon it is recorded with G.O., No. 1,903, dated 5th July 1875. The only further remark regarding it which seems necessary in this place is, that a portion of the excess charged to item No. 12, "filling in front of anicut," should properly be debited to this work, but it is impossible to say now what the amount should be.

24. Item No. 19, "rubble dam.—" * This work was constructed for various purposes. It connected the anicut with the north bank of the river across the breach made by the floods of October 1874. It held up the water above the anicut for Irrigation purposes; it answered the purposes of a road across the breach. It kept the river in low freshes from flowing through the breach, and by this means it facilitated the work of extending the anicut. It cost altogether Rupees 11,671-11-7. Of this

* *Vide* G.O., No. 565, of 26th February 1875.

sum Rupees 6,524-13-5 was debited to the repair estimate of Rupees 59,500 sanctioned in G.O., No. 544, dated 24th February 1871, and Rupees 5,146-14-2* was charged to the extension estimate. Besides the advantage of keeping low freshes from the extension works, it was calculated that when the extension works			
* Repairing tramway ...	RS. A. P.	1,546	14 2
3,605 Cubic yards of stone at 1 Rupee ...		3,605	0 0
Total ...		5,146	14 2

were advanced to a certain point the rubble dam would not be required, and that 3,605 cubic yards of stone could be obtained from it for the apron of the new portion of the anicut; the value of this stone was calculated at 1 Rupee a cubic yard, and it was at once charged as shown above to the extension estimate as so much materials at site.

25. There is no doubt that a dam of some sort would have been necessary for the purposes of the extension work alone, and it is probable that it could not have been constructed for much less than Rupees 5,146-14-2, which is the proportion of the cost of rubble dam that was charged to the extension estimate; but, as observed above in paragraph 13, the repair of the tramway for the purpose of bringing stone to the rubble dam, the cost of which was charged to this estimate had to be done over again, and out of 3,605 cubic yards of stone which by calculation would be obtained from the dam for the extension work, only 1,279 cubic yards have been received up to date, leaving 2,326 still shown as materials at site. This stone is now however so embedded in the river that it would be as cheap or cheaper to get stone from the quarry as to extract it from its position. It is moreover useful where it is; it acts as a sunken groyne and will prevent scour in its neighbourhood. For these reasons I propose to let it remain as it is, and with this view I have struck it out of the account of materials at site and charged it as a separate item as shown in the abstract estimate above.

26. Item No. 20, "temporary wall on body wall" to prevent water passing over the new work until the work in rear was completed, cost Rupees 2,125-3-4. The proposal to construct this work was reported in letter printed with G.O., dated the 5th July 1875, No. 1,903.

27. Item No. 21 "extra building wall" cost Rupees 356-3-5. This additional work is no doubt of great use; its position is shown on the plan. It is a small and inexpensive work and seems to require no further explanation.

28. Item No. 22 "feeding coolies" Rupees 3,224-5-4. This expenditure was incurred during the very severe outbreak of cholera that occurred in July and August 1875. There can be no question as to the propriety of this expenditure, but I am not sure it ought to have been charged to this work. The coolies were, however, collected together for the work, and it was to the interest of the work to have kept them together until the disease and the scare had disappeared from amongst them, but Government would have to provide for them any how. The disease had broken out so badly on the works, and the report of it was so fearfully spread about, that the work-people could get neither food nor shelter in any of the surrounding villages, and if they were not fed and cared for and tended as they were by the Executive Officer and the one or two assistants who stuck to him in his trouble, the people would have died like rotten sheep and have spread a pestilence in the surrounding country.

29. Item No. 23, "Tools and Plant." There is a large excess on this item; but on looking over the list, enclosure No. 6, there seems to have been but very few

articles purchased that were not required, and the excess is due principally to the extravagantly high charges for truck wheels, &c., received from the Government Workshop, Madras.

30. The wheels are much worn and are not of much value now; but the "cranes," "dredgers," "blocks," and some other articles are almost as good as new, and the excess shown against this part of the estimate may be entirely recovered by transferring the still good and useful articles to "stock." The present value of such articles is about Rupees 7,000.

31. Items 24 and 25 are very high; they swell up the amount of the estimate in a most unduly excessive manner, and make the work appear much more expensive than it really is. I have included these items in the revised estimate, because it appears to be the present practice to do so, but I am not aware that there is any authority from this Government for the practice, and I consider that there is neither reason nor propriety in its adoption.

32. I now come to the financial state of the work. The comparative statement, enclosure No. 3, shows that, including tools and plant, the work done to the end of—

	RS.	A.	P.
July last amounts to ...	1,41,666	9	4
And the work still to be done is ...	21,333	6	8
Total ...	1,63,000	0	0

	RS.	A.	P.
The expenditure in 1874-75 was ...	21,466	11	0
Do. in 1875-76 ...	1,06,319	2	3
Do. to end of July in 1876-77 ...	12,642	7	0
Do. in August 1876-77 ...	1,688	12	8

Total expenditure to end of August 1876-77...	1,42,117	0	11
Add amount of due bills ...	5,249	3	9
And of the work that cannot be deferred—			
Vide enclosure No. 8 ...	3,000	0	0
	8,249	3	9
	1,50,366	4	8

The allotments are—			
Passed expenditure in 1874-75 ...	21,466	10	0
Do. in 1875-76 ...	1,06,319	2	3
Budget grant* for 1876-77 ...	16,649	0	0
	1,44,434	13	3

The work done and the work now required which cannot be deferred amounts therefore to ... 5,931 7 5 or say Rupees 6,000 in excess of existing allotments, and the grant of this amount is now solicited.

33. I regret that this application was not made sooner, but it is not long since I found out that it was so urgently required; I did not know until lately that "due bills" to the Government Workshop amounted to so much, and judging from the Progress Report I was under the impression that we were working well within the

* Item 17 for works only.

amount of our allotment; even to this day the Progress Report shows that this is the case, but it is quite deceptive in this respect.

34. The comparative statement (enclosure No. 3) shows that the work still to be done appertains almost entirely to the embankment and road approach at the north wing. The state of the work at present is sufficient to meet a flood of 16 feet over the crest of the anicut, and it is not probable that we shall have such a flood this year, so that in this respect there is no occasion for hurry in finishing the work, but every thing is now in working order, and it will be a pity to break up arrangements that have cost so much time and labor in their preparation and perfection. The tramway is specially liable to injury by being kept idle, as the sleepers are then attacked by insects, and generally there is no doubt that delay in completing the work will cause inconvenience and loss, and may probably lead to greater expenditure than is provided for in the revised estimate. I beg therefore to urge the necessity of providing funds at once for the completion of the work.

35. The amount required, Rupees 18,500, is small; of this sum Rupees 6,000 must be provided to pay for putting the work in a safe state, and it is hoped that there will be no difficulty in granting the further amount of Rupees 12,500 still required for works. The amounts required to meet charges for establishments for direction and for accounts is already provided for in the budget.

	RS.	
Revised estimate	1,63,000	
Grants already made, vide paragraph 32, say	1,44,500	
Still required	18,500	

36. It remains to me to explain the great delay that has occurred in submitting this estimate. It was known so far back as a year ago that a revised estimate would be necessary, and it is possible that it would have been submitted about the end of the past official year if Mr. Smith, the late District Engineer, had lived, but that gentleman's illness and death disarranged everything, and but little or nothing had been done definitely towards this particular work until May and June of this year.

37. The rough estimate was sent to me by the Executive Officer at the end of June. It was checked and examined in my office in July and in the beginning of August, and from the appearance of what was then done I hoped to have been able to submit it about the 20th of August as promised in my letter, No. 75, dated

11th August 1876;* but on going over the papers myself, I found I had much to alter and much to correct, and it has taken

nearly a month of so much of my own time as I could possibly give to it to put it in what I consider a proper shape for submission to Government. I trust that the Government will be satisfied that the delay could not be avoided, and I hope that all the necessary information will be found in the papers now submitted.

NOTES.

1. The body wall differs from the sanctioned section owing to its foundation having been carried deeper; the extra masonry was partly covered by savings on brickwork for wells and concrete filling.

2. The sections of binding walls deviate from design on account of the badness of the foundation, the difficulty of building in water, and the emergency under which they were constructed; the thickness was increased to compensate for the want of depth.

3. The distances between the binding walls differ from the design, but they agree with the distances in the old anicut.

4. The apron beyond retaining wall, second portion, does not vary from sanctioned design.

5. The wells under retaining wall are 4 feet 6 inches in diameter; a number of well tatties of this size were made, and building wells for the retaining wall was commenced before the design was received.

6. The coping of second binding wall is only 1 foot 3 inches in height instead of being 1 foot 6 inches, the masonry of the wall had been built with reference to the height given in the design when it was found that the coping would be too high, so the coping was reduced 3 inches.

7. Part of the retaining wall was built of rubble masonry in accordance with the original design, but the greater part is of brick in mortar.

(Signed) C. B. HENDERSON, Lieutenant, R.E.,
In charge of Pennair Anicut Range,
Nellore District.

Revised Estimate for Extension of Pennair Anicut.

General Remarks.—The large excess of the revised over the original estimate has been explained in detail, but the following points may be recapitulated:—

1. All deviations from the design were by order of the late District Engineer.
2. The real work of the extension did not commence until February 1875, and thus six weeks were lost which would have been most valuable for brick and lime burning, &c.
3. The unusual quantity of water in the river, so that the first brick of the first well could not be laid until 1st April, this year the wells might have been commenced on the first of January.
4. The continual small freshes from March to October.
5. The outbreak of cholera in July at a most critical stage, a number of people died on the works, and for a few days all operations in the river ceased, though the quarries were kept at work. Hospitals were established and sanitary rules strictly enforced at a considerable expense.
6. The work was carried on without intermission throughout the monsoon, and batta was given to the bricklayers when there was no work for them owing to cholera, freshes in the river or local rain.
7. The whole of the plant was in bad order, and there was so great a deficiency of rolling stock that the trucks had to be kept running day and night.
- 7(a). The enormous quantity of sand brought by the flood in 1874 and blown by the wind over the tramways for months, necessitating a large staff of coolies to keep the lines clear.
8. As the labor obtained north of the river was insufficient, arrangements had to be made to ferry across the coolies from the south bank; with only two boats available, this was a slow process, the coolies got late to their work and had to leave early for fear of accidents from overcrowding after sunset.

The ferrying operations at night were superintended by the Range Officer in person, and on several occasions they lasted from 5 P.M. until midnight.

9. Until 1st April 1875 the Range Officer, in addition to the anicut works, held charge of the present East Coast Canal range and half of the present southern range, and even after the 1st

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April much additional office work was entailed on him by these charges, and the accounts of the anicut extension works got into such arrears that with a totally inadequate office establishment it took months to bring them into proper order.

10. The revised estimate was ready for submission in January 1876, when the late Mr. R. Smith died; since then the Range Officer has been called on to undertake much additional work, and the estimate has been revised several times as the work has been carried on and a better idea of its probable ultimate cost obtained.

11. The rates allowed for work remaining to be done are believed to be ample; they are based on the cost of work done in the last six months; had cholera broken out in April or May, or a fresh of 3 feet come in May, it is probable that the rates would have proved insufficient.

NELLORE, (Signed) C. B. HENDERSON, Lieutenant, R.E.,
12th June 1876. In charge of Pennair Anicut Range,
Nellore District.

MEMORANDUM.

In reply to District Engineer's Memorandum, No. 673, of 22nd July 1876.

1. Excess in the rate for concrete in wells under body wall is due to the difficulty experienced in getting the wells dry, the water had to be baled out and the bottom stopped with clay; the first layer of concrete was put into bags of date mats, and an extra quantity of mortar was added to compensate for the loss by springs. Broken stone for concrete had to be brought at

Concrete.		RS.	A.	P.
E rate	..	2	3	0
W do.	..	4	2	5

NOTE.—The quantities mentioned in this memorandum refer to work done to end of May. The comparative statement is made up to end of July, which accounts for differences of quantities shown here and in comparative statement.

night from the quarries, as the tramway and trucks were wanted for other work in the day time. The place for storing the stone and mixing the concrete was confined; everything had to be brought along one narrow line of communications from the north bank. Surki was added to the lime to make it hydraulic.

Decrease in quantity is owing to clay having been met with, and the wells were not, therefore, sunk to the estimated depth.

2. Increased rate is due to the cost of a special new tramway 1,000 yards in length having been laid down from the brickfield, to the emergency of the work and to the scarcity of fuel.

Brick Work in Wells.		RS.	A.	P.
E rate	..	0	3	0
W do.	..	0	3	4

Less quantity to clay having been found at less than the estimated depth.

3. Body-wall.—Foundations.

Rubble Masonry.		RS.	A.	P.	C. yds.	RS.	A.	P.
E rate	..	3	8	0	Rubble in chunam	675	2,694	3 2
W do.	..	3	15	10½	Rubble in Portland cement.	86	611	10 10

Increased rate is due to the emergency under which the work was done and to the difficulty in bringing up materials, a tramway was in use for some time, but, owing to freshes, it had to be removed. The stone used for the body-wall was partly taken from stock in hand before the work commenced, and it had to be charged for at the book value from 4 to 7 Annas a cubic yard, or that value was saved subsequently by improved arrangements at the quarries and by improved tramways.

Increased quantity is due to the foundation having been carried down deeper than was originally intended, necessitating a change of design, the extra cost was partly met by decreased

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brickwork and concrete in wells. Rubble in Portland cement was used to close the breach made by a fresh on 11th June 1875.

4. Increased rate is owing to reasons given in No. 3, increased quantity to greater depth of foundation already alluded to.

Rubble Masonry.		RS.	A.	P.
E rate	..	3	8	0
W do.	..	4	2	2

5. Increased rate goes to cover the cost of land taken up for new quarries in Thoovoor an for baling day and night at the quarries for months. A large quantity of laterite was carted to site and trimmed before it could be put into the work, thus brick-layers were subsequently available for other masonry, but the laterite cost more, as it had to be carried from the depôt and again trimmed before it could be put into the work.

Laterite Masonry.		RS.	A.	P.
E rate	..	6	12	0
W do.	..	7	6	8

Increased quantity is owing to the coping of the breached portion having had to be rebuilt, and to a slight increase in the length of the body-wall which was necessary to get the wells at the abutments to fit in properly.

6. An extra rate has been allowed as the wall must be thoroughly cleaned; all the remains of the temporary wall on top must be removed and the joints raked out before pointing can be done.

Pointing.		RS.	A.	P.
E rate	..	2	0	0
W do.	..	2	4	0

9. Increased rate for reasons given in No. 3.

Rubble Masonry.		RS.	A.	P.
E rate	..	3	8	0
W do.	..	4	7	11

Foundation.		RS.	A.	P.
Rubble in chunam 345½ cubic yards	..	1,552	10	3
Without mortar 77 cubic yards	..	144	6	0

earth that had been thrown in a few days before and which became soft mud in contact with water.

10. Excess rate for reasons given in No. 3.

Rubble Masonry.		RS.	A.	P.
E rate	..	3	8	0
W do.	..	4	0	0

Laterite Masonry.		RS.	A.	P.
E rate	..	6	12	0
W do.	..	7	8	10

Pointing.		RS.	A.	P.
E rate	..	2	0	0
W do.	..	No work.		

13. Increased rate—Vide No. 3.

Rubble-in-Chunnam.		RS.	A.	P.
E rate	..	3	8	0
W do.	..	4	7	1

Foundation—		RS.	A.	P.
Rubble-in-chunam 132½ cubic yards	..	595	12	3
Without mortar 174 ..	..	459	12	3

Rubble Masonry.		RS.	A.	P.
E rate	..	3	8	0
W do.	..	3	14	1

15. Reasons for increased rate for laterite are given in No. 5.

Laterite Masonry.		RS.	A.	P.
E rate	..	6	2	0
W do.	..	6	12	2

Less quantity owing to the coping being 1 foot 3 inches in height instead of 1 foot 6 inches; this change was made to bring the level of the top of the binding wall to a mean between the design and the section of old anicut.

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Pointing.				RS. A. P.	16. Rupees 2½ per square has been allowed to cover the cost of raking out joints and preparing the surface for pointing.
E rate	..	..	..	2 0 0	
W do.	..	..	..	No work.	

Rubble Masonry.				RS. A. P.	17. Excess in quantity is owing to damage by fresh and change in design.
E rate	..	..	..	3 8 0	
W do.	..	..	..	3 11 6	

3rd.—Binding wall foundation—

Rubble in chunam 104½ cubic yards	...	...	...	389 5 4
Rubble without mortar 124 ..	...	...	...	293 8 0

Rubble Masonry.				RS. A. P.
E rate	..	..	..	3 8 0
W do.	..	..	..	3 12 9

Laterite Masonry.				RS. A. P.
E rate	..	..	..	6 12 0
W do.	..	..	..	6 6 5

Pointing.				RS. A. P.
E rate	..	..	..	2 0 0
W do.	..	..	..	No work.

Concrete.				RS. A. P.
E rate	..	..	..	2 3 0
W do.	..	..	..	3 13 5

Brick Work in Chunam.				RS. A. P.
E rate	..	..	..	0 2 0
W do.	..	..	..	0 3 6

Rubble Masonry.				RS. A. P.
E rate	..	..	..	3 8 0
W do.	..	..	..	5 6 7½
Do.	..	..	..	5 2 11½

Brick and Rubble.				RS. A. P.
E rate	..	..	..	5 2 11½
W do.	..	..	..	

Retaining Wall.

Rubble in chunam for foundation and superstructure 55 cubic yds.	297 11 7
--	----------

Brick in chunam.

For foundation 242 cubic yards	...	...	...	1,643 2 3
For superstructure 91 ..	...	...	...	

Part of this wall has been built on the clay without wells.

24. Less rate owing to the greater part of the work having been done after the monsoon of 1875, when there was no emergency; fresh quarries were opened in Thovoor where baling was not necessary, the stone was supplied direct

Laterite Masonry.				RS. A. P.
E rate	..	..	..	6 12 0
W do.	..	..	..	5 12 2

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the stock of Cyclopean stone at the anicut was utilized then carried by coolies. The work from the confined the foundations for the wings being then in progress was most expensive. The value of the fuel used for

Increased quantity is due to a change in the design it was found that any earth or sand thrown behind the apron above water level would not stand, the earth (but little was available) was washed away by the current stone entirely above water level.

27. Increased rate for Cyclopean rubble is due

Cyclopean Rubble.				RS. A. P.
E rate	..	..	..	1 8 0
W do.	..	..	..	1 14 9

directly owing to the wings being then under construction steep ramp which was expensive to work. Less quantity found that the best work could be done with the stone the Cyclopean apron 3 feet instead of 3½ feet thick packed; they rest on a bed of handpacked stones (as underneath again there is a layer of stones merely the stone; with a Cyclopean apron 3½ feet thick many proper level instead of resting fairly on the lower run from trucks or rolling them into position it is found under the percussion while loose stone gives way serious

28. The increased rate for concrete has been

Concrete.				RS. A. P.
E rate	..	..	..	2 3 0
W do.	..	..	..	2 13 7
Do.	..	..	..	2 13 0½

handpacking between the Cyclopean stones to a depth

Increased quantity of concrete used is on account were expected, and an extra thickness was allowed overtop the wall or body wall and the water fall should cause a displacement of the stones.

Rubble Apron.				RS. A. P.
E rate	..	..	..	1 6 0
W do.	..	..	..	1 12 0

Less quantity to change in design for apron

One-fifth.

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33. Less rate owing to the greater part of the work being done after the monsoon when the emergency was over, to improvements introduced into the system of working the quarries, and to being able to lay and keep down tramways without fear of freshes.

Less quantity owing to change in design—*Vide* 27.

34. Increased rate for concrete owing to the change for concreting including handpacking between the Cyclopean stones to a depth of 2 feet. Concrete costs about Rupees 3 a cubic yard at the anicut, the original rate Rupees 2½ is insufficient to cover the cost of surki to make it hydraulic. It is found that by taking a square yard as a unit the measurements are much simplified, the original estimate allowed for 2 inches of concrete only not enough to make sound work.

35. Increased quantity is due to change in design for apron explained in No. 27.

Less rate to improved system of working the quarries to the emergency being over and to increased facilities for bringing up materials.

36. Less quantity is due to change in design for apron.
Less rate to improvements in system and absence of emergency.

37. *Vide* No. 34.

38. Increased quantity is owing to change in design.
Less rate to improvements in system of working.

39. Less quantity is owing to change in design.
Less rate to improvements in system of working.

40. The original rate allowed for concreting apron was too low to ensure good work—*Vide* No. 34.

41. As this sub-head has been completed without interference by freshes, the "work still required" at end of May, viz., 1,972 cubic yards, may be calculated at Rupees 1-5-0 per yard instead of at Rupees 1-8-0.

48. For the increased rate for concrete in wells under front wing—*Vide* No. 1.

Increased quantity is due to the extra depth some of the wells were sunk to in hopes of reaching clay, and to the spaces between the wells to a depth of about 9 inches having been filled with concrete to make a good foundation for the masonry.

49. Increased rate—*Vide* No. 2.

Increased quantity to wells having been sunk below estimated depth in hopes of meeting with clay, the wells near the abutment reached the clay, but the others are apparently in an old river channel and clay could not be found at a depth of 14 feet, the state of the work was too critical to allow of more time being spent in sinking, so the wells were filled up with concrete and the masonry of the wing commenced.

E rate	Cyclopean Rubble.	RS. A. P.
W do.		1 8 0
		1 4 4

E rate	Concrete.	RS. A. P.
W do.		2 3 0
		2 7 7

E rate	Rubble Apron.	RS. A. P.
W do.		1 5 0
		1 0 8

E rate	Cyclopean Rubble.	RS. A. P.
W do.		1 8 0
		1 5 2

E rate	Concrete.	RS. A. P.
W do.		2 3 0
Do.		1 14 9½
		2 0 5

E rate	Rubble Apron.	RS. A. P.
W do.		1 5 0
		1 3 4

E rate	Cyclopean Rubble.	RS. A. P.
W do.		1 8 0
		1 0 6

E rate	Concrete.	RS. A. P.
W do.		2 3 0
		No work.

E rate	Rubble Apron.	RS. A. P.
W do.		1 5 0
		1 1 2

E rate	Concrete.	RS. A. P.
W do.		2 3 0
		3 2 10

E rate	Brick Work in Chunam.	RS. A. P.
W do.		0 3 0
		0 3 3

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50. Increased rate is due to the emergency of the work. Less quantity to the slightly decreased depth at which the foundation near end of front wing is built, there was so much water in the foundations and from the situation baling was so difficult that the late District Engineer decided that it was not worthwhile dismantling the tops of the wells in order to get the foundation down a few inches deeper.

51. The increase in quantity of rubble masonry and brick in chunam is met by a decreased quantity of laterite in chunam. The rubble masonry has been carried up to the level of the crest of anicut, and brickwork has been substituted partly for laterite (see sketches). The laterite stone collected for this work had to be used on an emergency for building the temporary wall on body wall; cholera had broken out badly in the village of Thovoor where the laterite quarries are situated, no one would work there, and the quarries were full of water; under these circumstances, as the raising of the front wing above ordinary flood level was most important, the materials at site available had to be made use of—

For rates for laterite in chunam *Vide* No. 5
For rubble masonry " 3
For brickwork " 2

	RS. A. P.
Rubble in chunam for foundation 160 cubic yards	730 0 8
Do, above 302 "	1,277 12 6
Brick in chunam above 180 "	851 1 7
Laterite in chunam above 665 "	4,097 12 7

52. Less quantity explained in 51. Increased rate—*Vide* No. 5.

53. This is what the work has actually cost; it includes the cost of some rather elaborate scaffolding for the wall, which is about 25 feet above ground level.

54. Concrete in wells under abutment. Increased quantity and rate—*Vide* No. 48.

55. Increased quantity owing to two of the wells under front wing having been included as under abutment. Less rate to greater facilities at time of building for bringing up materials.

56. Increased rate—*Vide* No. 3.

57. Rubble in chunam for foundations 39 C. yds. 173 4 11
Do, above 54 " 189 0 11
Brick in chunam for do. 20 C. yds. 100 0 5
Laterite in chunam 86½ C. yds. 618 12 4

E rate	Rubble Masonry.	RS. A. P.
W do.		3 8 0
		4 9 6

E rate	Rubble Masonry.	RS. A. P.
W do.		3 8 0
		4 3 8

E rate	Brick Work in Chunam.	RS. A. P.
W do.		5 1 0
		4 11 8

E rate	Laterite Masonry.	RS. A. P.
W do.		5 0 0
		6 2 7

E rate	Pointing.	RS. A. P.
W do.		2 0 0
		2 3 8

E rate	Concrete.	RS. A. P.
W do.		2 3 0
		2 15 9

E rate	Brick in Mortar.	RS. A. P.
W do.		0 3 0
		0 2 8

E rate	Rubble Masonry.	RS. A. P.
W do.		3 8 0
		4 7 1

E rate		RS. A. P.
W do.		3 8 0
		3 8 0

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Laterite Masonry.			
E rate	..	..	5 0 0
W do.	..	..	7 2 1
Work done, deduct—			
9½ C. yards of laterite in chunam, cost Rs. 68-1-4—Vide 73.			

Concrete.			
E rate	..	..	2 3 0
W do.	..	..	3 4 7

Brick in Mortar.			
E rate	..	..	0 3 0
W do.	..	..	0 3 6

62. Increased quantity owing to the foundation of rear wing at east end having been placed at a lower level than the estimate allowed; it is thus securely bonded with the last retaining wall. The design provided for the tops of the wells under rear wing being level with the top of the coping of the last retaining wall in which case no bond could have been made.

Increased rate—Vide No. 3.

				RS. A. P.		
Rubble in chunam for foundations	...	...	184 C. yds.	703	12	3
Brick in chunam do.	...	...	11 "	56	0	6
The brickwork was done on an emergency.						

Rubble Masonry.			
E rate	..	..	3 8 0
W do.	..	..	4 4 0

Pointing.			
E rate	..	..	2 0 0
W do.	..	..	No work.

Concrete.			
E rate	..	..	2 3 0
W do.	..	..	3 7 4

Brick in Mortar.			
E rate	..	..	0 3 0
W do.	..	..	0 2 11

Saving of 1 Pie per cubic foot is trifling.

Rubble Masonry.			
E rate	..	..	3 8 0
W do.	..	..	4 3 5

Increased rate—Vide No. 3.

Rubble Masonry.			
E rate	..	..	3 8 0
W do.	..	..	3 11 8

Increased rate is trifling; the rate for the lower part of the wall was high, but the upper part being built after the emergency was over cost less than the estimated rate.

Pointing.			
E rate	..	..	2 0 0
W do.	..	..	No work.

Concrete.			
E rate	..	..	2 3 0
W do.	..	..	3 14 9

Increased quantity on account of the foundation being built in steps up the slope, each step overlaps the next one. The original estimate did not allow for these steps.

* Note.—Quantity has been reduced accordingly and transfer adjusted in revised estimate.

58. Less quantity owing to substitution of brick work—Vide 51. Increased rate—Vide 5.

* This includes some laterite which should have come in No. 73.

60. Less quantity owing to clay having been met with and to decreased number of wells. Increased rate—Vide No. 1.

61. Less quantity owing to clay having been met with. Increased rate—Vide No. 2.

63. Increased rate—Vide No. 3.

64. Increased rate is to allow for scaffolding.

65. Increased quantity is on account of the interstices between the wells having been filled with concrete—Vide No. 1 for increased rate.

66. To the foundations of rear return having been placed at a lower level and to clay having been met with.

67. Increased quantity to foundation having been carried down deeper to bond them with last retaining wall—Vide No. 62.

68. Same reasons as 67.

69. Increased rate to allow for scaffolding.

70. Increased rate is on account of what must be paid to secure good work.

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Laterite Flooring.			
E rate	..	..	5 0 0
W do.	..	..	3 14 6

Work done—*add 9½ cubic yards of laterite in chunam, cost Rupees 68 1-4.

* Has been adjusted in revised estimate.

Pointing.			
E rate	..	..	2 0 0
W do.	..	..	No work.

Cyclopean Rubble.			
E rate	..	..	1 8 0
W do.	..	..	No work.

Gravel Basking.			
E rate	..	..	1 8 0
W do.	..	..	..

Excavating foundation and filling in.

Work done to end of May	...	...	...	Cubic yards	55,775
Cost	...	...	...	Rupees	7,340-15-0
Some filling in remains to be done. No measurements have been taken.					

Earthwork.

Work done, 21,182½ cubic yards, Rupees 2,289-0-3.

Earthwork.

Revised estimate allows for 20,000 cubic yards at 2 Annas, equals Rupees 2,500.

Sinking Wells.			
E rate	..	..	10 0 0
W do.	..	..	5 4 3
	..	..	4 7 5

E rate	..	..	10 0 0
W do.	..	..	11 4 6

E rate	..	..	10 0 0
W do.	..	..	4 3 0
Do.	..	..	5 3 1
Do.	..	..	7 9 1

Quarry.
Rubbish.

Repair of Tramway.

Baling water.

101. A large temporary establishment was entertained to look after the daily coolies. All hospital charges, sanitary arrangements, construction, and working of latrines, and cost of paying work-people across the river are charged to this head.

Compensation for Land.

73. Some of this laterite work has been included under abutment by mistake; hence the decreased quantity—Vide No. 58.

Less rate owing to absence of emergency and improved system.

77. To cover cost of scaffolding.

79. It is expected that the work will cost Rupees 1-12-0 per yard, including laying down tramways and making other special arrangements.

82. Vide No. 79.

84. Original estimate too low. The earth had to be carried some distance to clear the stone depot.

85. Original estimate too low. Work done on emergency and some washed away by freshes.

86. This was omitted (apparently by accident) from the original estimate.

87, 88. Sinking wells was done by task-workers who were kept in check by Bull's patent dredgers.

89. Increased depth of wells and great emergency. Two wells included under abutment.

90. }
91. } Vide Nos. 87 and 88.
92. }

94. Increased quantity of work done to render the body wall secure after the breach in June.

95. The whole of the tramways had to be relaid on a new system.

96. Work was carried on throughout the monsoon.

97. Other land has been accepted in exchange.

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98. Feeding charges commenced when freshes were in the river and cholera had broken out badly towards the end of July; they lasted until October, when the emergency was over and cholera had ceased.

Feeding Charges.

99. To prevent work done being carried away by freshes, and to allow work to go on while freshes were passing over the old anicut, a wall was raised to a height of 7 feet with a wing 14 feet high. Construction of wall reported to Government by late District Engineer.

Rubble Dam.

G.O., 5th July 1875, No. 1,903.

100. Extra binding wall. This wall is built in continuation of a binding wall in the old anicut from north under sluices to old wing; it was built to strengthen the weak place in the body wall where the new work joins the old and where wells could not be sunk owing to the debris of the old wing which could not be removed, the extra binding wall is a few feet behind the body wall and it saved the body wall from a larger breach in June.

Rubble Masonry.

Executive Establishment.

Direction and Control.

102. Bad wheels supplied for tramway trucks by Public Works Workshops—*Fide* estimate for tools and plant, compare wheels estimated for and the number found necessary.

Tools and Plant.

103. Amount has been calculated at 25 per cent. on the estimate for works.

104. G.O., No. 1,738, of the 19th June 1875, sanctioning estimate.

(Signed) C. B. HENDERSON, Lieutenant, R.E.,
Range Officer, Pennair Anicut Range.

NELLORE,
31st July 1876.

Proceedings of the Madras Government, Public Works Department,
16th December 1876. No. 3,455.

NELLORE DISTRICT.

REVISED ABSTRACT ESTIMATE.

* Pennair Anicut Irrigation.

Capital Ordinary.

(1).—Head Works. C.—Works.

WORK.—Extension of the Pennair Anicut at Nellore.

Quantity as per Comparative Statement No. 3.	Particulars.	Rate (Average).	Per	Amount.	Total.
	<i>Body Wall.</i>	RS. A. P.		RS. A. P.	
338½	Concrete for wells under body wall.	4 2 5	C. yd.	1,404 6 7	
22,731	Brick in chunam wells ...	0 3 4	C. ft.	4,751 15 11	
669½	Rubble in chunam for foundation of body wall ...	3 15 10½	C. yd.	2,671 4 0	
5½	Do. for breach ...	3 15 10½	Do.	22 15 2	
86	Do. with Portland cement for breach ...	7 1 9½	Do.	611 10 10	
890½	Rubble in chunam for body wall above foundation... C. yds.	4 2 2	Do.	3,683 5 11	
52	Do. for breach ...	4 2 2	Do.	215 5 0	
169½	Laterite on edge in chunam for top of body wall ... C. yds.	7 6 8	Do.	1,258 5 5	
15	Do. for breach ...	7 6 8	Do.	111 4 0	
62·3	Pointing front face and top of body wall ... Squares.	2 4 0	Square.	140 2 9	
188½	Rubble stone for foundation of groynes ...	1 6 7½	C. yd.	267 1 10	
232½	Rubble stone for groynes above foundation ...	1 4 6½	Do.	298 13 4	
	<i>First Binding Wall.</i>				
153½	Rubble in chunam for foundation ...	4 7 11	Do.	687 6 4	
192½	Do. for breach ...	4 7 11	Do.	865 3 11	
77	Do. without mortar for do.	1 14 0	Do.	144 6 0	
382½	Rubble in chunam above foundation.	4 0 0	Do.	1,531 3 9	
78½	Laterite on edge in chunam for top of binding wall ...	7 8 10	Do.	591 10 7	
14	Pointing top of binding wall ...	2 4 0	Square.	31 8 0	
	<i>Second Binding Wall.</i>				
132½	Rubble in chunam for foundation ...	4 7 1	C. yd.	595 12 3	
174	Do. without mortar for breach.	2 10 3	Do.	459 12 3	
319½	Rubble in chunam above foundation.	3 14 1	Do.	1,254 5 2	
40½	Do. for breach ...	3 14 1	Do.	157 2 4	
66½	Laterite on edge in chunam for top of binding wall ...	6 12 2	Do.	449 9 1	
14½	Pointing top of do. ...	2 4 0	Square.	32 14 6	
	<i>Third Binding Wall.</i>				
104½	Rubble in chunam for foundation ...	3 11 6	C. yd.	389 5 4	
124	Do. without mortar for breach.	2 5 10½	Do.	293 8 0	
220½	Rubble in chunam above foundation.	3 12 9	Do.	835 7 0	
12	Do. for breach ...	3 12 9	Do.	45 9 0	
87½	Laterite on edge in chunam for top of binding wall ...	6 6 5	Do.	561 6 2	
14·5	Pointing top of do. ...	2 4 0	Square.	32·10 0	

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WORK.—Extension of the Pennair Anicut at Nellore—(Continued).

Quantity as per Comparative Statement No. 3.	Particulars.	Rate (Average).	Per	Amount.	Total.
	<i>Retaining wall.</i>	RS. A. P.		RS. A. P.	RS.
195½	Concrete for wells ...	3 13 5	C. yd.	751 13 6	...
56	Concrete for breach ...	3 13 5	Do.	214 15 4	...
16,612½	Brick in chunam wells ...	0 3 6	C. ft.	3,636 4 0	...
600	Do. for breach ...	0 3 6	Do.	115 3 5	...
30	Rubble in chunam ...	5 6 7½	C. yd.	162 6 4	...
25	Do. for breach ...	5 6 7½	Do.	135 5 3	...
242	Brick in chunam for foundation ...	5 2 11½	Do.	1,542 3 8	...
55½	Rubble in chunam above do. ...	5 2 11½	Do.	184 5 6	...
297½	Do. for breach ...	5 2 11½	Do.	1,069 13 10	...
35½	Laterite on edge in chunam...	5 12 2	Do.	55 6 6	...
185½	Pointing top of retaining wall ...	2 4 0	Square.		...
24½					
	<i>Apron between body and first binding wall.</i>				
2,859	Rubble ...	2 1 4	C. yd.	5,958 12 7	...
1,636	Cyclopean rubble ...	1 14 9	Do.	3,148 14 6	...
200½	Concrete for filling interstices ...	2 13 0½	Do.	564 15 7	...
	<i>Apron between first and second binding walls.</i>				
861	Rubble ...	1 12 0	Do.	1,506 4 6	...
1,332	Cyclopean rubble ...	2 1 8	Do.	2,803 12 10	...
144	Concrete for filling interstices ...	4 6 8	Do.	636 3 0	...
	<i>Apron between second and third binding walls.</i>				
1,580	Rubble ...	1 5 5	Do.	2,114 12 0	...
1,420	Cyclopean rubble ...	1 4 4	Do.	1,798 1 3	...
177½	Concrete for filling interstices ...	2 7 7	Do.	440 10 1	...
	<i>Apron between third binding wall and retaining wall.</i>				
1,594	Rubble ...	1 0 8	Do.	1,658 5 3	...
1,469	Cyclopean rubble ...	1 5 2	Do.	1,945 12 3	...
246½	Concrete for filling interstices ...	2 0 5	Do.	499 3 1	...
	<i>Apron beyond retaining wall.</i>				
2,130	Rubble ...	1 3 4	Do.	2,573 10 11	...
2,042½	Cyclopean rubble ...	1 0 5	Do.	2,091 3 6	...
243	Concrete for filling interstices ...	2 3 0	Do.	531 9 0	...
	<i>Apron beyond retaining wall second portion.</i>				
4,266½	Rubble ...	1 1 2	Do.	4,589 0 8	...
	<i>Pitching adjacent to rear return.</i>				
199	Cyclopean rubble for foundation ...	1 3 8	Do.	245 2 7	...
452	Do. above foundation...	1 7 0	Do.	649 12 0	...
	<i>Pitching adjacent to front wing.</i>				
266½	Cyclopean rubble for foundation ...	1 7 0	Do.	383 5 4	...
650½	Cyclopean rubble above foundation.	1 7 0	Do.	934 15 7	...
290½	Gravel backing ...	0 8 0	Do.	145 5 4	...

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WORK.—Extension of the Pennair Anicut at Nellore—(Continued).

Quantity as per Comparative Statement No. 3.	Particulars.	Rate (Average).	Per	Amount.	Total.
	<i>Front wing wall.</i>	RS. A. P.		RS. A. P.	RS.
203	Concrete for wells ...	3 2 10	C. yd.	645 1 5	...
9,212	Brick in mortar wells ...	0 3 3	C. ft.	1,895 1 1	...
160	Rubble masonry for foundation ...	4 9 6	C. yd.	730 0 8	...
302	Do. above foundation ...	4 3 8	Do.	1,277 12 6	...
180	Brick in chunam for foundation ...	4 11 8	Do.	851 1 7	...
665	Laterite in chunam ...	6 2 7	Do.	4,097 12 7	...
32½	Pointing squares ...	2 3 8	Square.	72 8 6	...
	<i>Abutment.</i>				
39	Concrete for wells ...	2 15 9	C. yd.	116 7 7	...
1,917	Brick in mortar wells ...	0 2 8	C. ft.	317 2 11	...
39	Rubble in chunam for foundation ..	4 7 1	C. yd.	173 4 11	...
54	Do. above do. ...	3 8 0	Do.	189 0 11	...
20	Brick in do. ...	5 0 0	Do.	100 0 5	...
86½	Laterite in do. ...	7 2 1	Do.	618 12 4	...
10½	Pointing ...	1 14 7	Square.	20 4 10	...
	<i>Rear wing wall.</i>				
111	Concrete for wells ...	3 4 7	C. yd.	364 11 8	...
5,779	Brick in mortar wells ...	0 3 6	C. ft.	1,252 10 9	...
184	Rubble in mortar for foundation ...	3 13 2½	C. yd.	703 12 3	...
11	Brick do. do. ...	5 1 6	Do.	56 0 6	...
892	Rubble in mortar above foundation ..	4 4 0	Do.	3,791 0 6	...
30	Pointing ...	2 4 0	Square.	67 8 0	...
	<i>Rear return.</i>				
73	Concrete for wells ...	3 7 4	C. yd.	255 4 10	...
1,853	Brick in mortar wells ...	0 2 11	C. ft.	339 8 9	...
165	Rubble in mortar for foundation ...	4 3 5	C. yd.	695 6 9	...
386	Do. above foundation ...	3 11 8	Do.	1,438 10 5	...
13½	Pointing ...	2 4 0	Square.	30 6 0	...
	<i>Revetment walls road approach.</i>				
410½	Concrete ...	2 10 10½	C. yd.	1,101 13 7	...
308½	Rubble in mortar for foundation ...	3 2 11½	Do.	981 12 1	...
1,505½	Do. above foundation ...	3 3 3	Do.	4,821 11 6	...
21½	Laterite flooring on edge ...	3 14 6	Do.	83 15 6	...
7	Concrete under flooring ...	2 4 8	Do.	16 0 8	...
28	Packed rubble flooring ...	0 13 9	Do.	24 1 0	...
56½	Packed rubble ...	0 14 5½	Do.	52 13 6	...
72	Pointing ...	2 4 0	Square.	162 0 0	...
	<i>Pitching of outer face of upstream approach.</i>				
153	Cyclopean rubble for foundation ...	1 7 0	C. yd.	219 15 0	...
743½	Do. above foundation ...	1 7 0	Do.	1,068 1 0	...
599½	Gravel backing ...	0 8 0	Do.	299 12 0	...
	<i>Pitching of outer slope of down stream approach.</i>				
121	Cyclopean rubble for foundation ...	1 7 0	Do.	173 15 0	...
478	Do. rubble above foundation	1 7 0	Do.	687 2 0	...
340½	Gravel backing ...	0 8 0	Do.	170 5 4	...
...	Excavating foundation and filling in ...	...	...	8,500 0 0	...

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WORK.—Extension of the Pennair Anicut at Nellore—(Continued).

Quantity as per Comparative Statement No. 3.	Particulars.	Rate (Average).	Per	Amount.	Total.
	<i>Pitching of outer slope of down stream approach—(Continued).</i>	RS. A. P.		RS. A. P.	RS.
20,000	Filling in pool in line of body and retaining walls to water level for wells	...	...	2,290 14 6	...
	Embankment from ends of front wings and head of approach including earthwork above ground level and ramp to approach ...	0 1 9	C. yd.	2,185 2 4	...
	<i>Sinking wells.</i>				
113	Under body wall	5 4 3	Each.	621 6 1	...
103	Do. last retaining wall	4 7 5	Do.	482 3 1	...
37	Do. front wing wall	11 4 6	Do.	417 7 8	...
9	Do. abutment	4 3 0	Do.	37 11 0	...
26	Do. rear wing wall	5 3 1	Do.	135 1 3	...
13	Do. rear return	7 9 1	Do.	98 6 3	...
3,800	Turfing	0 0 6	Sq. yd.	118 12 0	...
...	Quarry rubbish and clay for front of anicut	...	...	2,000 0 0	...
...	Repair and extension of tramway	...	...	8,000 0 0	...
...	Baling water	...	...	5,000 0 0	...
...	Compensation for land	...	...	1,000 0 0	...
...	Feeding charges	...	...	3,224 5 4	...
...	Ring bund at the breach	...	...	832 2 0	...
...	Rubble dam	...	...	2,326 0 0	...
	<i>Temporary wall over body wall.</i>				
398	Laterite in chunam	3 14 8	C. yd.	1,558 9 1	...
1,413	Brick in chunam	0 4 0	C. ft.	407 13 9	...
17½	Concrete	9 1 2	C. yd.	158 12 6	...
	<i>Extra binding wall.</i>				
131½	Rubble in chunam for foundation and superstructure	2 11 4	Do.	356 3 5	...
...	Special petty superintendence, scaffolding and sundries	...	...	10,303 3 4	...
	Total, Works	...	...	1,47,500	
...	Tools and Plant	...	...	15,500 0 0	15,500
	Executive Establishment	...	...	36,870 0 0	1,63,000
	Direction and Control	...	...	7,375 0 0	44,245
	Total	...	...	...	2,07,245

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NELLORE DISTRICT.

ABSTRACT ESTIMATE.

Work to be emergently done for the Extension of Pennair Anicut from 1st August 1876.

Quantity.	Particulars.	Rate.	Per	Amount.	Total.
		RS. A. P.		RS. A. P.	RS. A. P.
7,084½	Cubic yards of earthwork (embankment)	0 1 8	C. yd.	737 15 0	
5,014½	Do. of do. do.	0 1 6	"	470 1 9	
170½	Do. of building rough stone groynes (foundation)	1 7 0	"	257 8 10	
104½	Do. of do. do. (superstructure).	1 7 0	"	150 9 3	
	Making brick dust surki	...	...	183 9 1	
	Manufacture of lime	...	...	158 4 0	
	Grinding chunam	...	...	36 2 9	
445½	Cubic yards of filling excavation in rear of west approach walls	0 1 6	C. yd.	41 12 1	
278½	Do. do.	0 1 5	"	24 10 11	
486	Do. do.	0 1 4	"	40 8 0	
555½	Do. do.	0 1 3	"	43 6 4	
13	Do. do.	0 1 0	"	0 13 0	
2,441½	Do. of filling in behind pitching adjacent to rear wing wall	0 1 8	"	296 0 1	
	Quarry rubbish and clay in front of body wall	...	...	960 7 9	
11½	Do. of earthwork for tramway to revetment walls	0 1 3	C. yd.	0 14 4	
44½	Do. of do. do.	0 1 6	"	4 2 3	
	Average	0 3 9½	"	5 13 0	
24½	Do. of foundation for do. do.	0 3 7	"	0 13 0	
	Average	0 3 7	"	0 13 0	
3½	Do. of superstructure for do. do.	0 11 4½	"	28 3 3	
394½	Do. of do. do.	0 14 7	"	32 12 0	
36½	Do. of do. do.	0 14 7	"	32 12 0	
58½ ¹⁹ ₂₀	Candies of mortar hire for carrying from mill to work	0 2 6	For 11 paras.	16 11 6	
222½	Cubic yards of hire for supplying water-mortar and stone to bricklayers for building revetment walls	0 3 6	C. yd.	48 10 2	
217½	Square yards of filling interstices of apron between third binding wall and retaining wall with concrete (task work)	0 1 0	S. yd.	13 9 9	
60	Do. of do. do. between second and third binding walls do.	0 1 0	"	3 12 0	
333½	Do. of filling interstices beyond retaining wall	0 1 0	"	20 13 4	
3	Carts for conveying twelve cast iron truck wheels from Muttuku	1 10 0	Each.	4 14 0	
12	Candies of sand	0 5 0	Candy.	3 12 0	
21½	Cubic yards of concrete under revetment walls (task work)	0 6 6	C. yd.	8 9 11	
451½	Do. of hire for building rubble pitching below rear wing wall with loose stone	0 3 0	"	84 10 10	
...	Departmental labor for supplying stone and repairing tramway	...	...	28 6 3	

Proceedings of the Madras Government, Public Works Department,
16th December 1876. No. 3,455.

Work to be emergently done for the Extension of Pennair Anicut from 1st August 1876—(Contd.)

Quantity.	Particulars.	Rate.	Per	Amount.	Total.
		RS. A. P.		RS. A. P.	RS. A. P.
451½	Cubic yards of new stone ...	1 0 0	C. yd.	451 8 0	
...	Superintendence ...	...	...	247 14 8	
...	Sundries ...	...	...	92 4 11	
	Total ...	...	...	...	4,500 0 0
	Deduct work paid for in August ...	...	...	...	1,638 12 8
	Work to be done after 1st September ...	...	...	...	2,811 3 4
	Add for Contingencies, say ...	...	...	...	188 12 8
	Total—Vide paragraph 33 of report.	...	...	...	3,000 0 0

PENNAIR ANICUT EXTENSION.
Restoring the work destroyed by the flood of June 1875.

Quantity.	Particulars.	Rate.	Per	Amount.	Total.
		RS. A. P.		RS. A. P.	RS. A. P.
	<i>Body Wall.</i>				
86	Cubic yards of rubble in Portland cement for foundations ...	7 1 9½	C. yd.	611 10 10	
5½	Cubic yards of rubble in chunam.	3 15 10½	Do.	22 15 2	
52	Cubic yards of do. for superstructure ...	4 2 2	Do.	215 5 0	
15	Cubic yards of laterite coping ...	7 6 8	Do.	111 4 0	
	<i>First Binding Wall.</i>				
192½	Cubic yards of rubble in chunam for foundations ...	4 7 11	Do.	865 3 11	
77	Cubic yards of do. without mortar ...	1 14 0	Do.	144 6 0	
	<i>Second Binding Wall.</i>				
174	Cubic yards of rubble without mortar for foundations ...	2 10 3	Do.	459 12 3	
40½	Cubic yards of rubble in chunam for superstructure ...	3 14 1	Do.	157 2 4	
	<i>Third Binding Wall.</i>				
124	Cubic yards of rubble without mortar for foundations ...	2 5 10½	Do.	293 8 6	
12	Cubic yards of rubble in chunam for superstructure ...	3 12 9	Do.	45 9 0	
	<i>First Retaining Wall.</i>				
56	Cubic yards of concrete under foundations ...	3 13 5	Do.	214 15 4	
25	Cubic yards of rubble in chunam for foundations ...	5 6 7½	Do.	135 5 3	
22½	Cubic yards of brick in chunam...	5 2 11½	Do.	115 3 5	
35½	Cubic yards of rubble in chunam for superstructure ...	5 2 11½	Do.	184 5 6	
	Repairing bund at breach ...	...	Do.	832 2 0	
	Total ...	...	...	...	4,408 12 6

Proceedings of the Madras Government, Public Works Department,
16th December 1876. No. 3,455.

Revised Abstract Estimate of the Tools and Plant required for the Pennair Anicut Extension, Nellore District.

Quantities.	Description of Tools.	Amount.	Total.
	<i>Machinery.</i>	RS. A. P.	RS. A. P.
1	Two ton crane ...	1,680 9 5	
1	Crane small travelling ...	210 5 5	
15	Sets, wheels, axles, bearings for 15 tramway trucks...	3,333 1 9	
140	Cast iron truck wheels ...	4,190 0 9	
16	Making truck bodies ...	536 10 1	
			9,950 11 5
	<i>Tools and Plant.</i>		
15	Dredgers...	1,444 1 0	
12	Country axes ...	27 3 1	
41	6 lb. each. } pick axes ...	39 7 0	
9	10 do. }		
50			
4	Iron blocks, double ...	58 8 0	
16	Iron galvanized blocks...	275 12 6	
4	Iron blocks, triple ...	87 12 0	
10	Wooden blocks ...	193 2 1	
4	Bars tamping 1½ inches 3 feet in length ...	24 12 0	
25	24 lbs. each. } Crowbars ...	132 13 0	
25	16 do. }		
25	14 do. }		
781½	Regulating feet iron chain ½ inch ...	380 12 7	
20	Bill hooks 2½ lbs. each ...	20 0 0	
30	Jumpers bore 5 feet 29 lbs. each ...	108 12 0	
30	Do. { 1 and 1½ inch hole. } ...	31 14 0	
	Do. { 17 feet long 7 lbs. each. }		
10	Wooden mallets ...	4 5 11	
100	Felling axes, 5 lbs. each ...	106 4 0	
3	Chunam grinding stones 24" × 4" ...	26 12 0	
51	Brick moulds ...	132 10 7	
600	Pallet boards ...	71 5 1	
1	Weighing scale ...	7 10 7	
12	Files ...	8 1 9	
8	Hammers ...	8 8 11	
4	Stone cutting picks ...	3 15 9	
	Iron works for mortar mills ...	46 2 8	
6	Pullies ...	25 14 11	
4	Measuring rods ...	2 9 6	
4	Plumb levels ...	2 0 6	
4	Bricklayers' square ...	5 6 5	
6	Cast iron sheaves ...	32 2 4	
	Repairing tools ...	800 0 0	
		4,108 12 2	
			4,108 12 2
	<i>Cordage.</i>		
	Hemp ropes ...	...	399 3 6
	Carriage and contingencies ...	...	1,041 4 11
	Total ...	...	15,500 0 0

NELLORE,
20th September 1876.

(Signed) J. O'SHAUGHNESSY,
District Engineer, Nellore.

Proceedings of the Madras Government, Public

NELLORE

Comparative Statement of the Original and Revised Estimates

No.	Particulars.	ORIGINAL ESTIMATE.			WORK EXECUTED UP TO END OF JULY 1876.		
		Quantity.	Rate.	Amount.	Quantity.	Rate.	Amount.
* 1		2			3		
Body Wall.							
1	Concrete for wells under body walls, cubic yards	469½	2 3 0	1,026 3 4	338½	4 2 5	1,404 6 7
2	Brick in chunam wells, cubic feet	26,125½	0 3 0	4,898 8 6	22,731	0 3 4	4,751 15 11
3	Rubble in chunam for foundation of body wall, cubic yards	523½	3 8 0	1,832 4 0	669½	3 15 10½	2,671 4 0
3a	Do. for breach	..	..	..	5½	3 15 10½	22 15 2
3b	Do. with Portland cement for breach	..	..	..	86	7 1 9½	611 10 10
4	Rubble in chunam for body wall above foundation, cubic yards	653½	3 8 0	2,287 4 0	890½	4 2 2	3,683 5 11
4a	Do. for breach	..	..	..	52	4 2 2	215 5 0
5	Laterite on edge in chunam for top of body wall, cubic yards	170½	6 12 0	1,150 0 0	169½	7 6 8	1,258 5 5
5a	Do. for breach	..	..	..	15	7 6 8	111 4 0
6	Pointing front face and top of body wall, squares	61.2	2 0 0	122 6 4	..	..	..
7	Rubble stone for foundations of groynes, cubic yards	141½	1 5 0	185 15 0	9½	1 0 0	9 9 0
8	Rubble stone for groynes above foundation	237½	1 5 0	311 11 6	128	1 1 3	148 4 1
First Binding Wall.							
9	Rubble in chunam for foundation, cubic yards	252½	3 8 0	884 11 9	153½	4 7 11	687 6 4
9a	Do. for breach	..	..	..	192½	4 7 11	865 3 11
9b	Do. without mortar for breach	..	..	..	77	1 14 0	144 6 0
10	Rubble in chunam above foundations, cubic yards	265½	3 8 0	929 4 0	382½	4 0 0	1,531 3 9
11	Laterite on edge in chunam for top of binding wall, cubic yards	75½	6 12 0	512 8 0	78½	7 8 10	591 10 7
12	Pointing top of binding wall, squares	13.67	2 0 0	27 5 5	..	..	..
Second Binding Wall.							
13	Rubble in chunam for foundation, cubic yards	171½	3 8 0	598 14 2	132½	4 7 1	595 12 3
13a	Do. without mortar for breach	..	..	..	174	2 10 3	459 12 3
14	Do. in chunam above foundation, cubic yards	231½	3 8 0	808 15 0	319½	3 14 1	1,254 5 2
14a	Do. for breach	..	..	..	40½	3 14 1	157 2 4
15	Laterite on edge in chunam for top of binding wall, cubic yards	77½	6 12 0	520 5 0	66½	6 12 2	449 9 1
16	Pointing top of binding wall squares..	13.9	2 0 0	27 12 9	..	..	..
Third Binding Wall.							
17	Rubble in chunam for foundation, cubic yards	173½	3 8 0	606 10 8	104½	3 11 6	389 5 4
17a	Do. without mortar for breach, cubic yards	..	..	..	124	2 5 10½	293 8 0
18	Do. in chunam above foundation, cubic yards	234½	3 8 0	819 7 0	220½	3 12 9	835 7 0
18a	Do. for breach, cubic yards	..	..	..	12	3 12 9	45 9 0
19	Laterite on edge in chunam for top of binding wall, cubic yards	78½	6 12 0	527 1 0	87½	6 6 5	561 6 2
20	Pointing top of do.	14.00	2 0 0	28 0 0	..	..	..
Retaining Wall.							
21	Concrete for wells, cubic yards	374½	2 3 0	819 9 4	105½	3 13 5	751 13 6
21a	Do. for breach, cubic yards	..	..	..	56	3 13 5	214 15 4
22	Brick in chunam wells, cubic feet	20,864½	0 3 0	3,912 0 6	16,612½	0 3 6	3,636 4 0
22a	Do. for breach, cubic feet	..	..	..	600	0 3 6	115 3 5
23	Rubble in chunam, cubic yards	330½	3 8 0	1,158 1 9	600	0 3 6	162 6 4
23a	Do. for breach	..	..	..	30	5 6 7½	135 5 3
23b	Brick in chunam for foundations, cubic yards	..	..	..	25	5 6 7½	135 5 3
23c	Rubble in chunam above do.	..	..	..	242	5 2 11½	1,542 3 8
23d	Do. for breach	..	..	..	35½	5 2 11½	184 5 6
24	Laterite on edge in chunam, cubic yards	175½	6 12 0	1,183 8 0	185½	5 12 2	1,069 13 10
25	Pointing top of retaining wall squares	23.5	2 0 0	47 0 0	..	..	..

Works Department, 16th December 1876. No. 3,455.

DISTRICT.

for the Extension of the Pennair Anicut at Nellore.

WORK STILL REQUIRED.			REVISED ESTIMATE, TOTAL OF COLUMNS 3 AND 4.			INCREASE.		DECREASE.	
Quantity.	Rate.	Amount.	Quantity.	Rate.	Amount.	Quantity.	Amount.	Quantity.	Amount.
4.			5			6		7	
RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.
..	..	..	338½	4 2 5	1,404 6 7	..	378 3 3	130½	146 8 7
..	..	..	22,731	0 3 4	4,751 15 11	..	..	3,394½	..
..	..	..	669½	3 15 10½	2,671 4 0	145½	839 0 0	..	..
..	..	..	5½	3 15 10½	22 15 2	5½	22 15 2	..	..
..	..	..	86	7 1 9½	611 10 10	86	611 10 10	..	..
..	..	..	890½	4 2 2	3,683 5 11	137	1,396 1 11	..	..
..	..	..	52	4 2 2	212 5 0	52	215 5 0	..	..
..	..	..	169½	7 6 8	1,258 5 5	..	108 5 5	19	..
..	..	..	15	7 6 8	111 4 0	15	111 4 0	..	..
62.3	2 4 0	140 2 9	62.3	2 4 0	140 2 9	1.1	17 12 5	..	..
179½	1 7 0	257 8 10	188½	1 6 7½	267 1 10	47½	81 2 10	..	..
104½	1 7 0	150 9 3	232½	1 4 6½	298 13 4	..	..	4½	12 14 2
..	..	..	153½	4 7 11	687 6 4	..	..	99½	197 5 5
..	..	..	192½	4 7 11	865 3 11	192½	865 3 11	..	..
..	..	..	77	1 14 0	144 6 0	77	144 6 0	..	..
..	..	..	382½	4 0 0	1,531 3 9	117½	601 15 9	..	..
..	..	..	78½	7 8 10	591 10 7	2½	79 2 7	..	..
14	2 4 0	31 8 0	14	2 4 0	31 8 0	0.33	4 2 7	..	..
..	..	..	132½	4 7 1	595 12 3	..	..	38½	8 1 11
..	..	..	174	2 10 3	459 12 3	174	459 12 3	..	..
..	..	..	319½	3 14 1	1,254 5 2	88½	445 6 2	..	..
..	..	..	40½	3 14 1	157 2 4	40½	157 2 4	..	..
..	..	..	66½	6 12 2	449 9 1	..	..	10½	20 11 11
14½	2 4 0	32 14 6	14½	2 4 0	32 14 6	0.72	5 1 9	..	..
..	..	..	104½	3 11 6	389 5 4	..	..	68½	217 5 4
..	..	..	124	2 5 10½	293 8 0	124	293 8 0	..	..
..	..	..	220½	3 12 9	835 7 0	..	16 0 0	13½	..
..	..	..	12	3 12 9	45 9 0	12	45 9 0	..	..
..	..	..	87½	6 6 5	561 6 2	9½	34 5 2	..	..
14.5	2 4 0	32 10 0	14.5	2 4 0	32 10 0	0.5	4 10 0	..	..
..	..	..	195½	3 13 5	751 13 6	..	..	178½	67 11 16
..	..	..	56	3 13 5	214 15 4	56	214 15 4	..	..
..	..	..	16,612½	0 3 6	3,636 4 0	..	..	4,251½	275 12 6
..	..	..	600	0 3 6	115 3 5	600	115 3 5	..	..
..	..	..	30	5 6 7½	162 6 4	..	..	800½	995 11 5
..	..	..	25	5 6 7½	135 5 3	25	135 5 3	..	..
..	..	..	297½	5 2 11½	1,542 3 8	297½	1,542 3 8	..	..
..	..	..	35½	5 2 11½	184 5 6	35½	184 5 6	..	..
..	..	..	185½	5 12 2	1,069 13 10	10½	..	..	113 10 2
24½	2 4 0	55 6 6	24½	2 4 0	55 6 6	1.12	8 6 6	..	..

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Comparative Statement of the Original and Revised Estimate

Comparative Statement of the Original and Revised Estimate									
No.	Particulars.	ORIGINAL ESTIMATE.			WORK EXECUTED UP TO END OF JULY 1876				
		Quantity.	Rate.	Amount.	Quantity.	Rate.	Amount.		
1		2			3				
26	Apron between Body and First Binding Wall.								
27	Rubble, cubic yards	1,377	RS. A. P.	RS. A. P.		RS. A. P.	RS. A. P.		
28	Cyclopean rubble, cubic yards	1,929	1 5 0	1,803 5 7	2,859	2 1 4	5,958 12 7		
29	Concrete for filling interstices, C. yds.	92	1 8 0	2,893 8 0	1,636	1 14 9	3,148 14 6		
30	Apron between First and Second Binding Walls.								
31	Rubble, cubic yards	1,062	2 3 0	201 4 0	192	2 13 7	646 11 11		
32	Cyclopean rubble, cubic yards	1,487							
33	Concrete for filling interstices, C. yds.	70	1 5 0	1,394 8 6	861	1 12 0	1,506 4 6		
34	Apron between Second and Third Binding Walls.								
35	Rubble, cubic yards	1,291	1 8 0	2,231 4 0	1,332	2 1 8	2,803 12 10		
36	Cyclopean rubble, cubic yards	1,808	2 3 0	154 15 2	144	4 6 8	636 3 0		
37	Concrete for filling interstices	86							
38	Apron between Third Binding Wall and Retaining Wall.								
39	Rubble, cubic yards	1,291	1 5 0	1,695 5 0	1,540	1 5 5	2,114 12 0		
40	Cyclopean rubble, cubic yards	1,808	1 8 0	2,712 8 0	1,420	1 4 4	1,798 1 3		
41	Concrete for filling interstices	86	2 3 0	188 6 3	177	2 7 7	440 10 1		
42	Apron beyond Retaining Wall.								
43	Rubble, cubic yards	1,259							
44	Cyclopean rubble, cubic yards	1,763	1 5 0	1,652 14 0	1,594	1 0 8	1,658 5 3		
45	Concrete for filling interstices, C. yds.	84	1 8 0	2,614 10 1	1,469	1 5 2	1,945 12 3		
46	Apron beyond Retaining Wall, second portion.								
47	Rubble, cubic yards	4,346	2 3 0	183 12 0	144	1 14 9	277 6 6		
48	Pitching adjacent to Rear Return.								
49	Cyclopean rubble for foundation, cubic yards	1,396	1 5 0	1,833 4 4	2,130	1 3 2	2,573 10 11		
50	Do. above foundation, cubic yards	2,897	1 8 0	4,346 10 8	2,042	1 0 6	2,091 2 6		
51	Gravel backing, cubic yards	121	2 3 0	265 12 6					
52	Pitching adjacent to Front Wing.								
53	Cyclopean rubble for foundation, cubic yards	266	1 5 0	5,705 0 0	4,266	1 1 2	4,589 0 8		
54	Cyclopean rubble above foundation, cubic yards	177							
55	Gravel backing, cubic yards	488	1 8 0	266 10 8	199	1 3 8	245 2 7		
56	Front Wing Wall.								
57	Concrete for wells	163	1 8 0	733 5 4					
58	Brick in mortar wells, cubic feet	9,097	0 8 0	109 8 0					
59	Rubble masonry for foundation, cubic yards	178							
60	Do. above foundations, do.	363	1 8 0	400 0 0					
61	Brick in chunam for do., cubic yards	803	1 8 0	975 5 4					
62	Laterite in chunam, cubic yards	30	0 8 0	145 5 4					
63	Pointing squares	29							
64	Abutment.								
65	Concrete for wells, cubic yards	29							
66	Brick in mortar wells, cubic feet	1,633	2 3 0	357 4 8	203	3 2 10	645 1 5		
67	Rubble in chunam for foundation, cubic yards	37	0 3 0	1,705 11 9	9,212	0 3 3	1,895 1 1		
68	Do. above, do.	78	3 8 0	616 0 0	160	4 9 6	730 0 8		
69	Brick in chunam, do.	803	3 8 0	1,271 6 0	302	4 3 8	1,277 12 6		
70	Laterite in chunam, do.	30	5 0 0	4,015 0 0	180	4 11 8	851 1 7		
71	Pointing squares	87	2 0 0	60 0 0	665	6 2 7	4,097 12 7		
72	Rear Wing Wall.								
73	Concrete for wells	29			32	2 3 8	72 8 6		
74	Brick in mortar wells, cubic feet	1,633	2 3 0	64 2 8	39	2 15 9	116 7 7		
75	Rubble in chunam for foundation, cubic yards	37	0 3 0	306 3 0	1,917	0 2 8	317 2 11		
76	Do. above, do.	78	3 8 0	132 6 8	39	4 7 1	173 4 11		
77	Brick in chunam, do.	803	3 8 0	274 12 0	54	3 8 0	189 0 11		
78	Laterite in chunam, do.	30	5 0 0	451 5 4	20	5 0 0	100 0 5		
79	Pointing squares	87	2 0 0	17 4 4	86	7 2 1	618 12 4		
80	Concrete for wells	29			10	1 11 7	20 4 10		
81	Brick in mortar wells, cubic feet	1,633	2 3 0	265 12 6	111	3 4 7	364 11 8		
82	Rubble in mortar for foundation, cubic yards	37	0 3 0	1,268 2 6	5,779	0 3 6	1,252 10 9		
83	Do. above, do.	78	3 8 0	621 14 3	184	3 13 2	703 12 3		
84	Brick in mortar for foundation	803			11	5 1 6	56 0 6		
85	Rubble in chunam above foundation, cubic yards	30	3 8 0	3,144 12 0	892	4 4 0	3,791 0 6		
86	Pointing squares	87	2 0 0	60 0 0					

Works Department, 16th December 1876. No. 3,455.

for the Extension of the Pennair Anicut at Nellore—(Continued).

WORK STILL REQUIRED.			REVISED ESTIMATE, TOTAL OF COLUMNS 3 & 4.			INCREASE.		DECREASE.	
Quantity.	Rate.	Amount.	Quantity.	Rate.	Amount.	Quantity.	Amount.	Quantity.	Amount.
4			5			6		7	
	RS. A. P.	RS. A. P.		RS. A. P.	RS. A. P.		RS. A. P.		RS. A. P.
8	2 3 0	18 3 8	2,859 1,636 200	2 1 4 1 14 9 2 13 1	5,958 12 7 3,148 14 6 564 15 7	1,481 108	4,150 7 0 255 6 6 363 11 7	293	
			861 1,332 144	1 12 0 2 1 8 4 6 8	1,506 4 6 2,803 12 10 636 3 0		111 12 0 572 8 10 481 3 10	201 155	
			1,580 1,420 177	1 5 5 1 4 4 2 7 7	2,114 12 0 1,798 1 3 440 10 1	288 91	419 7 0 252 3 10	388	914 6 0
			1,594 1,469 246	1 0 8 1 5 2 2 0 5	1,658 5 3 1,945 12 3 449 3 1	334 162	5 7 3 315 7 1	294	698 14 1
101	2 3 0	221 12 8	2,130 2,042 243	1 3 4 1 0 5 2 3 0	2,573 10 11 2,091 3 6 531 9 0	733 121	740 6 7 265 12 6	855	2,255 7 2
			4,266	1 1 2	4,589 0 8			80	1,115 15 4
			199 452	1 3 8 1 7 0	245 2 7 649 12 0	43			21 8 1 83 9 4 109 4 0
			266	1 7 0	383 5 4				16 10 8
650 290	1 7 0 0 8 0	934 15 7 145 5 4	650 290	1 7 0 0 8 0	934 15 7 145 5 4				40 5 9
			203 9,212	3 2 10 0 3 3	645 1 5 1,895 1 1	39 114	287 12 9 189 5 4		
			160 302 180 665 32	4 9 6 4 3 8 4 11 8 6 2 7 2 3 8	730 0 8 1,277 12 6 851 1 7 4,097 12 7 72 8 6		114 0 8 6 6 6 851 1 7 82 12 7 12 8 6	16 61 138	
			39 1,917	2 15 9 0 2 8	116 7 7 317 2 11	9 284	52 4 11 10 15 11		
			39 54 20 86 10	4 7 1 3 8 0 5 0 0 7 2 1 1 14 7	173 4 11 189 0 11 100 0 5 618 12 4 20 4 10	1 20 192	40 14 3 100 0 5 167 7 0 2 14 6	24 31	85 11 1
			111 5,779	3 4 7 0 3 6	364 11 8 1,252 10 9		98 15 2	10 984	15 7 9
			184 11	3 13 2 5 1 6	703 12 3 56 0 6	34 11	181 14 0 56 0 6		
			892 30	4 4 0 2 4 0	3,791 0 6 67 8 0		646 4 6 7 8 0	6	
30	2 4 0	67 8 0							

Comparative Statement of the Original and Revised Estimates

Comparative Statement of the Original and Revised Estimates.										
No.	Particulars.	ORIGINAL ESTIMATE.			WORK EXECUTED UP TO END OF JULY 1876.					
		Quantity.	Rate.	Amount.	Quantity.	Rate.	Amount.			
1		2			3					
<i>Rear Return.</i>										
65	Concrete for wells, cubic yards ..	64½	Rs. 2 3 0	Rs. 119 3 6	73	Rs. 3 7 4	Rs. 256 4 10			
66	Brick in mortar wells, do. ..	3,032	0 3 0	568 8 0	1,853	0 2 11	339 8 9			
67	Rubble in mortar for foundation, cubic yards ..	64½	3 8 0	225 2 8	165	4 3 5	695 8 9			
68	Do. above foundation, cubic yards ..	356½	3 8 0	1,217 12 0	386	3 11 8	1,438 10 5			
69	Pointing squares ..	18½	2 0 0	27 0 0	..	..	..			
<i>Revetment Walls Road Approach.</i>										
70	Concrete, cubic yards ..	364	2 3 0	796 4 0	276½	3 14 9	808 1 11			
71	Rubble in mortar for foundation, C. yds ..	308½	3 8 0	1,079 2 8	279½	3 2 5	881 6 9			
72	Do. above foundation, cubic yards ..	1,505½	3 8 0	5,268 4 5	1,102	3 1 6	3,410 7 1			
73	Laffrite flooring on edge, cubic yard ..	21½	5 0 0	108 5 4	21½	3 14 6	83 15 6			
74	Concrete under flooring, cubic yards ..	8½	2 3 0	18 11 5	7	2 4 8	16 0 8			
75	Packed rubble, flooring, cubic yards ..	30	1 5 0	39 6 0	28	0 13 9	24 1 0			
76	Packed rubble cubic yards ..	57½	1 5 0	75 13 4	56½	0 14 5½	52 13 6			
77	Pointing squares ..	72	2 0 0	144 0 0	..	..	..			
<i>Pitching of outer face of Up-stream Approach.</i>										
78	Cyclopean rubble for foundation, cubic yards ..	153	1 8 0	229 8 0	..	..	..			
79	Do. above foundation do. ..	743½	1 8 0	1,114 10 7	..	..	..			
80	Gravel backing, cubic yards ..	599½	0 8 0	299 12 0	..	..	..			
<i>Pitching of outer slope of Down Stream Approach.</i>										
81	Cyclopean rubble for foundation, cubic yards ..	121	1 8 0	181 8 0	..	..	..			
82	Do. above foundation, cubic yards ..	478	1 8 0	717 0 0	..	..	..			
83	Gravel backing, cubic yards ..	340½	0 8 0	170 5 4	..	..	..			
<i>Earthwork.</i>										
84	Excavating foundation and filling in ..	..	..	6,000 0 0	..	..	7,809 0 0			
85	Filling in pool in line of body wall and retaining walls and to water level for wells ..	..	..	1,500 0 0	..	..	2,290 14 6			
86	Embankment from ends of front wings to head of approach including earthwork above ground level and ramp to approach ..	..	..	..	1,781½	0 1 9	193 9 6			
<i>Sinking Wells.</i>										
87	Under body wall ..	112	10 0 0	1,120 0 0	118	5 4 3	621 6 1			
88	Do. last retaining wall ..	115	10 0 0	1,150 0 0	103	4 7 5	482 3 1			
89	Do. front wing wall ..	39	10 0 0	390 0 0	37	11 4 6	417 7 8			
90	Do. abutment ..	7	10 0 0	70 0 0	9	4 3 0	37 11 0			
91	Do. rear wing wall ..	29	10 0 0	290 0 0	26	5 3 1	135 1 3			
92	Do. rear return ..	13	10 0 0	130 0 0	13	7 9 1	98 6 3			
93	Turfing squares ..	3,800	0 0 6	118 12 0	..	..	..			
94	Quarry rubbish and clay for front of anicut ..	..	..	250 0 0	..	..	1,039 8 3			
95	Repair and extension of tramway ..	..	..	6,500 0 0	..	..	6,751 8 1			
96	Baling water ..	..	..	3,000 0 0	..	..	4,521 9 8			
97	Compensation for land ..	..	..	3,000 0 0	..	..	..			
98	Feeding charges ..	..	..	..	..	..	3,224 5 4			
98a	Ring bund at the breach ..	..	..	..	..	..	832 2 0			
98b	Rubble dam ..	..	..	..	..	..	2,326 0 0			
<i>Temporary Wall over Body Wall.</i>										
99	Laterite in chunam, cubic yards ..	..	..	..	398	3 14 8	1,558 9 1			
	Brick in chunam, cubic feet ..	..	..	..	1,413	0 4 7½	407 13 9			
	Concrete, cubic yards ..	..	..	..	17½	9 1 2	158 12 6			
<i>Extra Binding Wall.</i>										
100	Rubble in chunam for foundation and superstructure ..	..	..	..	..	..	..			
101	Special petty superintendence, scaffolding and sundries ..	..	..	7,361 5 1	131½	2 11 4	356 3 5			
	Total, Works ..	..	..	1,15,610 0 0	..	..	1,31,613 13 9			
	Tools and Plant ..	..	..	8,860 0 0	..	..	10,052 11 7			
102	Total ..	..	..	12,470 0 0	..	..	1,41,666 9 4			
103	Executive Establishment ..	..	..	28,900 0 0	..	..	..			
104	Direction and Control ..	..	..	6,780 0 0	..	..	..			
<i>Grand Total</i>										
				1,59,150 0 0			1,41,666 9 4			

for the Extension of the Pennair Anicut at Nellore—(Continued).

[illegible]

Proceedings of the Madras Government, Public

NELLORE

Condensed Abstract of the Original and Revised Estimates

Particulars.	ORIGINAL ESTIMATE.			WORK EXECUTED UP TO JULY 1876.		
	Quantity.	Rate.	Amount.	Quantity.	Rate.	Amount.
Concrete C. yds.	2,039	2 3 0	4,461 5 4	1,813	3 7 3	6,262 15 7
Brick in chunam C. ft.	67,515	0 3 0	12,659 2 3	75,114	0 3 3	15,638 1 11
Rubble in chunam C. yds.	6,773	3 8 0	23,707 1 0	6,343	3 13 3	24,305 6 6
Laterite in chunam Sqs.	1,492	5 10 10	8,468 0 8	1,364	6 6 5	8,731 5 6
Pointing C. yds.	280 47	2 0 0	660 14 10	43	2 2 6	92 13 4
Stone rubble C. yds.	24,167	1 6 7	34,148 13 2	21,620	1 6 8	30,668 7 11
Gravel backing	1,449	0 8 0	724 10 8	..	..	..
Excavating foundation and filling in	..	..	6,000 0 0	..	..	7,809 0 0
Filling pool in line of body wall and retaining walls to water level for wells	..	..	1,500 0 0	..	..	2,290 14 6
Wells	315	10 0 0	3,150 0 0	311	5 12 2	1,792 3 6
Turfing	3,800	0 0 6	118 12 0	..	..	1,039 8 3
Quarry rubbish and clay for front of anicut	..	..	250 0 0	..	..	6,751 8 1
Repair and extension of tramway	..	..	6,500 0 0	..	..	4,621 9 8
Baling water	..	..	3,000 0 0	..	..	..
Compensation for land	..	..	3,000 0 0	..	..	193 9 6
Embankment for roadway and filling between wings and road revetments	..	..	..	1,791	0 1 9	..
<i>Closing Breach.</i>	..	..	..	..	..	..
Concrete C. yds.	..	..	..	56	3 13 5	214 15 4
Brick in chunam C. ft.	..	..	..	600	0 3 1	115 3 5
Rubble stone in chunam C. yds.	..	..	..	449	4 16 8	2,237 9 0
Laterite in chunam	..	..	..	15	7 6 8	111 4 0
Rubble stone work	..	..	..	375	2 6 4	897 10 9
Ring bund at breach	..	..	..	..	..	832 2 0
Rubble dam	..	..	..	..	..	2,326 0 0
<i>Temporary Wall over Body Wall.</i>	..	..	..	..	..	..
Laterite in chunam C. yds.	..	..	..	398	3 14 8	1,559 9 1
Brick in chunam C. ft.	..	..	..	1,413	0 4 7	407 13 9
Concrete C. yds.	..	..	..	17	9 1 2	168 12 6
<i>Extra Binding Wall.</i>	..	..	..	..	..	..
Rubble in chunam for foundation	..	..	..	..	..	356 3 5
Feeding coolies	..	..	..	131	2 11 4	3,224 5 4
Special petty superintendence, scaffolding, and sundries	..	..	..	..	..	9,175 13 1
Total Works	..	..	7,361 5 1	..	..	..
Tools and Plant	..	..	1,15,610 0 0	..	..	1,31,613 13 9
Total	..	..	8,860 0 0	..	..	10,052 11 7
Executive Establishment	..	..	1,24,470 0 0	..	..	1,41,666 9 4
Direction and Control	..	..	28,900 0 0	..	..	..
Grand Total	..	..	5,780 0 0	..	..	..
Net Excess	..	..	1,59,150 0 0	..	..	1,41,666 9 4

NELLORE,
20th September 1876.

Works Department, 16th December, 1876. No. 3,455.

DISTRICT.

for the Extension of the Pennair Anicut at Nellore.

WORK STILL REQUIRED.			REVISED ESTIMATE, TOTAL OF COLUMNS 3 AND 4.			INCREASE.		DECREASE.	
Quantity.	Rate.	Amount.	Quantity.	Rate.	Amount.	Quantity.	Amount.	Quantity.	Amount.
4			5			6		7	
487	RS. A. P. 2 3 0	RS. A. P. 1,065 5 0	2,300 1/2	RS. A. P. 3 3 0	RS. A. P. 7,328 4 7	281	RS. A. P. 2,866 15 3	..	RS. A. P. ..
431 1/2	3 8 0	1,511 9 9	75,114 1/2	0 3 3 1/2	15,538 1 11	7,599 1/2	2,878 15 3	..	..
245 1/2	2 4 0	652 7 9	6,775 1/2	3 12 1 1/2	25,817 0 3	2 1/2	2,109 15 3	127 1/2	..
3,148	1 7 0	4,525 4 0	1,364 1/2	6 6 6	8,731 5 6	8 1/2	263 4 10	..	..
1,230 1/2	0 8 0	615 6 8	288 1/2	2 3 9 1/2	645 5 1	601	84 6 3	..	..
..	..	691 0 0	24,678	1 6 8	35,193 11 11	..	1,044 15 9	218 1/2	109 4 0
..	..	..	2,230 1/2	0 8 0	615 6 8	..	2,500 0 0	..	..
..	..	..	..	..	8,500 0 0	..	..	..	..
..	..	..	..	..	2,290 14 6	..	790 14 6	..	1,357 12 8
3,800	0 0 6	118 12 0	311	5 12 2	1,792 3 4	..	..	..	..
..	..	960 7 9	3,800	0 0 6	118 12 0	..	1,750 0 0	..	..
..	..	1,248 7 11	..	..	2,000 0 0	..	1,500 0 0	..	..
..	..	478 6 4	..	..	8,000 0 0	..	2,000 0 0	..	2,000 0 0
..	..	1,000 0 0	..	..	5,000 0 0	..	..	..	..
18,208 1/2	0 1 9	1,991 8 10	2,000	0 1 9	1,000 0 0	2,000	2,185 2 4	..	..
..	..	..	..	..	2,185 2 4	..	..	..	..
..	..	..	56	3 13 5	214 15 4	56	214 15 4	..	..
..	..	..	600	0 3 1	115 3 5	600	115 3 5	..	..
..	..	..	449 1/2	4 15 8 1/2	2,237 9 0	449 1/2	2,237 9 0	..	..
..	..	..	15	111 4 0	11 4 0	15	111 4 0	..	..
..	..	..	375	7 6 8	897 10 9	375	897 10 9	..	..
..	..	..	..	2 6 4 1/2	832 2 0	..	832 2 0	..	..
..	..	..	..	..	2,326 0 0	..	2,326 0 0	..	..
..	..	..	398	3 14 8	1,558 9 1	398	1,558 9 1	..	..
..	..	..	1,413	0 4 7 1/2	407 13 9	1,413	407 13 9	..	..
..	..	..	17 1/2	9 1 2	158 12 6	17 1/2	158 12 6	..	..
..	..	..	131 1/2	2 11 4	356 3 5	131 1/2	356 3 5	..	..
..	..	..	..	..	3,224 5 4	..	3,224 5 4	..	..
..	..	..	..	..	10,303 3 4	..	2,941 14 3	..	..
..	..	1,127 6 8	..	..	1,47,500 0 0	..	35,357 0 8	..	3,467 0 8
..	..	15,886 2 3	..	..	15,500 0 0	..	6,640 0 0	..	3,467 0 8
..	..	6,447 4 5	..	..	1,63,000 0 0	..	41,997 0 8	..	..
..	..	21,333 6 8	..	..	36,870 0 0	..	7,970 0 0	..	..
..	..	36,870 0 0	..	..	7,375 0 0	..	1,595 0 0	..	..
..	..	7,375 0 0	..	..	2,07,245 0 0	..	51,562 0 8	..	3,467 0 8
..	..	6,578 6 8	..	..	1,59,150 0 0	..	3,467 0 5	..	..
..	..	..	..	..	48,095 0 0	..	48,095 0 0	..	..

O'SHAUGHNESSY,

(Signed) J. O'SHAUGHNESSY,
District Engineer, Nellore.

Proceedings of the Madras Government, Public Works Department,
16th December 1876. No. 3,455.

List of Papers and Plans forwarded with letter No. 102, dated 20th September 1876,
from the District Engineer, Nellore, to the Chief Engineer for Irrigation.

- 1 Abstract Estimate, No. 2.
- 1 Comparative Statement, No. 3.
- 1 Condensed Abstract, No. 5.
- 1 Memorandum by the Executive Officer (Lieutenant Henderson, R.E.) No. 4.
- 1 Abstract Estimate for Tools and Plant, No. 6.
- 1 Account of restoring the work destroyed by the flood of June 1875, No. 7.
- 1 Abstract Estimate for work to be emergently done, No. 8.
- 1 Plan.

The return of the above papers is requested.

NELLORE,
20th September 1876.

(Signed) J. O'SHAUGHNESSY,
District Engineer.

No. 418.

ORDER THEREON, 16th December 1876, No. 3,455.

IRRIGATION, No. 33-A.

THE papers submitted by the Chief Engineer for Irrigation and reviewed in his note dated 24th November 1876, afford

very full information as to the cause of the excess cost of the Pennair Anicut Extension. The sanctioned estimate for this work is as follows:—

Works	...	...	...	...	...	...	...	RS.
Tools and Plant	...	...	...	...	...	...	...	1,15,610
Establishment	...	...	...	...	...	...	...	8,800
								34,680
Total	...	...	...	...	...	...	...	1,59,150

The revised estimate is—

Works	...	...	...	...	...	...	...	RS.
Tools and Plant	...	...	...	...	...	...	...	1,47,500
Establishment	...	...	...	...	...	...	...	15,500
								44,245
Total	...	...	...	...	...	...	...	2,07,245

Putting aside Establishment charges which are determined by the expenditure under other heads, the estimate for purposes of comparison will be—

As sanctioned	...	...	...	...	...	...	...	RS.
„ revised	...	...	...	...	...	...	...	1,24,470
								1,63,000
Difference	...	...	...	...	...	...	...	38,530

or 30-95 per cent. on the former amount.

2. The reasons assigned for this great difference are—

- 1st.—Deviations from sanctioned designs of works.
- 2nd.—Higher rates.
- 3rd.—Additional works.

It is shown that some of the deviations were not desirable, and that the difficulties which lead to them might in some cases have been obviated. As regards the work behind the north wing it is expected that some saving may still be effected, and it is

Proceedings of the Madras Government, Public Works Department,
16th December 1876. No. 3,455.

observed that the Chief Engineer for Irrigation has issued instructions to the District Engineer with a view to prevent unnecessary expenditure.

The remarkable variations in rates for the same description of work do not

Rates, note paragraph 5.

appear to admit of fully satisfactory explanation, and much of the expenditure

due to increased rates must, it is considered, be attributed to delay in commencing operations in the bed of the river, the state of which was favorable up to the middle of May, before which time the progress had been much less than it should have been, and to the absence of executive arrangements suited to the economical employment of the large amount of labor necessarily concentrated within a limited space. While admitting that sickness and the occurrence of freshes afford a legitimate excuse for some of the excess, His Grace the Governor in Council is unable to avoid the conclusion that a considerable sum would have been saved had the late District Engineer commenced work earlier and managed the labor more systematically. The additional

Additional works, note paragraph 6.

works not provided for in the sanctioned estimate are—

	RS.	A.	P.
1st.—Embankment at north approach	2,185	2	4
2nd.—Closing breach	4,408	12	6
3rd.—Rubble dam	2,326	0	0
4th.—Temporary wall on crest of anicut	2,125	13	4
5th.—Extra binding wall	356	3	5
Total	11,401	15	7

Of these items the first is in part a deviation from the intended arrangements, and it is expected that a saving will yet be secured. The second was rendered necessary by a fresh which went over the work when incomplete. The third ought to have been included in the sanctioned estimate. The fourth was properly carried out as a precautionary measure and answered the intended purpose, and the fifth is a trifling work not needing special notice.

3. Of the amount of the revised estimate, exclusive of establishment, it appears to the end of August—

	RS.	A.	P.
The amount spent was	1,42,117	0	11
Due bills	5,249	3	9
	1,47,366	4	8
Balance of revised estimate	15,633	11	4
Total	1,63,000	0	0

Also that in addition to the Budget allotment of Rupees 16,649 for the current year for this work, Rupees 18,500 would be necessary to allow of its completion according to the revised estimate within the current year, and taking into consideration that a reduction of cost at the north approach will be feasible, probably a further allotment of Rupees 16,000 will suffice. It is stated that Rupees 6,000 are necessary to adjust due bills and to complete work which cannot be postponed, and it is shown that the postponement of the rest of the comparatively small amount of work

*Proceedings of the Madras Government, Public Works Department,
16th December 1876. No. 3,455.*

remaining to be done will lead to further excess. The following transfers to allow of the completion of the extension within the current year will therefore be made:—

G.O., No. 3,234, dated 1st December 1876.	<i>Capital Ordinary.</i>					Rs.
	Amount transferred under stock balance, Godavery, from Ordinary to Extraordi- nary					13,272
	<i>ORDINARY AGRICULTURAL.</i>					
	<i>Original Works.</i>					
	Madras Water Works					2,728
	Total					16,000

The transfer from Ordinary Agricultural to Capital Ordinary will be subject to the confirmation of the Government of India.

4. The revised estimate will be forwarded for the sanction of the Government of India.

(Here enter No. 3,456, dated 16th December 1876.)

(True Extract.)

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

To the District Engineer, Nellore.

- „ Superintending Engineer, Godavery.
- „ „ „ Chingleput.
- „ Examiner of Public Works Accounts.
- „ Chief Engineer for Irrigation.

Exd. E. C. Shunker.

Exd. A. Grubert.

Spare Copies

Memorandum
His Excellency the Governor

1000

93

Sir,

I spoke to Mr. Hankins about printing these papers & he says that all the papers must be printed according to Chief King's remarks, in draft order except those noted for omission in the list.

The following is the order in which these papers should be printed.

1. Dist. Inq. letter No 122.
2. Inq. Inq. L. Henderson's Memo.
3. Abstract Inq. for No 207205.
4. - do - do for work blei done ^{emergently}
5. - letter for restoring work destroyed by flood.
6. - do - for Tools & Plant.
7. Comparative statement.
8. Condensed abstract.
9. List.

The list also should be printed.

P. J. G.

I pointed out to Mr. Hanks that it
would be too much to print the
Comparative statement as well as
the condensed abstract. but
he suggests that the E. & S. opinion
be taken on this point.

Please therefore have
it settled by writing E. & S.

4-11-76 P.H.

To the Registrar P.M.S.

C. 5717-

Air 5/12/76

E. I. Form No. 34.

MEMORANDUM.

REQUESTED for reference the under-mentioned papers:—

All original papers sent to Govt. with
Ch. Engr's Report No. 268 W of 1876.

OFFICE OF THE CHIEF ENGINEER
FOR IRRIGATION,

16-1-1877.

D. M. Hamilton

Head Clerk.

To

The Registrar of the P.M.S.

Memorandum

His Excellency the Governor has objected to the transfer of Rupees 2,728 from the Madras Water Works to the Bellon Ancient Extension. The provision for the Madras Water Works is principally for surplus works the construction of which has been deferred pending the submission & sanction of the revised estimate required by the Government of India, and it is therefore not probable that the money will be utilized this year except by transfer elsewhere.

2. If the objection be sustained it will be necessary to leave the Ancient works incomplete & to modify the latter part of the order slightly, Rupees 13,272 only being provided

Sub. M.
dated

May 15/12

CH^o 8717

No 3455

Public Works Department.

PROCEEDINGS of the MADRAS GOVERNMENT.

UNDER date the 16 May 6.

Read the following:—

The papers submitted by the Chief Engineer for Irrigation and reviewed in his Note dated 24th November 1896 afford very full information as to the cause of the recent cost of the Pennar Ancient extension. The sanctioned estimate for this work is as follows:

The papers submitted by the Chief Engineer for Irrigation and reviewed in his Note dated 24th November 1896 afford very full information as to the cause of the recent cost of the Pennar Ancient extension. The sanctioned estimate for this work is as follows:

Works	Rs 115,610
Tools & Plant	8860
Establishment	31,630
Total Rupees	157,100

<i>The revised Estimate is</i>	
Works	Rs 117,500
Tools & Plant	15,500
Establishment	44,245
Total Rupees	207,245

I agree except as to the sum from Madras W. W. when the estimate may be wanted. The sum is not less than 2770

By 9/12

24th
The papers submitted by the Chief Engineer for Irrigation and reviewed in his Note dated 24th November 1896 afford very full information as to the cause of the recent cost of the Pennar Ancient extension. The sanctioned estimate for this work is as follows:

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Taking aside Establishment charges which are determined by the expenditure under other heads, the estimate for purposes of comparison will be

As sanctioned \$124,470

As revised - - 163,000

Difference \$38,530

or 30.95 per cent on the former amount.

2. The reasons assigned for this great difference are

1st. Deviations from sanctioned designs of works

2nd. Higher rates

3rd. Additional works

It is shown that some of the deviations were not avoidable, and that the difficulties which led to them might in some cases have been obviated - As regards the work behind the North wing it is expected that some saving may still be effected, and it is observed that the

Deviations
Note para 4

Rates
Note para 5

Chief Engineer for navigation has issued instructions to the District Engineer with a view to prevent unnecessary expenditure.

The remarkable variations in rates for the same description of work do not appear to admit of fully satisfactory explanation, and much of the expenditure due to increased rates must, it is considered, be attributed to delay in commencing operations in the bed of the river, the state of which was favorable up to the middle of May, before which time the progress had been much less than it should have been, and to the absence of executive arrangements suited to the economical employment of the large amount of labor necessarily concentrated within a limited space. While admitting that

sickness and the recurrence of
 freshes afford a legitimate
 excuse for some of the delay.
 His Grace the Governor in
 Council is unable to avoid
 the conclusion that a con-
 siderable sum would have
 been saved had the late
 District Engineer commenced
 work earlier, and managed
 the labor more systematically.
 The additional works not
 provided for in the sanctioned
 estimate are

Additional works
 Note para 6

1 st Embankment at North approach	Rs 2155. 2. 4
2 nd Closing breach - - - - -	4408. 0. 6
3 rd Rubble dam - - - - -	2326. . .
4 th Temporary wall on crest of Amini	2126. 13. 4
5 th Extra building wall - - - -	356. 3. 5
<u>Total Rupees</u>	<u>11,461. 15. 7</u>

If these items the first is in
 part a deviation from the
 intended arrangements, and
 it is expected that a saving
 will yet be secured. The
 second was rendered
 necessary by a fresh
 which went over the work

when

90
 when incomplete. The third
 ought to have been included in
 the sanctioned estimate. The
 fourth was properly carried
 out as a precautionary measure
 and answered the intended
 purpose, and the fifth is a
 trifling work not needing
 special notice.

3 rd of the amount of the revised estimate, exclusive of establishment, it appears to the end of August the amount spent was - - - - -	Rs 11217. 0. 11
due bills - - - - -	5249. 3. 9
due bills - - - - -	117366. 4. 3
balance of revised estimate	15,653. 11. 11
<u>Total Rupees</u>	<u>16,300</u>

Also that in addition to the budget
 allotment of Rs 16,649 for the current
 year for this work, Rs 15,000
 would be necessary to allow
 for its completion according
 to the revised estimate within
 the current year, and taking
 into consideration that a
 reduction of cost at the North
 approach will be feasible,
 probably a further allotment

of 16,000 Rs will suffice. It is stated that Rs. 10,000 are necessary to adjust the bills & to complete work which cannot be postponed, and it is shown that the postponement of the rest of the comparatively small amount ^{work} remaining to be done will lead to further success. The following transfers, to allow of the completion of the extension within the current year will therefore be made:

Capital Ordinary

Amounts transferred under
 Stock balance Godavery from } R
~~the ordinary & extraordinary~~ } 13,272
 Ordinary & Extraordinary }
 Ordinary Agricultural
 Original works
 Major & Water works — 2,728

Rupees 16,000

The

G.O. No 3234 dated 1 December 1876

309 91
 The transfer from Ordinary Agricultural to Capital Ordinary will be subject to the confirmation of the Government of India.
 The revised estimate will be forwarded for the sanction of the Government of India.

RG No 3456 d 16 Dec 76
 23/11

[Signature]

H. E. Kellare 8
 L. E. Godavery 9
 L. E. Chingleput 6
 R. P. W. Accts 5
 Ch. E. for Irrig 5

Office 21
 S. J. K. 26

20-1-77

OFFICE OF CHIEF ENGINEER FOR IRRIGATION,
Fort St. George, 24 November 1876.

Note by the Chief Engineer for Irrigation.

Enclos. 11.

Pennair Arriant extension revised Estimate,

The sanctioned estimate amount
is Rupees 159,150 viz

Works.	Tools & Plant.	Establishment
115,610.	3360	34,680.

and the revised estimate amounts to Rs 207,215

viz. 117,500.	15,500.	44,215
difference 31890.	6640	9565

2. The causes of issues on work are

- 1st Deviations from sanctioned designs of work.
- 2nd Higher rates
- 3rd Additional work.

3. The papers submitted by the District Engineer afford very full information regarding every item of the revised estimate, and the present District Engineer who has had comparatively little to do with the extension work, has gone carefully through the report of the Executive Officer, so that but very few remarks need be added here. The comparative

The order may
be considered as
passed under
the explanation
given by Colonel
Mullins.

It will not do
to wait till the
Governor's return
4 months hence

[Signature]
16.12

417-418

Statement, Lieut Henderson's Memo in connection herewith explaining the differences item by item, and in the margin of which the work referred to and the estimate and work rates have been added to save repeated reference to the statement, that Officer's general remarks & his explanations regarding deviations will, together with the District Engineer's letter afford any information that may be desired.

No. 102. 20 Sept.

As regards deviations, some especially those which have been made in the direction of shallower foundations are to be regretted, and this remark applies more particularly to the retaining wall at the foot of the sloping apron. Most of the deviations of importance at the work in the bed of the river were occasioned by difficulties experienced in carrying on such work owing to freshets, but some of the difficulty might have been easily avoided, and a good deal of expense saved, had it not been thought necessary to uncover walls before filling with concrete; at Kellanc

the lime when mixed with burnt clay makes such an excellent hydraulic mortar, that concrete can be laid as satisfactorily in still water as out of water.

The arrangements for connecting the North wing with the flood embankment do not correspond with those considered most suitable when the estimate was sanctioned. The upstream connecting flood bank has been made on the alignment then stated to be objectionable, and it has not been mentioned why the preferable alignment laid down on the survey has not been adhered to. Even had the line for the west flood bank been suitable, the cross section of this and of the approach show that a good deal of unnecessary expense will result. There was no need of a high retaining wall on the west side of the roadway ramp, or for filling in the whole space between that wall and the rear face of the flood bank to 4 feet above M.W.L. The east retaining wall and earthwork behind is correct except that the masonry reinforcement should not extend beyond the

Note Para 7 in
M.C.G. 19 June/95
No 1738

the section IV seeing that it is neither necessary nor desirable to found masonry on made earth, and revetment ^(dry) should be substituted for masonry beyond section IV. Some reduction of expense may still be possible seeing that the revetment walls had not been carried ^{late of plan} up to their full height. It is questionable also whether the revetment (dry) on the east face of the east connecting bank is requisite.

The impression which the undersigned has formed from a careful perusal of the Executive Engineer's memoranda is that a good deal of the extra cost due to increase of water might have been avoided had the work been commenced earlier as it should have been. The arrangements resorted to carrying on extensive operations vigorously and without confusion been made in anticipation of the commencement of work in the bed of the river. Had the quarry plant been put to rights earlier & supplemented to the extent required

required. In order that the very great variations in rates for the same description of work at different times during the progress of the extension works may be the more easily seen, the following abstract of the rates shown in the Comparative Statement, has been prepared, from which it will be noticed that some of the work was done at very moderate rates and well within those provided in the estimate, while other has cost so very much more as to make it difficult to understand how any sufficient cause could be shown

Statement showing the rates on which the Pennair Ancient works ^{which} were constructed, ~~the same~~

Description of work	Extension rates		Repair Piled Estimate Rs 59,500 sanctd in go Rs 544 of 24th February 1877 Estimate	Restoration of 1859 Estimate		Remarks
	Estimate	Work				
<u>Concrete</u>						
<u>Body wall</u>						
Concrete for wells under						
Body wall - - - - - Cys	2 3 4	4 2 5	2.3.0	2.13 -		
<u>Retaining wall</u>						
Concrete for wells do	2 3 .	3 13 5				
do for breach do	- 1 .	3 13 5				
<u>Apron between Body</u>						
<u>and 1st Binding wall</u>						

Repair & Piled Estimate Rs 59,500
 done in 90 Rs 544
 of 24th February 1871
 Estimate

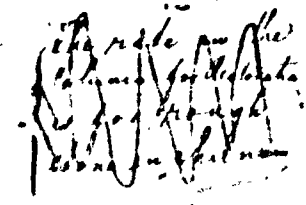
Restoration of 1859 Estimate

Concrete for filling in terracies - - - - - Cys	23	213	7
<u>Apron between 1st & 2nd</u>			
<u>Retaining wall</u>			
Concrete for filling in terracies - - - - - Cys	23	46	8
<u>Apron between 2nd & 3rd</u>			
<u>Retaining wall</u>			
Concrete for filling in terracies - - - - - Cys	23	27	7
<u>Between 3rd Retaining wall</u>			
<u>& Retaining wall</u>			
Concrete for filling in terracies - - - - - Cys	23	144	95
<u>Rear retaining wall</u>			
Concrete for filling in terracies - - - - - Cys	23		23
<u>Front wing wall</u>			
Concrete for wells - - - - -	23	32	10
<u>Abutment</u>			
Concrete for wells - - - - -	23	215	9
<u>Rear wing wall</u>			
Concrete for wells - - - - -	23	34	7
<u>Rear return</u>			
Concrete for wells - - - - -	23	37	4
<u>Retement walls road</u>			
<u>Approach</u>			
Concrete - - - - -	23	314	9
do under flooring	23	24	8

<u>Temporary wall over</u>			
<u>body wall</u>			
Concrete - - - - - Cys		9	12
<u>Brickwork in Mortar</u>			
<u>Body wall</u>			
Brick in chunam wells left	3	3	4
<u>Retaining wall</u>			
Brick in chunam wells	3	3	6
do do for breach		3	6
<u>Front wing wall</u>			
Brick in chunam wells	3	3	3
do for foundations		4	11
<u>Abutment</u>			
Brick in chunam wells left	3	2	8
do above foundation		5	
<u>Rear wing wall</u>			
Brick in chunam wells left	3	3	6
do for foundation		5	16
<u>Rear return</u>			
Brick in chunam wells left	3	2	11
<u>Temporary wall over</u>			
<u>body wall</u>			
Brick in chunam left		4	7 1/2
<u>Rubble Masonry</u>			
<u>Body wall</u>			
Rubble in chunam for			
foundations Cys	3	8	3 15 10 1/2
do breach			3 15 10 1/2
do above foundation	3	8	4 2 2
do breach			4 2 2

28 - Cysd.

<u>1st Binding wall</u>			
Rubble in chunam for			
foundation cys	33	47	"
do breach	...	47	"
do above foundation	33	4	..
<u>2nd Binding wall</u>			
Rubble in chunam for			
foundation	33	47	1
do above do	33	311	1
do for breach	...	311	1
<u>3rd Binding wall</u>			
Rubble in chunam for			
foundation	33	311	6
do above do	33	312	9
do for breach	...	312	9
<u>Retaining wall</u>			
Rubble stone in chunam	33	567	5
do for breach	...	567	5
<u>Front wing wall</u>			
Rubble in chunam for			
foundation	33	49	6
do above do	33	43	6
<u>Abutment</u>			
Rubble in chunam for			
foundation	33	47	1
do above do	33	33	..
<u>Rear wing wall</u>			
Rubble in chunam for			
foundation	33	313	3
do above do	33	44	..
<u>Rear return</u>			
Rubble in chunam do	33	43	5
do above do	33	311	8

if rate per the


<u>Retement walls road approach</u>			
Rubble in chunam for			
foundation cys	33	32	5
do above do	33	31	6
<u>Extra binding wall</u>			
Rubble in chunam for			
foundation & superstructure	...	211	4
<u>Rubble stone work</u>			
<u>Body wall</u>			
Rubble stone for foundation			
of groynes cys	15	1	..
do do groynes			
above foundation	15	11	3
<u>1st Binding wall</u>			
Rubble	15	21	4
<u>1st & 2nd Binding wall</u>			
Rubble	15	11	2
<u>2nd & 3rd Binding wall</u>			
Rubble	15	15	5
<u>3rd Binding & Retaining wall</u>			
Rubble	15	1	8
<u>Apron beyond Retaining wall</u>			
Rubble	15	13	4
<u>do 2nd Portion</u>			
Rubble	15	11	2
<u>Retement walls road approach</u>			
Packed rubble flooring	15	13	9
do do	15	44	5
<u>Rubble</u>			

35 2

The rate in the
 column of Retement
 is per solid yard
 of rough stone
 the corresponding
 rate for stone
 measured in situ
 would be about
 one rupee

Rubble with portland cement
Body wall
Rubble with portland cement
for breach etc

719

Rubble without mortar

1st Binding wall

Rubble without mortar
for breach

14

2nd Binding wall

Rubble as above

2103

3rd Binding wall

Rubble as above

2510

Cyclopean Rubble

Apron between body and

1st binding wall

Cyclopean rubble

18

149

1st & 2nd binding wall

Cyclopean rubble

18

213

2nd & 3rd binding wall

Cyclopean rubble

18

144

3rd binding wall and

retaining wall

Cyclopean rubble

18

152

Apron beyond re-

training wall

Cyclopean rubble

18

15

Pitching adjacent to

rear return

15

Cyclopean 2nd for foundation

18

138

do above do

18

Pitching adjacent to
front wing

Cyclopean rubble for

foundation etc

18

do above do

18

Pitching of outer face

of upstream approach

Cyclopean rubble for

foundation

18

do above do

18

Pitching of outer slope

of down stream approach

Cyclopean rubble for

foundation

18

do above do

18

Laterite Masonry

Body wall

Laterite on edge in

churnam

62

768

do for breach

5

768

1st Binding wall

Laterite on edge in do

612

7810

2nd Binding wall

Laterite as above

612

622

3rd Binding wall

Laterite as above

612

665

Retaining wall

Laterite as above

612

5122

Front wing wall

Laterite in churnam

5

627

Abutment

Laterite in churnam

5

721

Revetment

In the column of
description
rates are given
and for his description
of work

Revetment walls road approach

6	Laterite flooring on edge	5	3 14 6
6	Temporary wall over body wall		
6	Laterite in chunam	3 14 8	

4. 35. 4.

Gravel backing Pitching adjacent to rear return

Gravel backing-- Pitching adjacent to front wing

Gravel backing-- Pitching outer face of stream approach

Gravel backing Pitching outer slope of down stream approach

Gravel backing--

Painting

Body wall

Painting front face and top of body wall

1st Binding wall

Binding at top of binding walls

do

do

do

do

do

do

Binding at rear wing wall	2
do rear return	2
do revetment wall	2
Road approach	2

Sinking wells

Under Body wall	sub.	10	5 4 3
do last retaining wall		10	4 7 5
do front	do - -	10	11 4 6
do Abutments	- - -	10	4 3
do rear wing wall		10	5 3 1
do rear return	- - -	10	7 9 1

The rate given for the sinking of wells of brick in chunam fills with stone and cement.

Turfing

6

work done hurriedly and in all weathers

The reasons adduced are given in para 10 of the District Engineer's letter that marked (a) really means that a great deal of work had to be done in a short time, and this reason might hold good were the ancient work compared with work more favorably circumstanced but it can hardly be of much importance when rates based upon work done at the ancient previously and under not dissimilar circumstances are in question.

Confined space & short odd turn of work by labour.

The reasons (b) & (c) are cause and effect; they apply equally to the rates of former work at the ancient, on which the rates of the extension estimate were presumably based.

Inefficiency of rate for concrete

(d) here again the cost of some of this description of work indicates that the estimate rates might have sufficed.

labour unproductive from floods & sickness

(e) frequent freshets which would necessarily keep much of the labor either unemployed

or makes it impracticable to employ such labor in the best way is a legitimate reason for excess expenditure. The diagram of the river for 1858 is not in this office, and in that year there was much work done - In 1859-60 when the Anicut was restored on Sir Arthur Cotton's section there were high freshes in July and August, a considerable rise in the river in September and a heavy fresh in November. In 1870 up to the middle of May the state of the river was favorable. In June & July, at the end of August, and of September and in the last week of October the river rose considerably above the crest of the Anicut, but on the whole there do not appear to have been unusual difficulties from freshes.

Sickness would have the effect of delaying work, and might also by interfering with its regular progress tend to enhance the rates somewhat, though not very materially. It was responsible directly for one item of the expenditure, viz the cost Rs 3224-5-14 of feeding coolies, a measure which had good results & was approved at the time. Part of the cost of Rs 2941.14.3 on landries was also due to this cause, various sanitary measures having been rendered

DE's letter para 22

24 item 16

ious work
letter para 21
1876

rendered necessary, vide Executive Officer's Memo on item 101 of Comparative Statement. Rs 4000 perhaps may be taken as the extra cost due to the outbreak of cholera in July 1875.
The items amount to Rupees 11401.5-7
Rs 2135.2.4
The District Engineer supposes her to have been an omission by mistake from the original estimate, but it is in fact at least a deviation from the intended arrangements and it is hoped some of these items may still be saved. Instructions have been sent to the District Engineer
Rs 4408.12.6
Closing breach -
No single item of this amount appears in the comparative statement, but the charges appear to be made up of a number of small items shown as appertaining to the breach, which was caused by a fresh during the progress of the work. The particulars are given in enclosure No 7 of the District Engineer's letter.
Rs 2326
300 Rubble Dam -
Explanation will be found in paras 24 & 25 of the District Engineer's letter. The dam was constructed long before the sanctioned estimate was submitted, & whatever expenditure on its account had to be adjusted should have been provided for
Herein

therein. The dam was in the nature of a wing
band connecting the north bank of the river
with the uninjured part of the bank.

4th Temporary wall on body or crest wall. Rs 2125.15.4

This wall was to prevent water passing
over the extended crest until the masonry had
set and hardened sufficiently.

District para 26.

5th Extra binding wall. Rs 256.3.5

This is a petty work and is noticed in para 27
of the District Engineer's letter.

7. The value of Tools and Plant Tools & Plant
after completion of the work is estimated by
the District Engineer at Rs 7000, and he
suggests their transfer to Chok. Such as
are not likely to be required in the
District should be disposed of if practicable.

3. The Executive Officer, Lieutenant
Henderson, worked throughout with great
zeal and devotion, and the successful
progress of the work without serious accident.
from the frontier of 1875 was mainly due
to his exertions. It is considered that very
little responsibility can attach to him, for
the same reason, seeing that his experience
in such operations was necessarily limited,
and he worked under the immediate
orders and control of the late District
Engineer who died in January last.

District para 35. 9.

do para 32.

It will be seen that at the beginning
of September work estimated to cost Rupees 18,500
remained to be done to complete the Extension
and if this sum Rupees 6000 were needed to place
the work in a safe state and to meet due bills.
Enclosure No 8 of the District Engineer's letter
gives the particulars of the former, amounting
to Rupees 3000.

The undersigned is unable to make any
suggestion as to how the Rupees 6000 required, can
be provided, no money for re-appropriation
from Major works under Ordinary being
available. If possible the whole sum required
to complete should be allotted, for the post-
ponement of the completion will probably
involve extra outlay in the end.

Fort St George
24th Nov 1876

Voluntarily Lt Colonel R. L.
Chief Engineer for Irrigation

To

The Secretary to Government
Public Works Department

S. A.

W. C.

4022-2-58 No 305 with two
orig. papers & one
pamphlet }

- 14-6-58 ho 1858.
- 28-4-59 - 982
- 19-8-59 - 1938 orig.
- 15-9-59 - 2752 with 1 letter
- 24-2-71 - 5744 with 3 letters
- 23-1-75 - 198.
- 26-2-75 - 565
- 1-5-75 - 1227.
- 19-5-75 - 1738
- 1-7-75 - 1837 & 1838
- 5-7-75 - 1903.
- 26-7-75 - 2109
- 18-8-75 - 2380.
- 27-12-75 - 3628.
- 5-1-76 - 33.
- 18-3-76 - 7104 & 711
- 27-3-76 - 772
- 8-5-76 - 1134 & 1139.
- 25-7-76 - 1888.
- 1-8-76 - 1946.
- 21-8-76 - 2194.
- left of Rates.
- Err. memo. to 26 A & 2830-9-76 orig.
- Err. R 52 G. S. orig.

P.W.D. 6.
200076
From No. 8717
The Chief Engineer for Irrigation.

Dated 24th November 1976
Recd. 2nd Decr 1976.

Encls. 11 x
No. 268-W.
+ ret'd to Chief Engr.
for Insp.

Pennair Ancient Extension -
Kallare District - Note submitting
for sanction, Revised Estimate
for Rs. 207,245 for the completion
of the —, with remarks.

No 417

Cr: 6-12-76

No 3456 of 16 Dec 76
The Secretary to the
Govt. of India P.W.D.

Sir
I am directed to transmit
for the consideration of the Govt.
of India a copy of the Proceedings
of this Government as per
margin and to request the
sanction of the Govt of India
to the revised estimate as below
mentioned for the Pennair
Ancient extension, and their
confirmation of the transfers
made from Ordinary Agri-
cultural, Original works to
Capital Ordinary to allow
of the completion of the
work.

works —————	Rs. 147,500
Tools & Plant ———	15,500
Establishment: ———	44,245
Total Rupees	207,245

by 29/11

SPD

217 

Gobt. of 1876 Madras.
PUBLIC WORKS.

To *Mr. W. B. Hallowell*

Dated

Issued

Recd.

Encl.

G. O. 16th Dec. 1876, No. 3455-
3455

No. 41/15

Domestic Architectural
Illustrations

Building records on papers
on the subject of the Special
Cost for the —

Requesting sanction for
revised estimate for the
Domestic Architectural Illustrations
and also the transfer of
funds for the construction of the
same.

W. B. Hallowell