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# MADRAS RECORD OFFICE

Government of Madras

*Public Works* DEPARTMENT

|          |         |       |
|----------|---------|-------|
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Read the following papers:—

No. 292-A.

No. 121. *Note by the Chief Engineer for Irrigation.*

STREEVICOONTUM ANICUT PROJECT.—With a letter No. 24, of the 20th January 1873, the District Engineer submitted revised estimates, amounting to Rupees 9,57,200, in supersession of the estimates which were in G. O., No. 1,520, of the 21st June 1872, approved in place of those originally sanctioned. The amount of these latter, and of what may be termed the first revision, was identical, though as shown in the Government Order just quoted the alterations in the works were by no means inconsiderable.

2. Very shortly afterwards supplemental estimates, amounting to Rupees 74,070, were submitted for certain G. O., 10th August 1872, No. 1,896. works reported to be necessary, and Rupees 43,700 in addition were reported to be required for office and work establishments, making altogether an addition of Rupees 1,17,770 to the then sanctioned amount. Upon this revised estimates for the whole project were ordered to be prepared, and those sent up in January 1873 were the result of this order.

3. On some points, such as the proposed raising of the anicut, the amount of storage available, etc., the information was insufficient to allow of the modified arrangements being submitted to Government, and accordingly the District Engineer's attention was requested to the subject of the water-supply, etc., and a further report was called for. As a result the estimates have been modified, and, as submitted with the District Engineer's No. 143, of the 13th December 1873, their amount is Rupees 9,71,470.

4. Mr. Rundall explains the amount of the present estimates to be made up as follows:—

|                            | RS.            |
|----------------------------|----------------|
| Original Works ... ..      | 8,11,680       |
| Extra Works ... ..         | 1,17,790       |
| Petty Establishment ... .. | 42,000         |
|                            | <hr/> 9,71,470 |

But to this must be added the cost of the engineering establishment\* employed up to November

\* *Vide Statement.* 1872 on this project ... .. 59,150

Making the total... 

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10,30,620

5. The variations from the original arrangements of the works up to 1872 are explained in detail in the papers printed in Proceedings, Madras Government, of the 21st June 1872, No. 1,520. The District Engineer has not forwarded a comparative statement for the last revision, but he shows that the comparative

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statement, dated 15th January 1873, gives the cost of works included in the first revision as...

To which have to be added certain works mentioned in paragraph 35 of his letter, No. 143, of the 13th December 1873...

Making up the total, of "Original Works" above given, of ...

It is to be noticed also that Mr. Rundall does not appear to have anywhere taken account of the charge to be made to the project for capitalization of the abatement of assessment of lands taken up for the works, though a statement showing the particulars, as also the land compensation, was forwarded with the late Superintending Engineer's letter, No. 3,250, of the 16th October 1872. From this it will be seen that the land compensation is estimated to amount to ...

\* Corrected from 16,181 to ...

† District Engineer's No. 24, paragraph 33. It is however stated† that the whole of the provision for land compensation will be required, viz, ...

so that the total of the direct charge on account of the project will amount to Rupees 10,30,620 + 20,000 = 10,50,620.

6. In paragraph 24 of the memorandum on the estimates, printed in Proceedings, Madras Government, of the 26th October 1868, No. 3,365, it was stated that to these estimates, amounting to Rupees 8,31,600, probably not less than 10 per cent. would have to be added on account of extra establishments, and 30,000 Rupees for drainage channels, and that they would amount then to about 9,77,696 Rupees. The present estimates therefore are Rupees 73,000 in round numbers in excess of what the project was originally expected to cost. In paragraph 3 of the District Engineer's No. 24 of the 20th January 1873, it is remarked that the damage caused by the flood of November 1869. How this was distributed is not shown in the comparative statement or referred to in the remarks, but the facts

No. 1,424, dated 8th June 1870.

Rupees 5,000, Item No. 60, are also shown in the comparative statement as

G. O., No. , dated

charry; capitalized assessment, Rupees 20,000, also was not in 1868 commonly included in estimates; of the increase nearly 62,000 Rupees therefore are due to

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causes which could not have been provided for. The present estimates also contain a large item, Rupees 82,800, No. 3 in the list of extra works, for the revetment of the north tanks, a safe-guard which was not supposed to be necessary when the estimates of 1868 were prepared. A comparison between the works provided for in the estimates of 1868 and those either carried out or now proposed is not easy. A great many changes have been introduced, and of these a large number received the approval of Government in the Order No. 1,520, of the 21st June 1872, on the first revision of the estimates. The remarks now to be offered will be confined to the extra works, or those which have not already been fully considered and disposed of in previous papers.

7. Item No. 1, Rupees 4,400.—*Raising the Anicut.*—It is proposed to raise the anicut 18 inches in order to admit of a full supply being passed into the main channels on the two sides of the river when the water is flush with the crest. This alteration was advocated in the District Engineer's letter of the 20th January 1873, No. 24, paragraph 39, but the information therein given, and in Lieutenant

\* No. 22, 15th January 1873, paragraphs 4 and 5.

Shepherd's report,\* did not appear to be conclusive, and as in several respects the latter officer's deductions seemed to be incorrect, further details were called† for and paragraphs 4 to 13 of the

† Memorandum, No. 188, 25th March 1873.

District Engineer's letter, No. 143, of the 13th December 1873, deal with this question. It is stated that the calculations of water-supply available, which were made by Colonel Horsely, probably some time before the year 1855, have to a considerable extent been vitiated by the improvements subsequently carried out in the irrigation under the upper anicuts across the river, and that the extent of these improvements may be in some degree estimated by the increase of revenue amounting, it is said, to three lakhs of rupees, therefrom resulting; that as a consequence the minimum discharge of the river at the Streevigoontum anicut, which is the lowest of seven, has been reduced from 198 to 90 cubic feet per second. The information given is not as conclusive as might have been desired, owing in part to Lieutenant Shepherd's calculations having been made on data which were, from the varying state of the anicut then under construction, known only to him, and put into a shape which did not admit of the results being converted into actual quantities of water available on the average of the years over which observations extended. The data possessed by this office do not admit of the deficiencies in the information supplied by the local officers being made good, but it may be noticed that Mr. Rundall states that with the anicut at the sanctioned height of 6 feet, a full

No. 143, paragraph 12.

supply will not enter the channels until 1-20 millions of cubic yards an hour are passing

over the weir to waste, and no doubt if any of that water were really required for irrigation the loss would be undesirable. As far, however, as can be judged from the data available, it is by no means certain or even probable that the height of the anicut as sanctioned will be found insufficient. What has been termed by the District Engineer a full supply in the channels is really the maximum supply they are to carry, and it was not contemplated that this would be conveyed for more than a short time. This is indeed evident from the circumstance that this

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maximum supply is at the rate of 6.35 cubic yards per acre per hour for the north channel, and 5.66 cubic yards an acre for the south channel. It appears to me that the estimate of water-supply required is somewhat excessive. Lieutenant Shepherd allows—

for the Kar crop  $2\frac{1}{4}$  cubic yards per acre per hour for 90 days.  
for the Peshanum do. do. do. for 150 days.

This not only provides for a full supply of water during a longer period than such is usually needed, for even were the crops on the ground so long a full supply is not required for the whole time, but no account whatever is taken of the rainfall which will be stored in the tanks. And, moreover, it is by him supposed that the whole area will be double cropped, and this can hardly be anticipated as probable, though in Tinnevely it would appear that lands are re-cropped to a greater extent than elsewhere.

The allowance for the—

Kar crop may be taken at 2 cubic yards for 80 days.

Peshanum do. do. do. for 105 do.

over the whole area. The quantity of water required will then be—

North Channel 20,600 acres— $20,000 \times 185 \times 24 \times 2 = 177.60$  millions of cubic yards.

South Channel 13,500 acres— $13,500 \times 185 \times 24 \times 2 = 119.88^*$  do. do.

Total... 297.48

With the water flush with the crest of the anicut with a height of 6 feet, it has been ascertained that the depth in the north channel will be a little under .5 feet, and that the discharge may be taken at 690 cubic feet a second.

Similarly the depth in the south channel will be just under 4 feet, and the discharge about 462 cubic feet a second.

In paragraph 5 of Lieutenant Shepherd's report it is shown that a

\* i.e., Water for a maximum supply—  
North Channel ... .. C. FT. 953  
South do. ... .. 573

full\* supply may probably be depended upon for  $24\frac{1}{2} + 39\frac{1}{2} = 64$  days in the season. Consequently the supply the channels will carry with the water flush with the crest of the weir will be available for at least that time, and  $64 \times 24 \times 153,600 = 235.929$  millions cubic yards.

$690 + 462 = 1152$  cubic feet.  
384

153600 cubic yards.

It is further assumed by that officer that for the rest of the season an average of 26,000 cubic yards an hour will be available, and his season being 240 days, against the 185 here supposed to be necessary, the supply may be the more safely be supposed to be reliable for the shorter period, and the quantity will

be  $121 \times 24 \times 26,000 = 75.504$  do. do.

Total... 311.433 do. do.

As this calculation shows an excess of 14 millions of cubic yards, and as the additional supply derivable when the river may be above the crest of the anicut has

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been left out of the account altogether, I think it may at least be assumed that it is worthwhile to ascertain practically whether a 6-feet anicut will or will not suffice. It will cost a little, but only a little, more to take off and reset the coping should raising be ultimately deemed necessary, than it would to raise the crest at once. It may be that the character or duration of the freshes may be so far unsuitable as to make it insufficient that an ample quantity should be conveyed during the season, and this can be determined only by actual experience, or by a calculation of the

\* No. 188, 25th March 1873.

kind referred to in the memorandum\* on this subject. The District Engineer

has accordingly been informed that for the present it has been recommended that the anicut should remain at the sanctioned height of 6 feet, at which it should be completed.

8. Item 2.—Platform Bridge for working the under-slucice shutters, Rs. 3,550.—

It is more than doubtful whether the proposed arrangement would answer its purpose. I do not think baulk or needle shutters could be worked from a platform. This item will therefore be omitted.

9. Item 3.—Revetments to Northern Tanks, Rupees 82,800.—In connection with this part of the estimates it will be advisable to consider what amount of storage capacity has been provided to supply the irrigation between the freshes in the Tambrapoorney. Originally it was proposed that the tanks on the north side should hold 15 millions of cubic yards, or 750 cubic yards per acre; and on the south side 20 millions, or nearly 1,500 cubic yards per acre. Then Lieutenant Shepherd, on a consideration of the circumstances of the water-supply, suggested alterations of the northern tanks to raise their capacity to 42 millions of cubic yards, and similarly the capacity of the southern tanks, was to have been raised

No. 1,520, 21st June 1872.

from 20 to 28 millions; these modifications were approved in the Government

Order as per margin on the first revision of the estimates, and, so far as the work then provided for was concerned, carried out.

Note, paragraphs 4 and 7.

It was noticed, however, by the Acting

Chief Engineer for Irrigation that the estimated cost of these tanks was likely to be exceeded: first, because the height of the banks left a margin of 3 feet only above the highest water mark; and, secondly, because a stone revetment would probably be found necessary for the large tank of Chinnasawmy Naicken or Korumpullum. For reasons connected with the discharge of surplus at the Upar Oday dam, the full level of this tank has been reduced from 20.90 to 19.40; and, with the exception of the Korkei and Arumugamungalum tanks on the north, and the Kadamba tank on the south, these reservoirs have been contoured and their contents ascertained. The District Engineer has not stated what storage has been lost by the reduction of the level of the Chinnasawmy Naicken tank, but as the area of the tank as shown on the map is about  $2\frac{1}{2}$  square miles, the reduction is probably not in excess of 4 or  $4\frac{1}{2}$  millions of cubic yards, and Lieutenant Shepherd's estimate of capacity must have been much too high.

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The following is the acreage under each tank, etc.—

| Names of Tanks.            | Acres of<br>irriga-<br>tion. | LIEUTENANT SHEP-<br>HERD'S ESTIMATE<br>OF CAPACITY. |           | REVISED CAPACITY.      |           | Remarks.            |              |
|----------------------------|------------------------------|-----------------------------------------------------|-----------|------------------------|-----------|---------------------|--------------|
|                            |                              | Total.                                              | Per Acre. | Total.                 | Per Acre. |                     |              |
|                            |                              | Millions of<br>C. yds.                              | C. yds.   | Millions of<br>C. yds. | C. yds.   |                     |              |
| <i>North Side.</i>         |                              |                                                     |           |                        |           |                     |              |
| Paykolum ... ..            | 3,150                        | 3·500                                               | 1,111     | 3·604                  | 1,144     | Approximate.<br>do. |              |
| Marathony ... ..           | 1,000                        | 0·500                                               | 500       | 0·583                  | 583       |                     |              |
| Pottakolum ... ..          | 2,000                        | 3·500                                               | 1,750     | 2·316                  | 1,158     |                     |              |
| Chinnasawmy Naicken ... .. | 8,100                        | 30·000                                              | 3,703     | 15·194                 | 1,876     |                     |              |
| Arumugamungalum ... ..     | 2,000                        | 4·500                                               | 2,250     | 4·500                  | 2,250     |                     |              |
| Palayacoyal ... ..         | } 3,750                      | Put down<br>as under<br>channel.                    | } 3,750   | { 0·865                | } 497     |                     |              |
| Korkei ... ..              |                              |                                                     |           | { 1·000                |           |                     |              |
| <i>South Side.</i>         |                              | 20,000                                              | 42·000    | 2,100                  | 28·062    | 1,403               | Approximate. |
| Auvudiar ... ..            | 200                          | 1·500                                               | 7,500     | 0·996                  | 4,980     |                     |              |
| Autur ... ..               | 2,000                        | 1·000                                               | 500       | 2·094                  | 1,047     |                     |              |
| Seenimavady ... ..         | 250                          | 0·500                                               | 2,000     | 0·699                  | 2,800     |                     |              |
| Ammenpuram ... ..          | } 3,750                      | 3·000                                               | 800       | { 2·892                | } 1,176   |                     |              |
| Kanam ... ..               |                              |                                                     |           | { 0·819                |           |                     |              |
| Nullur ... ..              | } 2,200                      | 3·000                                               | 1,364     | { 0·398                | } 318     |                     |              |
| Keeranullur ... ..         |                              |                                                     |           | { 0·301                |           |                     |              |
| Tuluken ... ..             | 800                          | 0·750                                               | 937       | 0·757                  | 946       |                     |              |
| Kadamba ... ..             | 3,550                        | 16·000                                              | 4,507     | 15·000                 | 4,225     |                     |              |
| Ellapanaicken ... ..       | 750                          | 2·250                                               | 3,000     | 1·662                  | 2,216     |                     |              |
|                            | 13,500                       | 28·000                                              | 2,074     | 25·618                 | 1,398     |                     |              |

It would have been well had the differences which these statements exhibit been noticed by the District Engineer, but it may be remarked that on the north side the Paykolum and Marathony tanks are virtually one, and that they will get their supply maintained whenever there is water in the river as the main channel runs into them. Also the Palayacoyal and Korkei tanks are commanded by larger reservoirs, so that their duty will be almost nominal. It may be further observed that had the Chinnasawmy Naicken tank been actually made of the capacity calculated by Lieutenant Shepherd, it would have held much more water than is needed. On the south side all the tanks whose storage capacity is small are commanded by the Kadamba tank, and there should consequently be no difficulty in making the excessive contents of that work make up for deficiencies elsewhere. Indeed, it seems probable that ultimately some of the smaller tanks will be found unnecessary, and, if so, their beds may be cultivated. On the whole, then, I think that the arrangements will answer sufficiently well, but they cannot be demonstrated to be altogether suitable in the absence of such a calculation as was called for in paragraph 3 of this Office Memorandum, No. 188 of the 25th March 1873, and for this data are not available. Returning now to the question of the revetments there is, I think, no room for doubt that this protection is needed to a part of the bunds of the Pottakolum, and to a greater length of the Chinnasawmy Naicken tank, but I am disposed to consider that a reduction may be made if those portions of the bund which are not exposed to the prevailing winds are covered with nanul grass. While, therefore, recommending that the estimate be

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allowed to stand at the amount above named, the District Engineer should give this subject his further careful consideration, with a view to the omission of the revetment wherever it can safely be superseded by the cheaper material. The revised sections of the bund are suitable, and it will be seen that, with the

reduced water level in the larger tank, it has been deemed necessary to raise the bund 1 foot, so as to leave a margin of 3½ feet above the calculated maximum water level.

10. *Upar Oday Dam.*—This surplus work has not been included in the list of extra works, but the difference, Rupees 6,400, between it and the former estimate has been included in what the District Engineer terms original works.

The revised plan is a return to the general arrangement of the original design. This latter consisted of a body wall 4½ feet high with a flush, or unobstructed, crest and a number of sluice vents 4 feet wide, the estimated cost was Rupees 36,640. Then it was proposed to raise by calingulah posts the level at which water was to be retained to 3 feet above the crest, and the revised estimate amounted to Rupees 35,500. The removal of the shutters in time on the occurrence of freshes appearing doubtful, Mr. Rundall wished to substitute shutters worked from a bridgeway, and the estimate for this arrangement amounted to Rupees 32,700 + 17,450 or together Rupees 50,150. Either of these revisions would have necessitated the maintenance of a considerable establishment, and as, in a case of this kind where a large drainage, 120 square miles, has to be dealt with, it is much the better plan to have a self-acting escape, it was intimated to the District Engineer that this kind of work was considered preferable, and the result is the present design which, except in some minor details, differs from the original only in the height of the crest, which is 6 feet instead of 4½ feet above the first apron, the level of which latter has not been altered. The maximum flood discharge from

the drainage basin may be taken at D = 562·5 M<sup>3</sup>. 13,685 cubic feet a second, and, leaving out of account the sluice vents which might not be opened when most required, the depth passing over the crest 600 feet in length will be 43 inches, the top of the bund being 5½ feet above the crest. The margin is enough but none too much, and it is evident that had it been necessary to retain water at 1½ feet higher level, a considerable additional outlay on the tank would have been necessary. With the 24 sluice vents open 2½ feet on the crest will be the maximum W.L. The only

modifications considered desirable are the raising\* of the wings to the level of the top of the bund as sketched on the plan, and the keeping of tops of the sluice shutters flush with the crest of the dam.

11. Items 4 and 5 are—  
Pitching to North Channel ... .. Rs. 4,440  
Do. to South do. ... .. " 1,100  
The heads of both the main channels are in very sandy soil, and at the north channel the District Engineer has proposed to carry the pitching for a length of 1,000 feet. Major Oakes wished to alter this to 300 feet, but it has been

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| Items. | Description.                             | Amount.   | Items.    | N.B.—The items in this list are taken from the Comparative Statement, dated 15th January 1873, the District Engineer's letter, No. 143, 13th December 1873, paragraph 35, and the list of extra works there-with forwarded. |
|--------|------------------------------------------|-----------|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7.     | Kadamba head sluice ...                  | RS. 3,115 | RS. 3,115 |                                                                                                                                                                                                                             |
| 8.     | Autur head sluice ...                    | 1,695     |           |                                                                                                                                                                                                                             |
|        | Screw gearing for do. ...                | 250       |           |                                                                                                                                                                                                                             |
|        | Autur channel ...                        | 16,870    |           |                                                                                                                                                                                                                             |
|        | Drop in do. ...                          | 1,084     |           |                                                                                                                                                                                                                             |
|        | Do. in do. ...                           | 940       |           |                                                                                                                                                                                                                             |
| 9.     | Trichendoor road tunnel ...              | 1,140     | 20,840    |                                                                                                                                                                                                                             |
| 10.    | Yeral road tunnel ...                    | 1,140     | 1,140     |                                                                                                                                                                                                                             |
| 11.    | Aqueduct across old Autur channel ...    | 1,140     | 1,140     |                                                                                                                                                                                                                             |
| 12.    | Sathuvoycal calingulah ...               | 3,690     | 3,690     |                                                                                                                                                                                                                             |
|        | Rough stone pitching ...                 | 1,559     |           |                                                                                                                                                                                                                             |
|        |                                          | 1,210     |           |                                                                                                                                                                                                                             |
| 13.    | Poriur head sluice ...                   | 3,070     | 2,769     |                                                                                                                                                                                                                             |
|        | Screw gearing for do. ...                | 720       |           |                                                                                                                                                                                                                             |
| 14.    | Poriur channel ...                       | 7,277     | 3,790     |                                                                                                                                                                                                                             |
|        | Do. do. bridge ...                       | 3,260     |           |                                                                                                                                                                                                                             |
|        | Dam in channel ...                       | 540       |           |                                                                                                                                                                                                                             |
| 15.    | Improving Ammenpuram and Kanam tanks ... | 800       | 11,077    |                                                                                                                                                                                                                             |
|        | Ammenpuram channel ...                   | 937       |           |                                                                                                                                                                                                                             |
|        | Kanam do. ...                            | 3,162     |           |                                                                                                                                                                                                                             |
| 16.    | Tuluken channel head sluice and drop ... | 906       | 4,959     |                                                                                                                                                                                                                             |
|        | Tuluken channel ...                      | 2,560     |           |                                                                                                                                                                                                                             |
|        | Do. do. drop ...                         | 555       |           |                                                                                                                                                                                                                             |
|        | Do. tank ...                             | 2,590     |           |                                                                                                                                                                                                                             |
|        | Do. do. calingulah ...                   | 920       |           |                                                                                                                                                                                                                             |
| 17.    | Kanam channel ...                        | 35,450    | 7,531     |                                                                                                                                                                                                                             |
|        | Do. drop ...                             | 1,350     |           |                                                                                                                                                                                                                             |
| 18.    | Ellapanaicken tank ...                   | 8,411     | 36,800    |                                                                                                                                                                                                                             |
|        | Do. calingulah ...                       | 1,745     |           |                                                                                                                                                                                                                             |
| 19.    | Auvudiar tank ...                        | 6,903     | 10,156    |                                                                                                                                                                                                                             |
|        | Do. do. calingulah ...                   | 1,846     |           |                                                                                                                                                                                                                             |
| 20.    | Ammenpuram syphon sluice ...             | 964       | 8,749     |                                                                                                                                                                                                                             |
| 21.    | Palipat do. ...                          | 746       | 964       |                                                                                                                                                                                                                             |
| 22.    | Alwar Tinnevely bridge ...               | 3,200     | 746       |                                                                                                                                                                                                                             |
| 23.    | North channel head sluice ...            | 17,930    | 3,200     |                                                                                                                                                                                                                             |
|        | Screw gearing do. ...                    | 1,486     |           |                                                                                                                                                                                                                             |
| 24.    | North channel ...                        | 95,791    | 19,416    |                                                                                                                                                                                                                             |
|        | Stone pitching do. ...                   | 2,660     |           |                                                                                                                                                                                                                             |
|        | Dam in do. ...                           | 871       |           |                                                                                                                                                                                                                             |
| 25.    | Kulapadagai head sluice ...              | 1,921     | 99,322    |                                                                                                                                                                                                                             |
|        | Screw gearing for do. ...                | 250       |           |                                                                                                                                                                                                                             |
|        |                                          |           | 2,171     |                                                                                                                                                                                                                             |

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| Items. | Description.                                            | Amount.        | Items.    | N.B.—The items in this list are taken from the Comparative Statement, dated 15th January 1873, the District Engineer's letter, No. 143, 13th December 1873, paragraph 35, and the list of extra works there-with forwarded. |
|--------|---------------------------------------------------------|----------------|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 26.    | Savaramungalum bridge ...                               | RS. 4,257      | RS. 4,257 |                                                                                                                                                                                                                             |
| 27.    | Mungalakurichy bridge ...                               | 4,915          | 4,915     |                                                                                                                                                                                                                             |
| 28.    | Korkei head sluice ...                                  | 1,290          |           |                                                                                                                                                                                                                             |
|        | Screw gearing do. ...                                   | 250            | 1,540     |                                                                                                                                                                                                                             |
| 29.    | Yeral under tunnel 8,500 + 340. Do outfall channel ...  | 8,840<br>3,800 | 12,640    |                                                                                                                                                                                                                             |
| 30.    | Yeral bridge and calingulah ...                         | 4,692          | 4,692     |                                                                                                                                                                                                                             |
| 31.    | Causeway ...                                            | 3,780          | 3,780     |                                                                                                                                                                                                                             |
| 32.    | Siruthundu bridge ...                                   | 3,550          | 3,550     |                                                                                                                                                                                                                             |
| 33.    | Double dam ...                                          | 7,160          | 7,160     |                                                                                                                                                                                                                             |
| 34.    | Palayacoyal road bridge ...                             | 3,503          | 3,503     |                                                                                                                                                                                                                             |
| 35.    | Marathony tank ...                                      | 478            |           |                                                                                                                                                                                                                             |
|        | Do. calingulah ...                                      | 2,885          | 3,363     |                                                                                                                                                                                                                             |
| 36.    | Pottakolum tank ...                                     | 11,998         |           |                                                                                                                                                                                                                             |
|        | Do. calingulah ...                                      | 5,934          |           |                                                                                                                                                                                                                             |
|        | Do. revetment, etc. ...                                 | 12,800         | 30,732    | Revetment taken out of estimate for northern tanks.                                                                                                                                                                         |
| 37.    | Chinnasawmy Naicken tank ...                            | 33,614         |           |                                                                                                                                                                                                                             |
|        | Do. escape weir called Upur Oday dam 32,700 + 6,400 ... | 39,100         |           |                                                                                                                                                                                                                             |
|        | Revetment, etc., to tank ...                            | 70,000         | 1,42,744  | Do. do. do.                                                                                                                                                                                                                 |
| 38.    | Upur Oday embankment ...                                | 26,830         | 26,830    |                                                                                                                                                                                                                             |
| 39.    | Tuticorin channel ...                                   | 14,112         | 14,112    |                                                                                                                                                                                                                             |
| 40.    | Distribution sluices ...                                | 18,600         |           |                                                                                                                                                                                                                             |
|        | Do. channels ...                                        | 29,000         | 47,600    |                                                                                                                                                                                                                             |
| 41.    | Bridge on cotton road ...                               | 2,500          | 2,500     |                                                                                                                                                                                                                             |
| 42.    | Perungolum surplus channel embankment ...               | 3,500          | 3,500     |                                                                                                                                                                                                                             |
| 43.    | Dam near Kulpadagai head sluice ...                     | 240            | 240       |                                                                                                                                                                                                                             |
| 44.    | Padugudy bungalow ...                                   | 3,888          | 3,888     |                                                                                                                                                                                                                             |
| 45.    | Land compensation ...                                   | 40,000         | 40,000    |                                                                                                                                                                                                                             |
| 46.    | Capitalized assessment on land taken up ...             | 20,000         | 20,000    |                                                                                                                                                                                                                             |
| 47.    | Damage to materials ...                                 | 5,000          | 5,000     |                                                                                                                                                                                                                             |
| 48.    | Inlets ...                                              | 1,440          | 1,440     |                                                                                                                                                                                                                             |
| 49.    | Sundries, including tools and plant—                    |                |           |                                                                                                                                                                                                                             |
|        | Contractor ... 31,621                                   |                |           |                                                                                                                                                                                                                             |
|        | Departmentally ... * 8,156                              |                |           |                                                                                                                                                                                                                             |
|        |                                                         | 39,777         | 39,777    | * Rupees 40,937, Item No. 61 of comparative statement, 15th January 1873, less contractor 31,621.                                                                                                                           |
| 50.    | Temporary sheds 3,700 + 1,159                           | 4,859          | 4,859     | Vide statement of details.                                                                                                                                                                                                  |
| 51.    | Petty establishment ...                                 | 42,000         |           | Store shed 52                                                                                                                                                                                                               |
|        | Engineering do. ...                                     | 59,150         | 1,01,150  | Overseer's Bungalow... 1,107                                                                                                                                                                                                |
|        |                                                         |                | 10,40,480 | Uneven item 1                                                                                                                                                                                                               |

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The difference between the total and that mentioned in paragraph 5 above is thus explained:—

|                                                                                                           |           |  |
|-----------------------------------------------------------------------------------------------------------|-----------|--|
| Total in paragraph 5...                                                                                   | Rs.       |  |
| Deduct error in the excess amount required for Yeral syphon sluice, this excess being 8,840 — 8,500 = ... | 340       |  |
| and not 8,840 — 8,090 ...                                                                                 | 750       |  |
| Item for raising anicut ...                                                                               | 410       |  |
| Under sluice platform bridge ...                                                                          | 4,400     |  |
| Reduction of stone pitching, north channel ...                                                            | 3,550     |  |
|                                                                                                           | 1,780     |  |
|                                                                                                           | 10,140    |  |
| Revised Total ...                                                                                         | 10,40,480 |  |

The District Engineer should now prepare an abstract exhibiting the works in their proper order thus:—

- (1.)—The anicut and all its works.
- (2.)—The south channel and all its works. Each branch of the south channel with all the works, tanks, etc, thereto appertaining in their regular order.
- (3.)—The north channel and all its works. Each branch of the north channel and all the works, tanks, etc., belonging to it and them, in their regular order.

and then a classified abstract dividing the works into the heads required to be shown in the Budget and accounts.

Much more time than should have been necessary has had to be devoted to the examination of these estimates, owing to the absence of any abstract estimate, to connected works not being placed together, and to unconnected works being amalgamated. Thus the item, rough stone 3,000 Rupees, is stated to belong principally to the anicut, and to a small extent to the escape (Upar Oday dam) of a tank a great many miles off; and again the revetments of two tanks are put into one estimate without the cost of each being shown separately, although other items for each have to be added to the shares in the revetment estimate. The Account Department cannot possibly deal with items thus jumbled up together.

21. With regard to the returns to be expected from this project, the latest information available is contained in the Collector's report to the Board of Revenue, dated 31st May 1872, No. 224, in which the additional revenue is estimated at 1,60,000 Rupees, or over 15 per cent. Government have called for detailed Revenue Statements in the form in which those for the Godavery Delta have been prepared, and when these are received and the standard revenue, with which that obtained after the construction of the anicut or opening of the main channels for irrigation, is to be compared shall have been determined, a more definite idea of the effect of the works will be obtainable.

22. With these remarks this latest revision of the estimates is submitted for sanction.

OOTACAMUND,  
25th April 1874.

(Signed) J. MULLINS, Lieut.-Colonel, R.E.,  
Chief Engineer for Irrigation.

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No. 121A. From J. W. RUNDALL, Esq., District Engineer, Tinnevely, to Lieutenant-Colonel J. MULLINS, R.E., Chief Engineer for Irrigation, dated Palamcottah, 13th December 1873, No. 143.

I HAVE the honour, with reference to your memorandum No. 188 of the 25th

Two Lists, one of plans and estimates of first revision and one of other documents, all sent by banghy.

March last, to re-transmit the papers connected with the Streevigooontum Anicut Project revised estimate, and to supply such additional information

as it is possible for me to afford with reference to your remarks in the memorandum under reply.

2. I send also all the plans and sections connected with the first revision forwarded to Major Oakes by the Superintending Engineer, late 8th Division.

3. The sections have been re-drawn and reduced to the mean sea level. The masonry works and other details have been shown as constructed, and I trust you will now find them sufficiently clear.

4. The first point to be noticed is the question of the supply of water reaching the anicut.

5. Lieutenant Shepherd's observations were based on a register of the height of water in the river, and he, knowing the height of anicut from time to time, deduced the information recorded in the tables already sent to you. I have no means of reducing his figures to cubic yards per hour, for with anicut incomplete, and with under sluices sometimes open, sometimes partly closed with turf, etc., Lieutenant Shepherd's calculations are necessarily only approximations.

6. I think there is one fallacy in them, viz., that he has assumed that whenever there is a discharge of 210,000 cubic yards per hour, it will all go down the channels, whereas with an anicut 6 feet high, and the head sluices as constructed, not more than 158,000 cubic yards per hour can enter the channels when the water is level with the crest.

7. From June of this year we have kept registers of the water in the river at anicut, of the height on rear floor of each head sluice, and of the number of vents of the anicut under sluices open, and have calculated out as nearly as possible the quantity of water reaching the anicut.

8. I forward diagrams showing the result up to the full discharge of the channels, beyond this it is not necessary to go; the diagrams of height of water in river sent to you every month will give you any other information you may need.

9. I should, however, state that the south-west monsoon supply in June and July of this year has been far above the average. The opinion of the ryots was that they had not had such a season for twenty years.

10. In this year, therefore, there were forty days between 1st June and 31st October where the river supply was equal to or above the full supply of the two channels.

11. If the anicut is only 6 feet high, we should lose during every one of these forty days up to 52,000 cubic yards per hour. Of course we might not want it if the tanks were already full, but I think it is highly necessary to have the power of passing into the channels the maximum they will carry whenever it may be available. Raising the anicut to 7 feet 6 inches will alone give us this power in the case of the north channel.

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12. The calculations by which this is arrived at are appended; with the anicut only 6 feet high 1,200,000 cubic yards per hour must be passing to waste over the anicut before the full supply can be passed into the channels.

13. The full supply can be passed into the south main channel with 7.1 foot on the upper floor of sluice. The calculations suppose both channels clear of silt, which is only likely to be the case at the commencement of a season. I should here note that the calculations given by Major Prendergast in the printed report do not apply now, the north head sluice having been built with six instead of four vents. The necessity for taking as much as possible of the flood waters was not, I think, realized by that officer when preparing the project, as the minimum discharge of the river was estimated on Colonel Horsley's data to be so much more than we have found it. For thirty-one days consecutively in September and October the discharge was below 30,000 cubic yards per hour, the minimum being 12,000, so that the statement in paragraph 3 of Major Prendergast's memorandum is clearly wrong, the minimum discharge being 90 cubic feet per second instead of 198.

14. With regard to the question of storage in the tanks, it was originally proposed (see Major Prendergast's report) that the north tanks should contain 15,000,000 and the south tanks 20,000,000 cubic yards. During the execution of the work the tank banks were raised and alterations introduced, by which Lieutenant Shepherd calculated the storage would be increased to 42,000,000 cubic yards on the north and 28,000,000 on the south. As, however, these were only approximations, and as it seemed advisable that the storage should be accurately known, I wished before re-submitting the papers to have the tanks contoured and their capacities properly determined. The list which accompanies this shows the capacities of the tanks at the maximum level at which it is proposed to maintain them. Only three tanks could not be contoured on account of water in them, viz., the Korkei and Arumugamungalum on the north and the Kadamba on the south side. I believe, however, the capacities given to be very close approximations.

15. The result is that the storage is not as much as Lieutenant Shepherd estimated it to be, on the north side it is 28,000,000 on the south 25,600,000 cubic yards. The greatest difference between the actual and estimated capacities is in the Chinnasawmy Naicken (or Korumpullum) tank, which is shown to be 15,200,000 cubic yards against 30,000,000 estimated by Lieutenant Shepherd. This partly arises from my having reduced the proposed maximum level of this tank from +20.90 to +19.40. The reasons for this change will be explained when noticing the Upar Oday dam.

16. For the Kar or south-west monsoon crop we shall have to depend entirely on the river, and cannot calculate on receiving water from the rainfall. I forward a statement showing the rain registered at Ottapedaram and Tuticorin during the last ten years. The rainfall at Ottapedaram may be assumed to be the amount of the Upar Oday basin, that at Tuticorin may be assumed to be the amount of rainfall which would assist in raising the crops. From this statement it will appear that it is only in the north-east monsoon that the tanks will receive any supply, and that principally on the north side. The Kadamba is the only tank on the south side which can receive much rain water. The other tanks are bounded by the sand hills, called the Teri, off which the rainfall comes only slowly

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and in the shape of springs, which are already used for garden cultivation.

17. On the north side it is proposed to cultivate 20,000 acres, and assuming for the Kar crop 50 cubic yards per diem to be required for 90 days  $\frac{90,000,000}{28,000,000} = 3.2$  times, the tanks will have to be filled to bring the crop to maturity or for the Peshanum crop of 150 days  $\frac{150,000,000}{28,000,000} = 5.3$  times.

18. It will be some time before the 20,000 acres extent of cultivation are reached, but we must now arrange for the total area.

19. Similarly, on the south side, with 13,500 acres the tanks will have to be filled 2.4 times for the Kar and nearly four times for the Peshanum crop.

20. It does not seem to me possible to state positively that a certain supply of water will be available in the river for a certain number of days. Situated as the Streevigoontum Anicut is, the last on a river which has already seven anicuts across it, and on every feeder of which there are numerous anicuts, the flood water is really what we have to depend on; and, as originally designed, the height of anicut and the dimensions of the channels and sluices are not proportioned one to another.

21. As the cost of raising the anicut will be so small, about Rupees 4,000, and the extra afflux and velocity over it will in no way endanger the stability of the work, I trust there may be no hesitation in sanctioning it.

22. With regard to the remarks in paragraph 4 of your memorandum under reply, I would beg to state that the 13,000 acres of old irrigation was not cultivated entirely from independent sources of supply. On the north side the cultivation was supplied by the Kulpadagai and Korkei channels, on the south by the Tentra-peri and Autur channels, all of which are merged into the north and south main canals respectively. The independent supply was uncertain and precarious, being the surplus from the Marudur, Melakal, and Kilakal.

23. With regard to your paragraph 5, I would beg to point out that the northern tanks are really divided into three, with calingulahs between each. The old Paycolum and Marathony tanks form one, the Pottacolum the second, and the Chinnasawmy Naicken (or Korumpullum, for I regret to say it is called by both names) the third. I have, bearing in mind your instructions with regard to the Upar Oday dam, reduced the maximum level of the latter tank by  $1\frac{1}{2}$  feet. I think it is very advisable to do this as the material of the bund is very inferior, and the tank very considerable in area and capacity, even allowing the water not to stand as high as was proposed by Lieutenant Shepherd.

24. With regard to your paragraph 6, I have the honour to enclose the statements showing the details of petty establishment as charged month by month to the anicut estimate. In G. O., No. 3,906, of the 15th December 1868, sanction was accorded to the entertainment of a first class Range Office for the project, and this was kept up till the 1st December 1872, when Lieutenant Shepherd became 2nd Range Officer on the general district establishments. It was of course necessary to maintain Maistries to supervise the work under execution, whether by the contractor or departmentally; and the Superintending Engineer was authorized by the Chief Engineer for Irrigation to do so.—Vide Colonel Anderson's Memorandum, No. 105, of the 30th November 1868. I have already, in my previous letter of the 18th January 1873, stated that I consider this establishment was on too extravagant a scale, and I reduced it after my arrival.

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25. The other statements you require are also forwarded, viz., one showing the cost of engineering establishment, and one the various items charged off to sundries. There are some items of the latter on which recoveries can be made, and these will be made as soon as possible.

26. With regard to your paragraph 7, I have the honour to state that though the general level of the Ammenpuram bund is high, both it and the Kanam bunds require raising in some places. I have had the levels taken and the longitudinal section of both bunds is included in the book of sections now forwarded. The work required is only Rupees 860, for which sum an estimate is likewise submitted.

27. As requested, general maps, one for the south side and one for the north side, have been prepared; in these all the works as carried out are shown, also the old and proposed irrigation. The part colored yellow indicates rather the position than the precise area of the new cultivation. In some places a much larger proportion of the ground can be cultivated than in others.

28. The estimate for Yeral syphon sluice has been prepared as directed by you, and the work has been completed accordingly.

29. The circumstances of the Perungolum surplus channel will, I think, be understood from the map and sections now forwarded. The Perungolum is the last of the series of tanks under the Marudur. Kilakal and its surplus formerly found its way into the Arumugamungalum tank, but is now intercepted by the northern main channel. The work called the "bridge and calingulah" being intended to pass both the regular supply, and as much of this surplus as may be necessary, to the Arumugamungalum tank. The Perungolum surplus channel had a small embankment on both sides for part of its length and for part on the south side only. This bank was very low, and would not admit of the water being kept at the intended level in the main channel. The raising of the bank should have been included in the original estimate, but was strangely overlooked both in it and in the first revision. The Perungolum surplus may amount to as much as 100,000 cubic yards per hour, in which case the north channel head sluice will have to be partially closed, and the water passed on both through the bridge and calingulah and down the channel to the Paycolum and other tanks. The longitudinal section of the proposed embankment has been re-drawn and embodied in the general book of sections. The anicut referred to by you in your memorandum under reply is a dam across the channel near its head for diverting water to the Nunjei on either side. The new road from Streevigoontum to Yeral will pass over the south bank of this surplus channel. The extra earth to form the bank to a proper width for a road has been provided for in the road estimate.

30. With regard to the Upar Oday dam, I quite think the flush calingulah as ordered by you is the best arrangement. The screw shutters were proposed by me in lieu of the dam stones and planks proposed by Lieutenant Shepherd, and included by him in his first revised estimate. Bearing in mind the soil of which the bund is composed, and the considerable capacity of the tank, I think it would not be advisable to fix the level of a flush escape higher than + 19.40. The bunds are already + 23.90 and the revetment estimate provides for raising them to + 24.90, with this height the water might be allowed to rise to + 21.40. Two feet passing over the weir with the under sluices open would discharge 11,259 cubic feet per second, or 1,400,000 cubic yards per hour, a discharging capacity sufficient in any

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case, taking the catchment basin of the Upar Oday at 120 square miles; but ample, I believe, when it is remembered that the tank itself will act as a regulator. The work has during the past season been built to a height of 4 feet above the floor of vents, leaving 20 feet to be added, or such a height as you may determine upon.

31. The estimate now sent provides for carrying out the work with crest at + 19.40, and amounts to Rupees 39,100. This is in excess of the revised estimate. The excess is due, firstly, to increase in the rate for cut stone, which we have everywhere found the most difficult part of the work to get executed; secondly, to my having allowed for plastering the wings with Portland cement, which is necessary owing to salt having already attacked the brick-work. The previous estimate did not allow for the iron bars to vents, nor for shutters for them, screw shutters having been provided in a separate estimate of Rupees 17,450, which will not now be required.

32. Lieutenant Shepherd omitted the second drop in the Autur channel, and showed the amount of the estimate as saving. This drop is, in my opinion, necessary, and I forward plan and estimate, amounting to Rupees 970, for it. Without it the fall would be too heavy in the sandy channel below the first drop, between it and the Sathuvoycal channel.

33. The estimate for the syphon sluice at Yeral amounts to Rupees 8,840; the increase is due to there having been no proper allowance in the previous estimate for making up the banks over the sluice for the centerings and for baling.

34. I must also ask you to increase the sum for field channels to Rs. 29,000. These channels have now been marked out and the levels taken. We had previously calculated on the ground being of a tolerably uniform slope, but find that in many places heavy embankments have to be made, and that on an average the cost will be about Rupees 1,000 per mile, including drops and sluices. The length of channels altogether will be 29 miles.

35. In Lieutenant Shepherd's comparative statement, forwarded with my letter of the 18th January, Rupees 7,94,590 is given as the total of the old estimates; to this must now be added the increased amounts noted above, viz. :—

|                                        | Rs.    |
|----------------------------------------|--------|
| 2nd Drop, Autur channel ... ..         | 940    |
| Increase on Yeral syphon sluice ... .. | 750    |
| Do. Upar Oday dam ... ..               | 6,400  |
| Do. small channels ... ..              | 9,000  |
| Total...                               | 17,090 |

This will make the total of the works originally included in the first revision Rupees 8,11,680, or less than the original estimate by Rupees 19,920.

36. Four of the extra estimates prepared by Lieutenant Shepherd have been revised by me, viz. :—

I.—Raising the anicut increased to Rupees 4,400. This is due to the rate for brick-work having been altered to Rupees 4-8-0.

II.—Perungolum surplus embankment Rupees 3,500 instead of Rupees 3,100. The increase here is chiefly due to the extra provision for protecting the village of Siruthundu.

III.—Dam in Poriur channel, Rupees 540. In this I have lowered the floor as Lieutenant Shepherd allowed a fall of a foot in the surface in the lower part of the channel, even when the Ammenpuram tank was

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full, the fall would be greater with the tank empty, and would probably cut up the channel.

IV.—I have also revised the estimate for the tank revetments, first, because I think that in Lieutenant Shepherd's estimate the 2 to 1 slope was commenced at an unnecessarily low level, and that a saving in quantity could be effected; and, secondly, because I do not think the work can now be done at the rates allowed. It could have been done for Lieutenant Shepherd's rate had the work been carried out simultaneously with the bunds. Both the Nallamally and Puthukottei Hills, from which stone and gravel will have to be brought, are situated above the tank, and thus stone for the greater part of the work will have to be carried round it when there is water in the tanks. At the return of the bank, where the water will be shallow, I have allowed only gravel or small stone pitching. The estimate now amounts to Rupees 82,800 against Rupees 75,900.

37. I have also added two more estimates, one for the Ammenpura and Kanam tanks already alluded to, and one for deepening out the tail race from the Yeral syphon sluice to the Korkei tank. The old channel was quite insufficient to pass the water off. In your memorandum under reply you say Major Ryves' formula would allow for a drainage of 8 inches in 24 hours through the syphon sluice, but supposing this rainfall to occur, it would hardly run off paddy land all at once, the field banks would assist in retaining it. As the ground above the syphon sluice is flat, the water would stand back for a considerable distance. It is proposed to make the channel from the syphon sluice 30 feet at bottom with slopes 2 to 1 with 9 inches fall per mile, to carry after unusual, but not extraordinary, rains  $3\frac{1}{2}$  feet. The water level in the channel would in this case be 1.64 above the rear cistern wall, and in front the water would stand  $1.64 + 1.25 = 2.89$  above the upper cistern wall, that is about 2 feet over the Nunjei. This would only be for a short time. In order to render the syphon sluice effective this year it was necessary to clear the old channel partially; this has been done by digging the channel for the first half a mile to half width. It will be seen that the water from the syphon sluice is picked up by the Korkei tank, the calingulah of this tank is capable of discharging the surplus should much water come down when the tank is full.

38. The estimate amounts to Rupees 3,800, and should be added to the original estimate of Rupees 75,900.

39. The estimate amounts to Rupees 82,800.

38. The estimate amounts to Rupees 3,800, and should have been included in the original estimate.

40. In all the extra estimates forwarded provisionally to the Government of India, Rs. 1,17,790 have been included.

40. In all the extra estimates forwarded provision has been made for the petty establishment required, but to cover past expenditure the whole sum required will be about Rupees 42,000, the total expense of the project may therefore be considered to be—

Original works

|                      | Rs.             |
|----------------------|-----------------|
| Original works       | 8,11,680        |
| Extra works          | 1,17,790        |
| Establishment, Petty | 42,000          |
| <b>Total</b>         | <b>9,71,470</b> |

This is Rupees 14,000 more than Lieutenant Sh...

41. This is Rupees 14,000 more than Lieutenant Shepherd's total, but the corrections made are all necessary, and such as my present experience of the works leads me to believe to be essential.

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42. I should mention that the following extra works sanctioned by the Superintending Engineer, late 8th Division, from anticipated savings, have been completed :—

|                                                |     |     |     |     |     |     | RS.         |
|------------------------------------------------|-----|-----|-----|-----|-----|-----|-------------|
| Screw gearing for north and south Head Sluices | ... | ... | ... | ... | ... | ... | 2,240       |
| Do Porjur Head Sluice                          | ... | ... | ... | ... | ... | ... | 720         |
| Syphon Sluice at Palipat                       | ... | ... | ... | ... | ... | ... | 746         |
| Do Ammenpura                                   | ... | ... | ... | ... | ... | ... | 964         |
| Bridge on Cotton Road                          | ... | ... | ... | ... | ... | ... | 2,500       |
|                                                |     |     |     |     |     |     | <hr/> 7,170 |

43. A portion of the work on the Perungolum surplus embankment of syphon sluice tail race have also been carried out, as the water could not have been let down the north channel without the work being done.

44. I shall feel obliged if you will let me have the books of sections back to have tracings made from it for my Office. The sections I have now are all drawn to the previous datum (head sluice floor), and I am unwilling to detain these papers any longer while copies are being made.

45. I regret the time which has elapsed in answering your Memorandum ; it was only in November that the tank contours were completed by Lieutenant Boddy, R.E., without which information the papers could not be sent to you.

From J. W. RUNDALL, Esq., District Engineer, Tinnevely, to Lieutenant-Colonel J. MULLINS, R.E., Chief Engineer for Irrigation, dated Palamcottah, 20th January 1873, No. 24.

I HAVE the honour to forward herewith, as desired in G. O. No 1,896, of the 10th August, revised estimates for the Streevigoontum Anicut Project. All those items for which separate estimates have been submitted to you are now included, and some further works necessary for the proper development of the scheme have been now added.

1. Comparative Statement, one in number.
2. Statements showing the state of the river, six in number.
3. Estimates for extra work to be done to the Anicut, seventeen in number with a list.
4. Plans for do. do., seventeen in number (sent separately).
5. Do referred to Comparative Statement, one in number.
6. Estimates to do. do., two in number.
7. Report of Lieutenant Shepherd, R E., one in number.

2. The estimates are accompanied by a report from Lieutenant Shepherd, R.E., explaining in detail the reasons for the most important modification now proposed, viz., the raising of the anicut.

3. The total of the estimates as now completed is Rupees 9,57,200, including Rupees 40,000 for extra Petty Establishment, and Rupees 36,974 for damage by the flood of November 1869, both of which items should not be included in comparing the present with the original estimate of 1868.

4. The estimates as now submitted do not furnish a basis for comparison with that originally sanctioned, as they form a revision of the estimate prepared in March 1871 by Lieutenant Shepherd, R.E., and sanction to which was accorded in G. O. of the 21st June 1872.

5. The deviations proposed from the estimates as then sanctioned are few ; there would be a net saving of Rupees 37,010 (see comparative statement) on this estimate if carried out without further additions, but from the re-commencement of the works in September 1871, after Ragavacharry's contract was cancelled, it was evident that a very considerable saving would result in consequence of the reduction of rates.

6. From this saving certain of the works entered as additional works were from time to time sanctioned by the Superintending Engineer, late 8th Division, and have been completed. These are Items Nos. VI., VII., X., XI., XIV., the total cost of which is Rupees 7,170.

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7. I will first notice the items of the estimate of March 1871, which require explanation, and in doing so will reply to Major Oakes' Note of 20th May 1872, No. 74, as the reply thereto furnished by me in July 1872 has never, I find, been communicated to you. The numbers refer to those in the comparative statement.

8. *Item No. 1.—The Anicut.*—An increase of Rupees 4,300 is shown on this item; one cause for this is an increase in the rate for brick-work, which is due to Contractor Ragavacharry having been paid Rupees 5 for brick in common, and Rupees 5-8-0 for brick in hydraulic mortar, together with an extra allowance for firewood. Brick-work in common mortar can now be done by us at Rupees 4, and that rate is entered in the estimate for raising the anicut forwarded herewith. Besides the above reason, the stone ordered to be packed in rear of the under sluices and sanctioned in G. O., No. 193, dated 18th January 1870, was inadvertently omitted when the estimate of March 1871 was prepared. An increase to the rate of cut-stone for the coping has likewise been entered, Rupee 1 for cubic foot is not sufficient to provide a well cut granite coping. There is also an increase to the cost of earthwork owing principally to the anicut having been so long in hand, and the river having filled up previous year's work. It was not possible to alter the rear wings of the anicut as proposed by Major Oakes, as they were half finished in 1870.

9. *Item No. 3.—South Head Sluice.*—On this there is a saving, as in G. O., No. 449, dated 14th March 1872, Revenue Department, the construction of a bridge over the anicut was negatived, and as the estimate provided for raising the side walls and wings of this sluice, which is unnecessary except the bridge is built, a saving of Rupees 2,874 has been effected with reference to Major Oakes' remark regarding the level of the platform for working the shutters of this sluice, the estimates now sent provide for raising the platform.

10. *Item No. 6.—Tricalore Syphon Sluices.*—Of these two syphon sluices for passing irrigation water, one only has been constructed, and arrangements have been made by which the whole of the land intended to be cultivated by the two syphons is supplied from the one. The second is therefore not required. The syphon already built has cost more than the estimate; this is due to the fact that the work was commenced by Ragavacharry, but only a few foundation cubes put in. On resuming the work baling and excavation were heavy.

11. *Item No. 8* was completed in 1870; the alterations suggested by Major Oakes cannot be carried out.

12. *Item No. 10.—Autur Branch Channel.*—The question of this channel and the drop in it are intimately connected; several letters have passed regarding the latter. The earthwork of the channel had been carried out for a distance of 21,500 feet when the flood of 1869 broke in and obliterated about  $1\frac{1}{2}$  miles of the channel, necessitating a revision of its arrangements, the estimate for which was included in the flood-damage estimate. In the estimate of March 1871 provision was made for two drops, but as Lieutenant Shepherd, R.E., found that the Sathuvoycal channel (into which the Autur channel is dropped) had silted by the action of the flood about 3 feet, he raised the general level of the Sathuvoycal calingulah (Item No. 15), and by placing one drop at 17,500 feet from head, and allowing the water a slightly increased surface fall in the lower part of the channel, rendered the construction of a second drop unnecessary. I wished to lengthen the crest of this weir, and raise its level in order to reduce the velocity over (or rather through) the originally designed work, but as Major Oakes in his letter No. 135, dated 2nd August 1872, overruled my proposal, the work has been built on the level and with the length of crest ordered by him.

13. *Item No. 15.—Sathuvoycal Calingulah.*—The level of this work was altered as stated above, but this necessitated a greater depth of foundations than allowed for in the estimate, hence the slight increase of Rupees 145 shown.

14. *Item No. 20.—Ammenpuram Calingulah.*—The foundations of this work were put in by Ragavacharry, but as the Kanam tank immediately below it is very small, it is not necessary that it should be separated from the Ammenpuram tank by constructing a calingulah between them, and the unexpended balance of this estimate is therefore shown as a saving. The two tanks

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become practically one, but there is not likely to be any disputes between the villagers, as the anicut will give them a far more abundant supply of water than ever they had before.

15. *Items Nos. 22 and 23.—Tuluken Head Sluice and Channel.*—Major Oakes notices that the head sluice should consist of two vents of 4 feet each; it is true that by a mistake in the original estimate the head sluice and channel are not proportioned one to another, but the mistake consists in the channel having been made too large and not in the sluice being too small. The area of land which will be cultivated under the Tuluken tank and channel is under 1,000 acres, and for the supply of this the head sluice as constructed is amply sufficient. The saving on the Tuluken head sluice is due chiefly to reduction in rates, and partly to the fact that rock being met with there was less depth of foundation required.

16. *Item No. 24.—Tuluken Drop.*—This work is, as supposed by Major Oakes in his Note, founded on kunkur rock, and was built before the receipt of his remarks. The saving shown is due to a reduction of rates.

17. *Item No. 25.—Tuluken Tank.*—The capacity of this tank was not, as supposed by Major Oakes, reduced, as the bund was raised 3 feet above the level allowed in the estimate of 1868; the waterspread was however reduced, and the area which would have been submerged is thus available for cultivation from the Kanam tank.

18. *Item Nos. 27 and 28.—Kanam Channel and Drop.*—The crest of the drop has been built on the level given by Major Oakes in his Note.

19. *Item Nos. 31 and 32.—Auvudiar Head Sluice and Drop and Auvudiar Channel.*—It was found unnecessary to provide a sluice and channel of the dimensions originally allowed for; they have, therefore, been made of the dimensions of the ordinary supply sluice and distribution channel, and paid for from the lump sum allowed for such works.

20. *Items Nos. 33 and 34.—Auvudiar Tank and Calingulah* require no special notice. This tank is chiefly intended for the water-supply of the large town of Trichendoor hitherto most badly supplied.

21. *Item No. 35.—North Head Sluice.*—The saving shown here is due to the same cause as that on the south head sluice, viz., the non-construction of bridge over the anicut.

22. *Item No. 36.—North Channel.*—This has been completed. As observed by Major Oakes in his Note, the water will probably be delivered at the Paycolum tank at a somewhat higher level than shown in the section accompanying the estimate of March 1871. The bunds of the channel have however been made of a sufficient height, viz., about 10 feet above bed of channel.

23. *Item No. 37.—Dam in North Channel.*—Properly speaking an inlet; a new channel is proposed above the north channel which will pick up the drainage which this inlet was intended to pass into the north channel; this work need not therefore be built.

24. *Item No. 38.—Kulpadagai Head Sluice.*—This work was finished before the receipt of Major Oakes' Note, and the alteration in the thickness of the wings cannot therefore be carried out.

25. *Item No. 42.—Yeral Syphon Sluice.*—The foundations of this work have been completed, and it has been built up to floor level. Unfortunately the foundations were dug out by Ragavacharry in accordance with the provisions of the estimate of March 1871, hence it was not possible to raise the general level of the work. Regarding this work, I would beg to refer you to Major Oakes' letter of the 4th July 1872, replying to a proposition made by Lieutenant Shepherd, R.E., to omit the cut-stone lining. The cut-stone in the floor has been put down, but I would again venture to suggest that the cut-stone lining to piers and cistern may be omitted. The area to be drained is about five square miles of Nunjei, and supposing  $1\frac{1}{2}$  inches to run off this area per diem, the velocity through the work would be 4 feet per second. The above quantity would not be a constant discharge, and I think the brick-work would safely stand this, and an occasional higher velocity. The stone for this work has to be carted across a considerable distance of sand. Stone work is therefore both difficult and expensive to execute, hence the high rate of Rupees 20 per cubic yard, which it is found necessary to enter for this work in the estimate now submitted. I should mention that the quality of the bricks at Yeral is very good.

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26. *Item No. 46.—Double Dam at Arumugamungalum.*—The saving on this is due to a partial substitution of rough stone for brick-in-chunam, which was sanctioned by the Superintending Engineer, late 8th Division.

27. *Item No. 50.—Pudukulum Tank.*—The increase shown on this work is due to the fact that the return of the bund had to be taken through the Teri sand, as a great loss of water would have occurred unless the sand had been removed and the bund formed on a water-tight substratum of clay.

28. *Item No. 52.—Chinnasawmy Naicken Tank.*—Major Oakes' remarks on this will be noticed further on when explaining the necessity for the additional works. The saving shown is due to a more favourable line for the return of the bund having been found by which its length was considerably shortened.

29. *Item No. 53.—Upar Oday Dam.*—This work will be discussed further on. The saving of Rupees 2,800 shown is due partly to reduction of rates, and partly to the substitution, in the body of the work, of rough stone for brick-in-chunam, sanctioned by the Superintending Engineer, late 8th Division.

30. *Item No. 54.—Upar Oday Embankment.*—These bunds have been taken along the northern channel of the Upar Oday instead of along the southern (see map in the project book). The advantages of this are that the banks pass through land much less valuable than if carried to the south; that the field channels from the tanks are less interfered with; and the distance to the sea being shorter, the outfall is *pro tanto* the better. The quantity of earthwork is however about the same, and the saving shown is almost entirely caused by reduction of rates.

31. *Item No. 55.—Tuticorin Channel.*—This channel was carried to the natural outfall north of Tuticorin instead of the south, the length and other dimensions were the same, and the general level of the ground was similar to that of the line originally selected, hence the saving is due almost entirely to reduction of rates. This channel is for the diversion of drainage only; the water-supply of Tuticorin has been provided for by a small field channel and sluice included under Items Nos. 56 and 63.

32. *Item No. 56.—Small Sluices.*—Previous to the receipt of Major Oakes' Note a revised plan of sluice fitted with screw shutters was sanctioned by the Superintending Engineer; thirty sluices will still be required, and the average cost, including shutters, is about Rupees 600.

33. *Item No. 59.—Compensation for land.*—The sum of Rupees 40,000 here provided has not been fully paid away yet, but the Collector considers the whole sum will be required.

34. *Item No. 60.—Damage to Materials.*—This sum was paid to Contractor Ragavacharry.

35. *Item No. 61.—Tools and Sundries.*—This shows the expenditure to date; no new tools will be required.

36. *Item No. 62.—Rough Stone.*—The principal work on this item has been carried out in adding three yards of rough stone in rear of the retaining wall below the anicut apron. The addition of this stone was stated to be unnecessary by Major Oakes in his Note of the 23rd July 1872, on the ground that there was already 33 feet in width of rough stone below the anicut, and that this was sufficient; no doubt amply sufficient, had the retaining wall been placed at about two-thirds of the total length from the cut-stone apron. I think however (and you will, I believe, agree with me) that the masonry retaining wall if not backed by a small amount of rough stone might be damaged or destroyed by the action of the river, especially by any lateral scour from water discharged through the anicut under sluices. Similarly a small quantity of rough stone has for this reason been added beyond the retaining wall of the Upar Oday Dam.

37. *Item No. 63.—Small Channels.*—The reason for the lump sum estimate being doubled is that now that nearly all the distribution channels on the south side, and some of those on the north have been marked out and cut, it is evident that the original provision was quite insufficient. The sum of Rupees 20,000 now entered will cover the cost of small masonry works, such as aqueduct and drops, which may be found necessary.

38. I will now notice in order the additional works for which detailed estimates and plans are furnished; the numbers quoted refer to those in the list of these works which accompanies this.

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39. *Item No. I.—Raising the Anicut.*—Lieutenant Shepherd, R.E., in his report notices at length the reasons which have led him to the conclusion that it is necessary to raise the anicut  $1\frac{1}{2}$  feet. At the time of the preparation of the estimate of 1868, the only data of the water-supply available were those recorded by Colonel Horsley. The observations now recorded prove that the discharge of the river was either over-calculated by that gentleman, or that subsequent improvements in the upper anicuts and channels have reduced the quantity of water available at Streevigoontum. It might have been predicted from the character of the river, and of all the irrigation channels under it, that the combination of tanks with the channels is a necessity, and, if necessary with the upper channels, still more so with the channels from the anicut at Streevigoontum, the last on the river. As, therefore, there is not as much water in the ordinary state of the river as was supposed, full advantage must be taken of all freshes by running into the tanks the full supply of the channels. The revision of this project, which has been carried out by increasing the capacity of the north tanks during the progress of the work, and by bringing the Kadamba tank into the main system, is similar to that which it was found necessary to carry out to the Pennair anicut channels in Nellore. The capacity for storage has on the whole been double. The original storage was 65 (20 north + 15 south side) million cubic yards and is now 70 (42 north + 23 south side) million cubic yards. Lieutenant Shepherd, R.E., shows how the proposed arrangements will suffice for the areas on each side which are commanded and cultivable, but in doing so he does not take into account the rainfall and drainage caught by the tanks. This would be but small during the Kar (or south-west monsoon) crop, but would be considerable during the Peshanum (or north-east monsoon) crop. The height to which it is necessary to raise the anicut has been determined with reference to the head required to discharge the maximum supply of each channel through the sluices; this is shown by Lieutenant Shepherd to be  $6' + 1\frac{1}{2}' = 7\frac{1}{2}'$  above sluice floor on the north side, and  $4\frac{1}{2}' + 2\frac{1}{2}' = 7\frac{1}{2}'$  on the south side. I trust that, under the explanations given, that sanction may be granted for the raising of the anicut.

40. *Item No. II.—Bridge to work Under Sluice Needles.*—This has been provided in accordance with your own suggestion when visiting the works in 1869. The piers are slight, but there is no danger in this river from either floating timber or from boats.

41. *Item No. III.—Revetment to North Tanks.*—I regret that the explanation originally furnished by me when sending on the estimate for this, reviewed by Major Oakes in his Note of the 23rd July 1872, was not communicated when the estimate was forwarded to that officer. The weak point of the whole project seems to me to be the material of which the north tank banks are composed. Every care has, I think, been taken by Lieutenant Shepherd to reject sand, and to use the best soil obtainable, but bad is the best, considering the heavy wind from the west which prevails in this district from June to the end of September, and that these tank banks run in a N. N. easterly direction, I believe the banks will be a constant source of anxiety and trouble unless protected. There is, of course, the question as to whether the necessary protection could not be obtained by nanul planting, and Mr. Puckle, the Collector, who has advocated planting in discussing the question with me points to the nanul on several of the old tank banks as instances of its efficiency. But the slope of these old banks is 3 to 1 or even more (and the tanks shallow), and where this is the case sufficient depth of nanul can be obtained to break the waves. I do not think this can be done on the steeper slope of the new bunds; and even if done the nanul will require more attention and expenditure in maintenance than the rough stone revetment proposed. The estimate as now sent up has been revised, and the cost of the gravel backing included. It will be necessary torevet the tanks only for the length provided in the estimate, for other portions are either shallow or already protected by nanul or other plants. Major Oakes in his Note on the estimate of March 1871 (under No. 52) noticed that no protection had been provided for the interior slope of these tank banks, and had the above explanations been before him, together with explanations as to the necessity for the departure from the original estimate by increasing the capacity of storage and raising the tank banks, he would doubtless have looked more favourably on the estimates for revetments. The raising of the tank banks is a necessity from the fact that the number of days on which a full supply is obtainable is less than originally calculated, and the revetment of the banks is a necessity from the bad soil of which they are composed and

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their unfavourable aspect as regards the heavy winds. Believing the revetments essential to the success of the scheme, I regret the fact was not earlier foreseen and explained.

42. *Item No. IV.—Stone pitching in the North Channel.*—This is provided in accordance with your suggestion when visiting the works. In his Note of the 31st July, paragraph 8, Major Oakes suggests that this revetment be carried out for a length of only 300 feet. At this point, however, there is a sharp curve, and the pitching is necessary for some distance beyond it. The estimate provides for 1,000 feet; the work might be carried out tentatively, 600 feet being done the first year and added to if found necessary.

43. *Item No. V.—Extending the rough stone pitching in South Channel.*—There is now considerable action beyond the curve at 950 feet, and the soil being sandy it is desirable to lengthen the pitching.

44. *Item No. VI.—Screw gearing for the North and South Head Sluices.*—This was sanctioned by the Superintending Engineer and has been completed. The necessity hardly needs explanation, as nothing can be more crude than the needles originally proposed, and it is next to impossible to record accurately the volume discharged where needles are used. Estimates have been framed for fitting all sluices from the main canals with screw gearing, as in Item No. VII.

45. *Item No. VIII.—Screw gearing and shutters for the Upar Oday Dam.*—The necessity is great for having better arrangements for regulation than those sanctioned for this important work, viz., dam stones with either loose shutters or a turf bank. The crest of this dam has been fixed at 3 feet below the full supply level of the north tanks. Supposing heavy rain to fall throughout the catchment basin of the Upar Oday, which, though stated by Major Prendergast, R.E.,\* to be

\* Report accompanying original estimate, vide Project Book 342 square miles, is in reality (found by measurement on the Ordnance Map) only 120; it would sometimes be impossible to remove the planks quick enough or to breach a well consolidated turf bund, and breaches would certainly occur; on the other hand invaluable water might be lost from the length of time which would be occupied in closing a weir 600 feet long with either turf sods or plank shutters. If the latter were used they would constantly be washed away and lost. It would, I think, be impossible to work the weir satisfactorily unless provided with means for speedily opening or closing the shutters. The original dam stones stopped  $\frac{1}{8}$ ths of the water-way, the piers and cast-iron standards now estimated for reduce the effective water-way to 400 feet. A depth of 3 feet of water discharging over this length is in round numbers 1,050,000 cubic yards per hour; the sluices will give an additional discharge of 360,000, or a total discharge of 1,410,000 cubic yards per hour. This would permit of  $3\frac{1}{4}$  inches being run off the whole catchment basin in 24 hours, an amply sufficient provision. The cost of these shutters has been obtained from data supplied by the General Superintendent of Public Works Stores, they appear to be much more expensive than the cost of similar shutters at Dowlaishweram.

46. *Item No. IX.—Screw shutters for the Autur, Kulpadagai, and Korkei Head Sluices.*—This is simply a modification of the general plan of screw shutters to suit those sluices constructed sometime ago.

47. *Items Nos. X. and XI.—Syphon Sluices at Palipat and Ammenpuram.*—These are small syphon sluices required for the drainage of less than half a square mile in each case, which could not be drained into the channels. These were sanctioned by the Superintending Engineer and have been completed. No. XI. is part of an arrangement with the Collector, and its construction saved the necessity of purchasing land valued at Rupees 20,000, which would otherwise have been submerged by the extended water-spread of the Ammenpuram tank.

48. *Item No. XII.—Bridge near Alwar Tinnevely.*—You may remember that when down here there was a discussion as to whether this bridge should be built to the east or west of the town. Its necessity was admitted, and it will now be placed to the west, where the villagers propose to construct a road across the Nunjei.

49. *Item No. XIII.—Raising the bund of the Perungolum Surplus Channel.*—The necessity for this has only recently been recognised. Unless the old bank be raised and strengthened, as now proposed, the Nunjei lands of Perungolum will be submerged when the northern channel is running full.

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50. *Item No. XIV.—Skew Bridge on the Cotton Road over Tuticorin Drain.*—This work was rendered necessary as the road dam on the old drainage channel, now converted into our catchment drain, was on too high a level, vide explanations under Item No. 55; the work was sanctioned by the Superintending Engineer from the savings on that item, and has been completed.

51. *Items Nos. XV., XVI., XVII.,* are small works now found to be necessary.

52. There seems to be only one important engineering detail to which it is necessary to allude. In paragraph 27 of Colonel Anderson's memorandum, No. 549, of the 28th September 1868, that gentleman states that further provision for local drainage would probably be required. I will therefore explain how the drainage of each is provided for. On the south side local drainage coming into the south main channel will be passed on into the Kadamba tank. The calingulah of this tank is ample, and the water passing over it is discharged down existing channels, which do not require improvement, into a back-water between the villages of Autur and Arumuganery. Any drainage finding its way into the Ammenpuram tank and Kanam channel is discharged over the Ellapanicken calingulah. There is only a small area of about half a square mile which cannot be thus drained, and for this a syphon sluice has been provided, vide Item No. X, of the additional works. Local drainage below the Ammenpuram tank and Kanam channel is discharged in two places by natural channels, near Trichendoor and Arumuganery. On the north side the drainage crosses the channels and tanks at only three points. At Yeral a syphon sluice (No. 42) has been provided, the water passing under which is picked up by the Korkei tank. At Arumugamungalum the drainage passing the double dam passes over the Arumugamangalum tank calingulah and thence to the sea. The Upar Oday is the third point; the dam and embankments already referred to pass this into tide-water. The drainage from the north is caught and diverted by the Tuticorin drainage channel and carried out to the north of that town. Below the north tanks and parallel to the north embankment of the Upar Oday, a small drain eight yards wide has been cut to pass the local drainage to tide-water. The southern channel of the Upar Oday will become the main drain for the cultivation under the other tanks.

53. In his paragraph 12, Lieutenant Shepherd, R.E., shows that the total amount of the estimates as now submitted is Rupees 9,57,200, adding the cost of Engineering establishment, the total cost to the State would thus amount to not less than 10½ lakhs.

54. With regard to the sum of Rupees 40,000 entered for office and petty establishment, it should be borne in mind that Colonel Anderson struck out from the original estimate (see paragraph 29 of his Note of the 28th September 1868) the sum of Rupees 26,458 provided for office and petty establishment, remarking that a special establishment would be required. The extra cost of the petty establishment above the sum originally estimated is due partly to the longer time the works have been in hand, owing to the stoppage of work by Contractor Ragavacharry and his subsequent imprisonment, and partly to what I consider the somewhat extravagant scale on which the establishments were originally kept up.

55. With reference to the financial prospect of the scheme, having regard to what is now apparent, viz., that it cannot be completed for the sum originally estimated, I would refer you to the last paragraph of Lieutenant Shepherd's letter. Mr. Puckle estimates the increase of revenue at Rupees 1,60,000, hence the net returns will vary from 12 to 14 per cent. The south channel has already done good service in twice saving the cultivation under the Kadamba tank, and this year the Arumugamungalum and other tanks received water before the north-east monsoon filled the rain fed tanks. The return to Government in such cases is only indirect.

56. In these estimates it has been supposed that we shall have to pay Ragavacharry only the sums due on the bills prepared by Lieutenant Shepherd, R.E.; should the Government lawyers consider that we are likely to have to pay any further sums, it would be well to add sufficient to cover this. You will of course have information on this point and be able to add anything if necessary.

57. With these explanations, I trust you may be able to recommend all the estimates for sanction.

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From Lieutenant F. A. SHEPHERD, R.E., Officer in charge of No. 2 Range, Tinnevely, to  
J. W. RUNDALL, Esq., District Engineer, Tinnevely, dated Puthugudy, 15th January  
1873, No. 22.

With reference to your docket No. 870, dated 3rd October 1872, enclosing G. O., No. 1,896,

- 1 Comparative Statement.
- 6 Tables showing the mean state of the Tambrapoorney River from 1868 to 1873.
- 1 List of extra works required.
- 13 Drawings and Plans.
- 20 Estimates (Detailed and Abstract).
- 11 Specifications attached thereto.

dated 20th August 1872, I have the honour to forward plans and estimates, etc., as per margin, connected with the revised estimate for the Streevigoontum Anicut Project.

2. The comparative statement shows the difference between the revised and sanctioned estimates, and explanations of the causes of difference are given in the column of remarks. It is therefore only necessary for me to state here that the net saving of Rupees 37,000 is chiefly due to the general fall in the rates which took place throughout the district after the conviction of Mr. Colquhoun; and that Rupees 10,000 have been added to the estimate for field channels to cover the cost of excavating one channel to its full extent from each sluice. The original estimate only provided for completing these channels up to the point at which they might branch off to supply different villages. Further experience has, however, proved that it is not desirable to throw so much work on the villagers themselves, and that the gain to the revenue on account of the increased rapidity with which the land will be taken up for cultivation, if these field channels be excavated by Government, will amply compensate for the additional outlay. Where the works are nearly completed, and the differences between the revised and sanctioned estimates are in the rates only, I have not thought it necessary to give details in the comparative statement.

3. A list of extra works required is forwarded separately. The specifications which accompany the estimate fully explain the necessity for each work.

It will be observed that all the sluices, with the exception of some of minor importance in the various calingulabs, have been provided with shutters worked by screws (*vide* Estimates Nos. 6, 7, 8, and 9).

Estimates Nos. 10, 11, and 15 provide for additional drainage works that have been found necessary.

Nos. 4, 5, 12, 13, 14, 16, and 17 require no further explanation. In order to explain the necessity for Nos. 1, 2, and 3 I must refer to the original report on this project printed with G. O., No. 3,365, dated 26th October 1868, paragraph 3.

4. The calculations of the supply of water available were based on the records of the Office of this division, which showed that for six months in the year the discharge of the river at Streevigoontum is not less than 79,200 cubic yards per hour; and that during the cultivating season the minimum discharge is  $7\frac{1}{2}$  cubic yards per second, or 26,400 cubic yards per hour.

Five years careful observations of the river have convinced me that a supply of 79,200 cubic yards per hour cannot be depended on for three months in the year, and that during the cultivating season, with the exception of sixty-four days, it is not safe to calculate on more than an average discharge of 26,000 cubic yards per hour. I have only on one occasion observed a flow of less than 8,000 cubic yards per hour during the cultivating season; but after a fresh has begun to subside, the discharge of the river generally falls very rapidly to 15,000 cubic yards per hour. The anicut was thrown completely across the river in July 1870, since which time the vents in the anicut have afforded facilities for gauging the quantity of water with great accuracy.

A table showing the number of days on which a full supply for both the channels can safely be depended on is forwarded. This table is the result of my observations of the river for the last five years. It was prepared at the beginning of October, and the record for the last north-east monsoon has not been included. This monsoon has been unusually abundant, and the quantity of water in the river was about double the average. It was, therefore, considered safe to omit these results in calculating the average discharge. I may here mention that it appears to me probable that the data originally assumed were based on accurate observations, and that the discrepancy now pointed out is due to the fact that, after the date of the first series of obser-

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vations, improvements were made by Colonel Horsley, R.E., in the cultivation under the upper anicuts to such an extent as to increase the revenue by three lakhs of rupees. There is however, as far as I am aware, nothing to show the exact date of the first series of observations; but they must have been taken before 1855, when the project was originally sanctioned.

5. Assuming, then, that a full supply for the channel may be depended on for  $24\frac{1}{2}$  days for the Kar crop and for  $39\frac{1}{2}$  days for the Peshanum crop, and that during the remainder of the cultivating season there will be an average discharge of 26,000 cubic yards per hour, the quantity of land that may be brought under cultivation would be as follows:—

1. The constant stream of 26,000 cubic yards per hour, which will be maintained by the tanks when the supply from the river falls below that quantity, will, at 2 cubic yards per hour per acre, be sufficient for 13,000 acres for either the Kar or Peshanum crop.
2. The channels when running full discharge together 210,000 cubic yards per hour (in round number). Deducting 26,000 cubic yards per hour we have 184,000 cubic yards per hour available for storage during  $24\frac{1}{2}$  days for the Kar crop and  $39\frac{1}{2}$  days for the Peshanum crop.

$$24\frac{1}{2} \times 24 \times 184,000 = 108,192,000 \text{ cubic yards.}$$

Allowing for evaporation it may be assumed that  $2\frac{1}{2}$  cubic yards per hour per acre for ninety days will be sufficient allowance for the Kar crop.

Hence—

$$\frac{108,192,000}{24 \times 2\frac{1}{2} \times 90} = 22,300$$

nearly the number of acres that may be cultivated from the tanks.

Therefore the total number of acres for which water will be available during the Kar crop is  $13,000 + 22,300 = 35,300$  acres.

In the same way for the Peshanum crop, the number of acres that may be cultivated from

|          |                        |                       |           |                 |
|----------|------------------------|-----------------------|-----------|-----------------|
|          | Days.                  | Hours.                | C. Yds.   |                 |
| tanks is | $39\frac{1}{2} \times$ | $24 \times$           | $184,000$ | $= 174,432,000$ |
|          | Days.                  | C. Yds.               | Hours.    |                 |
|          | $150 \times$           | $2\frac{1}{2} \times$ | $24$      | $= 8,100$       |

$= 21,500$  acres nearly. Hence the total number of acres for which water will be available for the Peshanum is 34,500.

6. It has been shown in previous reports that the quantity of land actually cultivated before the anicut works were commenced was in round numbers—

|                   | Acres. |
|-------------------|--------|
| On the North Bank | 5,000  |
| Do. South do.     | 8,000  |
|                   | 13,000 |

Hence, it will be observed that the average supply of 26,000 cubic yards per hour has been assumed to be only sufficient to provide an unfailing supply for the existing cultivation.

Nearly all the field channels have been cut on the south side of the river, and I am therefore in a position to state that new land to the extent of 5,500 acres may be brought under cultivation on that side. I have no reason for doubting that 15,000 acres of new land can be brought under cultivation on the north bank in accordance with the original estimate, (*vide* Colonel Anderson's Memorandum, No. 549, of the 23rd September 1868, paragraph 16.)

The revised estimate now submitted provides, therefore, for the cultivation of 20,000 acres (old and new) on the north bank of the river and for 13,500 acres on the south bank. Total 33,500 acres. This quantity is approximately the same as that provided for in the original estimate.

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7. The original estimate provided for a storage of 15,000,000 cubic yards on the north side of the river, and 20,000,000 cubic yards on the south side of the river.

By raising the bunds of the northern tanks from 1 foot to 7 feet the storage capacity has been increased to 42,000,000 cubic yards, and by improvements on the south side from 20,000,000 to 28,000,000. The storage capacity of the tanks on each side is therefore nearly proportional to the quantity of land to be cultivated on each side.

For the Kar crop it will be necessary that the tanks should be filled about one and a half times and for the Peshanum crop about two and a half times.

8. The following is a statement of the approximate storage capacities of each tank, and the quantity of land directly under the influence of each tank or channel.

It will be observed, however, that due provision has been made in the estimate for passing on the water without delay from the upper to the lower tanks throughout the project, so that the lands under the lower tanks are not merely dependent on the storage capacity of those tanks.

|                                   |     |     |     |     |     | Capacity in<br>cubic yards. | Acres of<br>cultivation. |
|-----------------------------------|-----|-----|-----|-----|-----|-----------------------------|--------------------------|
| <i>North Side.</i>                |     |     |     |     |     |                             |                          |
| Chinnasawmy Naicken tank          | ... | ... | ... | ... | ... | 30,000,000                  | 8,100                    |
| Pottakolum                        | ... | ... | ... | ... | ... | 3,500,000                   | 2,000                    |
| Maruthunkulam                     | ... | ... | ... | ... | ... | 500,000                     | 1,000                    |
| Paykolum                          | ... | ... | ... | ... | ... | 3,500,000                   | 3,150                    |
| Arumugamungalukolum               | ... | ... | ... | ... | ... | 4,500,000                   | 2,000                    |
| North channel                     | ... | ... | ... | ... | ... | .....                       | 3,750                    |
| Total...                          |     |     |     |     |     | 42,000,000                  | 20,000                   |
| <i>South Side.</i>                |     |     |     |     |     |                             |                          |
| Kadamba tank and south channel    | ... | ... | ... | ... | ... | 16,000,000                  | 3,550                    |
| Ammenpuram tank and Kanam channel | ... | ... | ... | ... | ... | 3,000,000                   | 3,750                    |
| Ellapanaicken tank                | ... | ... | ... | ... | ... | 2,250,000                   | 750                      |
| Auvudiar tank                     | ... | ... | ... | ... | ... | 1,500,000                   | 200                      |
| Tuluken tank                      | ... | ... | ... | ... | ... | 750,000                     | 800                      |
| Nullur Arumuganery, etc, tanks    | ... | ... | ... | ... | ... | 3,000,000                   | 2,200                    |
| Seenimavady tank                  | ... | ... | ... | ... | ... | 500,000                     | 250                      |
| Autur tank                        | ... | ... | ... | ... | ... | 1,000,000                   | 2,000                    |
| Total...                          |     |     |     |     |     | 28,000,000                  | 13,500                   |

9. If the above data be accepted as correct it will be evident that the enlargement of the northern tanks (and the consequent necessity for a rough stone revetment) was absolutely required to ensure the success of the project. It is further evident that the anicut should be raised one and a half feet in order that the channels may receive a full supply whenever there is sufficient water available in the river.

The north channel has a fall of  $1\frac{1}{2}$  per mile with a maximum depth of water of 6 feet width of channel, at bottom 36 feet, slopes 2 to 1. The maximum discharge is in round numbers 130,000 cubic yards per hour.

The north head sluice has six vents of 4 feet. Hence the head necessary to effect the maximum discharge is one and a half feet nearly.

The south channel is of the same dimensions and slope as the north channel, but the maximum depth is  $4\frac{1}{2}$  feet. Hence the discharge will be in round numbers 80,000 cubic yards per hour.

The south head sluice has three vents of 4 feet. Therefore the head required to effect the maximum discharge is  $2\frac{1}{2}$  feet nearly.

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From this it follows that the height of the anicut should not be less than  $6' + 1\frac{1}{2}' = 7\frac{1}{2}'$ . The piers of the bridge over the anicut should be raised to the same extent. An estimate for this is forwarded; but the cost may be met from the balance of the ryots' contribution,

• G.O., No. 449, dated 14th March 1872.

and is therefore not included in the total of the revised estimate.

10. It may be observed that it would not have been necessary to raise the anicut if the waterway of the north head sluice had been made originally 48 feet instead of 24 feet, and that of the south head sluice 45 feet instead of 12 feet.

This increase in the dimensions of the head sluices would however have involved an additional cost of not less than Rupees 20,000. The estimate for raising the anicut is only Rupees 4,100.

11. The cultivation under this project will continue to receive a considerable supply from the Marudur anicut, and the tanks will be fed to a certain extent by the local rainfall, averaging 22 inches per annum. The catchment basin of the northern tanks is about 170 miles, including that of the Upar Oday. The catchment basin of the tanks on the south side is under twenty square miles.

The supply which will be derived from these sources, though considerable, has been omitted in the above calculations of the quantity of water available for the cultivation.

12. A sum of Rupees 40,000 has been included in the revised estimate for the cost of petty establishment both office and executive. Of this sum Rupees 38,878 have already been paid up to December from the estimate for this project, and the remainder will be required for disbursement during the current official year. The estimates now submitted for the extra works include due provision for the petty establishment required after 1st April next.

The sum of Rupees 40,000 cannot be considered as an excess above the sanctioned estimate of Rupees 8,31,600, but should be treated as a separate item, in the same way as the permanent establishment, (*vide* Memorandums of Chief Engineers for Irrigation, No. 519, dated 28th September 1868, paragraph 30, and No. 171, dated 3rd April 1869, paragraph 7.)

The revised estimate also includes a sum of Rupees 36,974, which was expended in repairing the damages caused by the flood of 1869, (*vide* G. O., No. 1,424, dated 8th June 1870,) but this amount can scarcely be considered as a fair charge against the estimate.

The total estimate for which sanction is solicited is Rupees 9,57,200 as follows:—

|                                                                |          |
|----------------------------------------------------------------|----------|
| Originally sanctioned works, including the damage by the flood | 7,94,590 |
| Petty Establishment                                            | 40,000   |
| Extra works                                                    | 1,22,610 |

Total ... 9,57,200

Excluding the petty establishment, and the cost of repairing the damages caused by the floods, the total will be Rupees 8,80,226, which is less than 6 per cent. in excess of the originally sanctioned estimate. I trust that this result will, on the whole, be considered not unsatisfactory.

13. The works that have been sanctioned up to date are now very far advanced. With the following exceptions they are all either fully completed, or are in working order:—

- (1.) Syphon Sluice at Yeral, built up to floor level.
- (2.) Upar Oday Dam, body not yet built.
- (3.) About two-thirds of the number of small sluices required on the north bank of the river have not yet been built.
- (4.) The field channels on the north side of the river, and a few miles of those on the south side, have not yet been cut.
- (5.) The Upar Oday embankment is about seven-eighths finished.

14. The following extract from the Collector Mr. Puckle's report to the Board of Revenue, (No. 224, dated 31st May 1872,) will explain the financial prospects of the project:—"I have recently been over every village under the anicut in company with Lieutenant Shepherd, the Execu-

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tive Engineer in charge of the work, and have arranged with him for the distribution of water from every sluice and channel \* \* \*. It is certain that the additional revenue will be at least 1,60,000 Rupees."

No. 188.

MEMORANDUM.

THE undersigned has the honour to acknowledge the receipt of the letter No. 24, of the 20th January last, from the District Engineer, Tinnevely, forwarding a revised estimate for the Streevigoontum Anicut Works, and to request that the following observations may receive early consideration.

2. In his letter No. 116, of the 3rd July 1872, Major Oakes asked that the plans and estimates of the first revision might be returned when the second revision was submitted. This has not been done, and the Chief Engineer is often unable to understand the explanations given in the letter of the District Engineer, and the report of the Executive Engineer.

- 1 G. O., No. 1,818, 28th July 1870.
- 1 Plan of Syphon Sluice at Yeral.
- 1 Sheet Longitudinal Section of Bund of Perungolum Surplus Channel.
- 1 Sheet Cross Sections of do. do.

3. The information given does not enable Lieutenant Shepherd's calculations of water-supply to be checked. A number of statements of number of days on which there will be a full supply and a half supply have been submitted; but what is really required is a statement of the quantities of water in each month reaching the anicut, showing also what becomes of it, or of that portion not in excess of the capacities of the channels; what quantity will be available at the commencement of the season of cultivation in the tanks, with the receipts and expenditure of water up to the close of the season. The Sungum Project in Nellore is a very similar scheme, and

G. O., No. 1,818, dated 28th July 1870.

were made are herewith forwarded; no correct deductions can be made from statements which do not profess to deal except in a rough way with half and whole day supplies. There are registers of the river in this office, but in the absence of information as to the state of the anicut in each month no calculations can be made here. Lieutenant Shepherd has made careful observations for five years; there must be therefore particulars of the discharge of the river for a period on which a tolerably reliable average for each month may be founded. When it has been shown for how many days in each month the water will stand at and below the crest of the anicut, with the supply which will be drawn off by the north and south channels respectively, and, next, on how many days the water will be above the crown, with the corresponding supply in the channels, the total river supply with the anicut at its present level will be known. It may, as has been done elsewhere, be assumed that it will suffice if the total supply required by the lands under irrigation in any ten days be provided during that period, that is that a short supply for a part of this limited period will do no harm if compensated for in the remainder of that period. Also that two cubic yards an acre an hour will be enough for the field channels, and that, on the average, the Kar crop will want water for about 75 to 80 days, and the Peshanum for 105 to 110 days. The

1870 and 1871.

Kistna experiments at Chebrole show that the quantity of artificial supply required is much less than has generally been assumed to be the case. It will not do to ignore either the rainfall supply of the tanks, or that which the fields obtain directly, and the average rainfall of this part of Tinnevely should be taken into account in estimating the state of the supply in the tanks in any month, though it will be best to assume that only a fourth or a fifth at most of the drainage due to rainfall will be utilized, while where the catchment basin is sandy a considerable further reduction may be proper.

4. To the Chief Engineer it would seem that the conclusion arrived at in the 6th paragraph of Lieutenant Shepherd's letter, No. 22, viz., that an average supply of 26,000 cubic yards an hour will suffice only for an unfailing supply to the 13,000 acres of land irrigated before the

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8th June 1874.*

anicut was constructed, is very strong evidence that this officer's deductions are not to be relied on. That area was before cultivated from independent sources of supply, and the water thus obtained must be an important element in the calculations. Until much more detailed and reliable information is obtained and put into a shape which will admit of its being thoroughly understood, it is impracticable to say either what amount of storage is needed, or whether the present level of the anicut is adapted to the requirements of the cultivation.

5. With regard to the proposal to unite all the northern tanks and, as the undersigned supposes, to have one waterspread from end to end, it must not be forgotten how serious a matter a breach under such circumstances would be, and it may therefore be desirable to connect them only by sluices or weirs, so that their whole contents may not be lost should an accident occur at any point in a length of many miles of bund.

6. In paragraph 4 of his No. 116, of the 3rd July, Major Oakes requested that a statement showing the details of the petty and office establishments provided for in the revised estimate might be forwarded, and this should be done; in addition to this there should be a further statement showing the cost of the engineering staff up to date, and in the future up to the completion of the work. It should at the same time be explained how the provision for sundries has been disposed of, as it would seem that the greater part, if not all, of the petty establishments employed on the works themselves should have been met from this source. The authority for the entertainment of the petty establishment with dates should be noted.

7. In connection with Item 20 of the revised estimate, it may be remarked that the original longitudinal section shows a difference of level of 2½ feet between the Ammenpuram and Kanam tanks, but no item for raising the bund of the latter can be traced.

8. The remark against Item 37, in the Comparative Statement, appears to show that the whole of the amount of the estimate ought not to have been entered as a decrease, seeing that other work was substituted.

9. A general map of the project as carried out should be preferred. Without this it will hardly be practicable to make the alterations which have been made intelligible to the Government of India. Longitudinal sections showing the channels as executed, with all the masonry works duly noted, are also required, and the longitudinal scale of these should be such as to allow of all requisite information as to levels being clearly entered upon them.

10. In a letter, No. 57, dated 21st March 1873, the District Engineer asks for early orders regarding the following works which it is desirable to go on with at once:—

1. The Yeral Syphon Sluice.
2. The embankment of Perungolum Surplus Channel.
3. The raising of the Upar Oday Dam to crest level.

As regards the first, which is referred to in paragraph 25 of the District Engineer's letter of the 20th January, No. 24, it must be remarked that 1½ inches per diem cannot be taken as the maximum rainfall drainage. The case is altogether different to that of drains not crossing a canal or other work. In the latter it is allowable to take time for relieving the lands of flood waters, but where an opening is made under a canal for the passage of drainage, it should either be of ample capacity, or it may in some cases be considered advisable to allow a breach in extraordinary seasons rather than incur the expense of providing sufficient waterway. Here Major Ryves' formula would allow for a drainage of 8 inches in the 24 hours, and in such a flood the water would rise considerably above the level of the top of the banks, before the head would be sufficient for the discharge. As the floor has been placed at so low a level, it will be as well to utilize the space available, and, instead of three vents of 4 feet, one vent of 12 feet with abutments 5 feet high and versed sine of 4 feet should be substituted, and the waterway will then be about 92 instead of 56 square feet; the abutments may be made 4 feet thick with two or three offsets at the base on the outside, and the work on this arrangement may be gone on with while, as the bricks are reported to be good, the cut stone facing to the abutments may be omitted and plastering substituted for the surface. A revised estimate for the work as thus altered should be sent in; the crown of the arches will be 6 inches below bed level, and can be covered with that thickness of concrete.

**Govt. of 1874 Madras.**  
**PUBLIC WORKS.**

To

THE CHIEF ENGINEER FOR IRRIGATION.

Ac., &c., &c.

Dated June 8th.

Recd.

Encl.

G. O., 8th June 1874, No. 1,493.

**JUNE**

**Nos. 121-122**

*Streevigoontum Anicut.*—The Government of India requested to sanction the revised estimates for the Anicut Project, amounting to Rupees 10,40,480. The District Engineer, Tinnevely, requested to furnish the Offices of the Chief Engineer for Irrigation and the Controller of Public Works Accounts with general and classified abstracts of the revised estimates, on early date.

PUBLIC WORKS DEPARTMENT,  
OOTACAMUND, 8th June 1874.

No. 123.

No. 1,499.

FROM

LIEUTENANT-COLONEL J. MULLINS, R.E.,

*Joint Secretary to the Government of Madras,*

*Public Works Department,*

TO

THE SECRETARY TO THE GOVERNMENT OF INDIA,

*Public Works Department.*

**IRRIGATION, No. 12.**

From Govt. of India, No. 53-I, dated 11th Feb. 1869.

Do. do. No. 160-I, dated 4th June 1869.  
Do. do. No. 143-I, dated 26th April 1872.  
Do. do. No. 181-I, dated 18th June 1872.

SIR,—Adverting to the correspondence quoted in the margin, I am directed by His Excellency the Governor in Council to submit plans with revised estimates amounting to Rs. 10,40,480 for the Streevigoontum Anicut Project in the Tinnevely District, the original

estimate for which amounted to Rupees 8,31,600, and was sanctioned by the Government of India in their letter No. 53-I, dated 11th February 1869.

2. The accompanying Note by the Chief Engineer for Irrigation, with the Proceedings quoted therein, will explain the history of the project since its original sanction, and the deviations which have from time to time been considered necessary; the information given will, it is hoped, be found full and complete, and I am to request that the sanction of the Government of India may be accorded to the difference of Rupees 2,08,880, and to point out that, as explained in paragraph 6 of the Note on the estimates, the actual excess above the total cost as calculated when the original estimates were brought forward for sanction is about Rupees 73,000 only.

3. The statement given in paragraph 20 of Colonel Mullins' memorandum shows how the total amount recommended for sanction is made up, but as this is not exhibited under the classified Budget heads, the District Engineer has been called upon to submit a revised abstract showing the works in their proper order, and this abstract will be furnished for record in the Offices of the Chief Engineer for Irrigation and the Controller of Public Works Accounts.

4. From the latest information available the additional revenue due to the project is estimated at Rupees 1,60,000, or over 15 per cent., but detailed statements have been called for, upon the receipt of which a more accurate comparison will be made and a better idea obtained of the effect of the works.

I have the honour to be,

Sir,

Your most obedient servant,

Lieut.-Colonel, R.E.,

*Joint Secretary to Government.*

Exd. S. T. Austin.

Spare Copies.

Enclosures

- 1 Comparative Statement
- 6 Tables showing the measurement of  
the Tumbhroony River from 1868 to 1872.
- 1 List of the low marks required
- 18 Forms & Plans
- 20 Estimates (40 stated & Abstract)
- 11 Specifications attached thereto.

No. 22. Tumbhroony Range Office  
Puthugur 15 January 1873  
The Officer in charge of  
No. 2 Range Tumbhroony  
The District Engineer  
Tumbhroony  
With reference to your  
letter No. 870 dated 3 October  
1872 enclosing No. 1876 dated  
20 August 1872. I have the honor to  
forward Plans & Estimates for  
marginal works with the Revised  
Estimate for the Tumbhroony  
Ancient Project.  
The Comparative Statement  
which shows the difference be-  
tween the Revised and sanctioned  
Estimates, and explanations of  
the causes of difference are  
given in the column of remarks.  
It is therefore only necessary for  
me to state here that the net  
saving of Rs. 37,000 is chiefly due  
to the general fall in the rates,  
which took place throughout the  
District after the completion of  
Mr. Colquhoun's and that Rs. 10,000  
have been added to the Estimate  
for field channels to cover the cost  
of excavating one channel to its  
full extent from east to west. The  
original Estimate only provided  
for completing these channels up  
to the point at which they might  
branch off to supply different  
villages. Further experience has,  
however, proved that it is not  
desirable to throw so much work  
on the villagers themselves and  
that

that this goes to the Revenue on account of the increased rapidly with which the land will be taken up for cultivation of these fields channels be excavated by Government will amply compensate for the additional outlay. When the works are nearly complete and the differences between the Revised and sanctioned Estimates and in the rates only I have not thought it necessary to give details in the comparative statement.

3 A list of extra works required is forwarded separately. The specifications which accompany the Estimate fully explain the necessity for each work.

It will be observed that all the sluices, with the exception of some of minor importance in the various Calingulabs have been provided with shutters worked by screws (vide Estimates Nos 6, 7, 8 & 9)

Estimates Nos 10, 11, 12 provided for additional drainage works that have been found necessary.

4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000

4 The calculations of the supply

supply of water available were based on the records of the Office of this Division which showed that for six months in the year the discharge of the river at Stronglyund was not less than 79,200 Cuyds per hour and that during the cultivating season the minimum discharge is 7% Cuyds per second or 261,000 Cuyds per hour.

Five years careful observation of the river has now convinced me that a supply of 79,200 Cuyds per hour cannot be depended on for three months in the year, and that during the cultivating season, with the exception of 60 days, it is not safe to calculate on more than an average discharge of 26,000 Cuyds per hour. I have only on one occasion observed a flow of less than 8,000 Cuyds per hour during the cultivating season, but after a fresh has begun to subside the discharge of the river generally falls very rapidly to 15,000 Cuyds per hour. The amount was thrown completely across the river in July 1876, since which time the vents in the Anicut have afforded facilities for gauging the quantity of water with great accuracy.

A table showing the number of days on which a full supply for both the channels can safely be

he depended on is forwarded. This table is the result of my observations of the river for the last five years. It was prepared at the beginning of October and the record for the last S.E. monsoon had not been included. This monsoon has been unusually abundant & the quantity of water in the river was about double the average. It was therefore considered safer to omit these results in calculating the average discharge. I may here mention that it appears to me probable that the data originally assumed were based on accurate observations, and that the discrepancy now pointed out is due to the fact that, after the date of the first series of observations, improvements were made by C. Horsley & Co. in the cultivation under the upper sluices to <sup>depth</sup> ~~increase~~ and extent ~~to~~ increase the revenue by 3 lakhs of Rupees. There is however, as far as I am aware, nothing to show the exact date of the first series of observations; but they <sup>must</sup> have been taken before 1855, when the project was originally sanctioned.

See Mr Puckle's letter to the B'g Rev. printed with G.O. No. 365 of the 11<sup>th</sup> Dec 1859: para 3.

Assuming then that a full supply for the channels may be depended on for 24 1/2 days for the Can crop & for 39 1/2 days for the Pishanum crop, & that during the remainder of the cultivating season there will be an average discharge of 26000.

26000 Cys. per hour the quantity of land that may be brought under cultivation would be as follows:  
 1. The constant stream of 26000 Cys. per hour, which will be maintained by the tanks when the supply from the river falls below that quantity will at 2 Cubic yards per hour per acre be sufficient for 13000 acres for either the Can or Pishanum crops.  
 2. The Channels when running full discharge together 210,000 Cys. per hour (in round numbers) deducting 26000 Cys. per hour we have 184,000 Cys. per hour available for storage during 24 1/2 days for the Can crop and 39 1/2 days for the Pishanum crop.

$24\frac{1}{2} \times 24 \times 184,000 = 108,192,000 \text{ Cys.}$   
 Allowing for evaporation it may be assumed that 2 1/4 Cys. per hour per acre for 90 days will be sufficient allowance for the Can crop.

Hence  
 $\frac{108,192,000}{24 \times 2\frac{1}{4} \times 90} = 22,300$   
 nearly the number of acres that may be cultivated from the tanks.  
 Therefore the total number of acres for which water will be available during the Can crop is  $13,000 + 22,300 = 35,300$  acres.  
 In the same way for the Pishanum crop, the number of acres that may be cultivated from tanks is  $\frac{39\frac{1}{2} \times 24 \times 184,000}{150 \times 2\frac{1}{4} \times 90} = 21,500$   
 = 21,500 acres nearly. Hence the total number of acres for which water will be available for the Pishanum is 34,500.  
 6 It has been shown in previous reports that

21500  
 13000  
 34500

that the quantity of land actually cultivated before the current works were commenced was as round of numbers

on the North Bank 5000 acres  
on the South 5000 acres

He observed that the average supply of 26000 Cys per hour has been assumed to be only sufficient to provide an unfailing supply for the existing cultivation.

Nearly all the field channels have been cut on the South side of the river & I am, therefore, in position to state that new land to the extent of 5500 acres may be brought under cultivation on that side. I have no reason for doubting that 15000 acres of new land be brought under cultivation on the North Bank, in accordance with the original estimate (vide Col Andersons Memo & 549 of 25 Sept 1868 para 16)

The Revised Estimate now submitted provides therefore for the cultivation of 20000 acres (old & new) on the North Bank of the river & for 13500 acres on the South Bank.

Total 33500 acres

This quantity is approximately the same as that provided for in the original estimate.

The original estimate provided for a storage of 15000000 Cys on the North side of the river & 20000000 Cubic Yards on the South side of the river.

By raising the bunds of the Northern tanks from 1 to 7 the storage capacity has been increased to 12000000 Cubic Yards and by improvements on the South side from 20000000 to

28000000. The storage capacity of the tanks on each side is therefore nearly proportional to the quantity of land to be cultivated on each side.

For the Cud crop it will be necessary that the tanks should be filled about  $1\frac{1}{2}$  times & for the Pichanur crop about  $2\frac{1}{2}$  times.

The following is a statement of the approximate capacities of each tank and the quantity of land directly under the influence of each tank or channel.

It will be observed however, that due provision has been made in the estimate for passing on the water without delay from the upper to the lower tanks throughout the period so that the lands under the lower tanks are not merely dependent on the storage capacity of those tanks.

| North side                         |                 |                     |
|------------------------------------|-----------------|---------------------|
|                                    | Capacity in Cys | Area of Cultivation |
| Chinnarayana Tank                  | 3000000         | 8140                |
| Potta Kulam                        | 500000          | 2000                |
| Marruthanay Kulam                  | 500000          | 1900                |
| Paykulam                           | 500000          | 3150                |
| Aroonjanganayaluru                 | 400000          | 2000                |
| Colius                             |                 | 5750                |
| North Channel                      |                 |                     |
| Total                              | 12000000        | 20000               |
| South side                         |                 |                     |
| Cadumla Tanks and South Channel    | 16000000        | 2550                |
| Ammapparamu Tank & Ammanur Channel | 8000000         | 3750                |
| Ellapparamu Tank                   | 2250000         | 1750                |

|                |                   |               |
|----------------|-------------------|---------------|
| Amadiad Tank   | 1,500,000         | 200           |
| Tulakew Tank   | 750,000           | 800           |
| Tallad Tank    | 2,000,000         | 2,200         |
| Seemungay Tank | 500,000           | 250           |
| Gulor Tank     | 1,000,000         | 2,000         |
| <b>Total</b>   | <b>28,000,000</b> | <b>13,500</b> |

9. If the above data be accepted as correct it will be evident that the enlargement of the Southern Tanks (& the consequent necessity for a rough flood prevention) was absolutely required to ensure the success of the project. It is further evident that the Anicut should be raised two and a half feet in order that the Channels may receive a full supply whenever there is sufficient water available in the River.

The North Channel has a fall of  $1\frac{1}{2}$  per mile with a maximum depth of water of 6 feet of Channel at bottom 36 feet. Slope is 1. The maximum discharge is in round numbers 30,000 cfs per hour.

The North Head Sluice has six vents of four feet. Hence the head necessary to effect the maximum discharge is  $1\frac{1}{2}$  feet nearly.

The South Channel of the same dimensions as the North Channel, but the maximum depth is  $1\frac{1}{2}$ . Hence the discharge will be in round numbers 30,000 cfs per hour.

The South Head Sluice has 3 vents of four feet. Therefore the head required to effect the maximum discharge is  $2\frac{1}{4}$  nearly.

\* G.O. No. 119 dated 14 March 1872.

From this it follows that the height of the Anicut should not be less than  $6\frac{1}{2} = 7\frac{1}{2}$ . The piers of the bridge over the Anicut should be raised to the same extent. An estimate for this is forwarded; but the cost may be met from the balance of the Ryot's contribution & is, therefore, not included in the total of the Revised Estimate.

10. It may be observed that it would not have been necessary to raise the Anicut if the water in any of the North Head Sluices had been made originally 4.8 feet instead of 3.4 feet, & that of the South Head Sluice 4.5 feet instead of 1.2 feet.

This increase in the dimensions of the Head Sluices would, however, have involved an additional cost of not less than Rs 20,000. The estimate for raising the Anicut is only Rs 4,100.

11. The Cultivation under this Project will continue to receive a considerable supply from the Murdur Anicut & the tanks will be fed to a certain extent by the local rain fall, averaging 22 inches per annum. The catchment basin of the Northern tanks is about 170 miles including that of the Boghat day. The catchment basin of the tanks on the South side is under twenty square miles.

The supply which will be derived from these sources though considerable, has been omitted in the above calculations of the quantity of water available for the cultivation.

12. A sum of Rs 40,000 has been included in the Revised Estimate for the cost of Petty Establishment both office and executive. Of this sum Rs 38,878 have already been paid up to December from the Estimate for this Project & the remainder will be required for disbursement during the current official year. The Estimate now submitted for this item works include due provision for the Petty Establishment required up to April next.

The sum of Rs 40,000 cannot be considered

20 miles from  
main tank.  
1745021  
72

as an excess about the sanctioned estimate of Rs 8,31,600, but should be treated as a separate item in the same way as the Permanent Establishment (vide Memo. of Chief Engineer for Sanction No. 549, dated 28 September 1868, para 30 and No. 171, dated 3<sup>rd</sup> April 1869, para 7).

The Revised Estimate also included a sum of Rs 36,975 which was expended in repairing the damage caused by the flood of 1869 (vide G.O. No. 11,216 dated 8 June 1870), but this amount can scarcely be considered as a fair charge against the Estimate.

The total Estimate for which sanction is sought is Rs 8,57,200 as follows:-

Originally sanctioned works including the damage by the flood. 7,74,530

Petty Establishment 40,000  
Extra works 1,22,670

Rs 9,57,200

Excluding the Petty Establishment and the cost of repairing the damage caused by the flood, the total will be Rs 8,80,226 which is less than sanctioned in excess of the originally sanctioned Estimate. I trust that this result will on the whole be considered not unsatisfactory.

13 The works that have been sanctioned up to date are now very far advanced and the following descriptions, they are all either fully completed or now in working order:-

- (1) Siphon sluice at Guro built up to floor level.
- (2) Open day sluice, body not yet built.
- (3) About 3 of the number of small sluices required on the north bank of the river have not yet been built.
- (4) The field Channels on the north side of the river and a few miles of those on the south side

side have not yet been cut.

- (5) The Open day embankment is about 7/8 finished.

14 The following extract from the Collector Mr. Puckles report to the Board of Revenue (No. 224, dated 31 May 1872) will explain the financial prospects of the Project. I have recently been over every village under the aegis in company with Lieutenant Shepherd, the Executive Engineer in charge of the work, and have arranged with him for the distribution of water from every sluice and Channel. It is certain that the additional Revenue will be at least 1,60,000 Rupees.

I have the honor to be Sir

Your most obedient servant

*Philip J. S. S.* Executive Engineer

46/101/73

Encls No 7 with letter

20 1 73

From

The District Engineer

Trincomalee

The Chief Engineer for  
Irrigation and Joint  
Secretary to Govt. P. W. D.  
Colon.

Report of Lieut. D. J. P. M.  
District Engineer forwarding  
Revised Plans & Estimates  
of the Drying out  
Ancient Projects.

8 Jan 1944

W. J.

From

The Officer in Charge  
of the Road Survey

To

The District Engineer

Trincomalee

Head of

Survey

10/1/44

Enclosure 57

For the purpose of the Survey

of the Road with the view

of the Road for the purpose

of the Road for the purpose

of the Road for the purpose

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of the Road for the purpose

No. 24 District Engineer Office, Sinner  
Palamcottah 20<sup>th</sup> January 1873.

From, J. W. Randall Esquire  
District Engineer  
Sinnerelly.

To, Lieut. Colonel J. Mullins R.E.  
Chief Engineer for  
Irrigation.

Enclos. 7  
Comparative State-  
ment <sup>in No. 1</sup>  
Statements  
showing the  
State of the River  
in No. 6  
Estimates for  
the work to be  
done with the  
1st in the  
Plans for do do  
(sent separately)  
2nd in  
to Comparative  
Statements in No. 2  
Estimates to do do  
2nd in No. 2  
Report of Lt. Shepherd  
1 in No. 2

I have the honor to forward herewith  
as desired in G.O. No. 1586 of the 10<sup>th</sup> August  
revised Estimates for the Struvigundum  
Project. All those items for which separate  
Estimates have been submitted to you are now  
included, and some further works necessary for  
the proper development of the scheme have been  
now added.

The Estimates are accompanied by  
a Report from Lieut. Shepherd R.E. ex-  
plaining in detail the reasons for the most  
important modification now proposed, viz. the  
raising of the Aicut.

3. The total of the Estimates as now  
completed is Rs. 9,57,200 including Rs. 4,000 for  
extra

extra Petty Establishment, and Rs 36,971 for damage by the flood of November 1869, both of which items should not be included in comparing the present with the original Estimate of 1868.

4. The Estimates as now submitted do not furnish a basis for comparison with that originally sanctioned, as they form a revision of the Estimate prepared in March 1871 by Lieut. Shepherd R.C., sanction to which was accorded in G. O. of the 21<sup>st</sup> June 1872.

5. The deviations proposed from the Estimates as then sanctioned are few; there would be a net saving of Rs 37,010 (see comparative statement) on this Estimate if carried out without further additions, but from the recommencement of the works in September 1871, after Nagavachary's contract was cancelled, it was evident that a very considerable saving would result, in consequence of the reduction of rates.

6. From this saving certain of the works

27  
works entered as additional works, were from time to time sanctioned by the Superintending Engineer late S<sup>td</sup> Division, and have been completed. These are items Nos. VI, VII, X, XI, XIV, the total cost of which is Rs 11,70.

7. I will first notice the items of the Estimate of March 1871 which require explanation, and in doing so will reply to Major Oake's note of 20<sup>th</sup> May 1872 No. 74, in the reply thereto furnished by me in July 1872, has never I find been communicated to you. The numbers refer to those in the comparative statement:—

8. Item No. 1. The Ancient. An increase of Rs 1,300 is shown on this item: one cause for this is an increase in the rate for brick work, which is due to Contractor Nagavachary having been paid Rs 5 for brick in common, and Rs 5.8. for brick in Hydraulic mortar, together with an extra allowance for firewood. Brick work in common mortar can now be done by us at Rs 4, and that rate is entered in the Estimate for raising the Ancient forwarded herewith.

herewith. Besides the above reason, the stone ordered to packed in rear of the under sluice and sanctioned in G. O. No 198 dated 18<sup>th</sup>

January 1870 was inadvertently omitted when the Estimate of March 1871 was prepared. An increase to the rate of cut stone for the coping has likewise been entered, Rs. 1 for cubic foot is not sufficient to provide a well cut Granite coping. There is also an increase to the cost of earthwork owing principally to the ancient having been so long in hand, and the river having filled up previous years work. It was not possible to alter the rear wings of the ancient as proposed by Major Oakes, as they were half-finished in 1870.

9. Item No 3. South Head Sluice. On this there is a saving, as in G. O. No 144 dated 11<sup>th</sup> March 72. As the construction of a Bridge over the ancient was negatived, and as the Estimate provided for raising the side walls and wings of this sluice, which is unnecessary except the Bridge is built, a saving of Rs. 2874 has been effected with reference to Major Oakes

30  
Oakes remark regarding the level of the platform for working the shutters of this sluice, the Estimates now sent provide for raising the platform.

10. Item No 6. Tricalore Siphon Sluice. Of these two Siphon Sluices for passing irrigation water, one only has been constructed, and arrangements have been made by which the whole of the land intended to be cultivated by the two Siphons, is supplied from the one. The second is therefore not required. The Siphon already built has cost more than the Estimate, this due to the fact, that the work was commenced by Nagarachary, but only a few foundation cubes put in. On resuming the work bulging and excavation were heavy.

11. Item No 8 was completed in 1870; the alterations suggested by Major Oakes cannot be carried out.

12. Item No 10. Subur Branch Channel. The question of this channel, and the drop in it are intimately connected, several letters have passed

passed regarding the latter. The earthwork of the channel had been carried out for a distance of 21,500' when the flood of 1869 broke in and obliterated about  $1\frac{1}{2}$  miles of the channel, necessitating a revision of its arrangements, the Estimate for which was included in the flood damage Estimate, and the Estimate of March 1871, provision was made for 2 drops, but as Lieut. Shepherd R.E. found that the Sathuroykol Channel (into which the Andur Channel is dropped) had silted by the action of the flood about 3 feet, he raised the general level of the Sathuroykol balingulak. (Item No 15) and by placing one drop at 17,500' from head, and allowing the water, a slightly increased surface fall in the lower part of the channel, rendered the construction of a second drop unnecessary. I wished to lengthen the crest of this weir, & raise its level in order to reduce the velocity over (or rather through) the originally designed work, but as Major Baker in his letter No. 135 dated 2<sup>nd</sup> August 1872.

31  
overruled my proposal, the work has been built on the level, and with the length of crest ordered by him.

13. Item No 15. Sathuroykol balingulak. The level of this work was altered as stated above, but this necessitated a greater depth of foundations than allowed for in the Estimate, hence the slight increase of Rs 145 shown.

14. Item No 20. Annampuran balingulak. The foundations of this work were put in by Ragavachari; but as the Kanain Tank, immediately below it, is very small it is not necessary that it should be separated from the Annampuran Tank by constructing a balingulak between them, and the unexpended Balance of this Estimate is therefore shown as a saving. The two Tanks become practically one, but there is not likely to be any disputes between the villagers, as the amount will give them a far more abundant supply of water than ever they had before.

15. Items No 22 & 23. Tutukin Head Sluice.

Sluice and Channel. Major Oakes thinks that the Head Sluice should consist of 2 Vents of 4' each; it is true that by a mistake in the original Estimate the Head Sluice and channel are not proportioned one to another, but the mistake consists in the channel having been made too large and not in the Sluice being too small. The area of land which will be cultivated under the Tulukew Sank and Channel is under 1000 acres, and for the supply of this, the Head Sluice as constructed is amply sufficient. The saving on the Tulukew Head Sluice is due chiefly to reduction in rates, and partly to the fact that rock being met with, there was less depth of foundation required.

16. Item No 24. Tulukew Drop. This work is, as supposed by Major Oakes in his note, founded on Concret rock and was built before the receipt of his remarks. The saving shown is due to a reduction of rates.

17. Item No 25. Tulukew Sank. The capacity

was this  
much?

Don't know  
what is required  
estimate was  
made for  
this reason  
only

Kuntine

32  
capacity of this Sank was not, as supposed by Major Oakes reduced, as the bund was raised 3' above the level allowed in the Estimate of 1868; the water spread was however reduced and the area which would have been submerged is thus available for cultivation from the Ad's main Sank.

18. Item No 27 & 28. Kaniam Channel and Drop. The crest of the drop has been built on the level given by Major Oakes in his note.

19. Item No 31. 32. Avoodyar Head Sluice and drop, and Avoodyar Channel. It was found unnecessary to provide a sluice and Channel of the dimensions originally allowed for; they have therefore been made of the dimensions of the ordinary supply sluice and distribution channel, and paid for from the lump sum allowed for such works.

20. Item No 33 & 34. Avoodyar Sank and Caluigulah require no special notice. This Sank is chiefly intended for the water supply

supply of the large town of Trichendur hitherto most badly supplied.

21. Item No 35. North Head Sluice. The saving shown here is due to the same cause as that on the South Head Sluice viz. the non-construction of a bridge over the Aricut.

22. Item No 36. North Channel. This has been completed. As observed by Major Oakes in his note, the water will probably be delivered at the Paykulam Tank at a somewhat higher level than shown in the section accompanying the Estimate of March 1871. The bunds of the channel have however been made of a sufficient height viz about 10' above bed of channel.

23. Item No 37 Dam in North Channel. Properly speaking an Inlet; a new Channel is proposed above the north channel which will pick up the drainage which this Inlet was intended to pass into the north channel; this work need not therefore be built.

24. Item No 38 Koolpadagay Head Sluice. This

This work was finished before the receipt of Major Oakes note, and the alteration in the thickness of the wings cannot therefore be carried out.

25. Item No 42. Goral Siphon Sluice. The foundations of this work have been completed, and it has been built up to floor level. Unfortunately the foundations were dug out by Ragarachari in accordance with the provisions of the Estimate of March 1871, hence it was not possible to raise the general level of the works. Regarding this work, I would beg to refer you to Major Oakes letter of the 14<sup>th</sup> July 1872, replying to a proposition made by Lieut. Shepherd, R.E. to quit the cut stone lining. The cut stone in the floor has been put down, but I would again venture to suggest that the cut stone lining to piers and culverts may be omitted. The area to be drained is about 5 square miles of Varjei, and supposing 1 1/2 inches to run off this area per diem, the velocity through the work would be 4' per second. The above quantity would not be a constant discharge and I think the brick work would safely stand this and occasional

provisions in original design but not about 10x5

the discharge which is much greater

low tide

occasional higher velocity. The stone for this work has to be carted across a considerable distance of sand. Stone work is therefore both difficult and expensive to execute, hence the high rate of Rs. 20 per cubic yard which it is found necessary to enter for this work in the Estimate now submitted. I should mention that the quality of the bricks at Aseral is very good.

26. Item No. 46. Double Dam at Anuranga Mangalam. The saving in this is due to a partial substitution of rough stone for brick in chunam, which was sanctioned by the Supt Engineer - late 8<sup>th</sup> Division.

27. Item No. 50. Padikulam Tank. The increase shown in this work is due to the fact that the return of the Bund had to be taken through the Feri sands, as a great loss of water would have occurred unless the sand had been removed and the bund formed on a water-tight substratum of clay.

28. Item No. 52. Chinna swamy Naicken Tank. Major Oakes' remarks on this will be noticed further on when explaining the necessity for

for the additional works. The saving shown is due to a more favorable line for the return of the Bund having been found, by which its length <sup>was</sup> considerably shortened.

29. Item No. 53. Upar Aday Dam. The work will be discussed further on. The saving of Rs. 2,500 shown, is due, partly to reduction of rates, and partly to the substitution, in the body of the work, of rough stone for bricks in chunam, sanctioned by the Supt Engineer - late 8<sup>th</sup> Division.

30. Item No. 54. Upar Aday Embankment. These bunds have been taken along the northern channel of the Upar Aday instead of along the Southern (see map in the Project Book). The advantages of this are that the Banks pass through land much less valuable than if carried to the South; that the field channels from the Tanks are less interfered with; and the distance to the sea being shorter, the outfall is proportionately better. The quantity of earthwork is however about the same and <sup>the</sup> saving shown is almost entirely caused by reduction of rates.

31. Item No. 55. Subicorin Channel. This Channel

the channel was carried to the natural outfall  
has north of Tuticorin instead of the south, the  
ear length, and other dimensions were the same  
and the general level of the ground <sup>was</sup> similar  
to that of the line originally selected, hence  
the saving is due almost entirely to reduction  
of rates. This channel is for the diversion of  
of drainage only; the water supply of Tuticorin  
has been provided for by a small field channel  
and sluice included under Item No. 56 & 63.

to 32. Item No. 56. Small Sluices. Previous  
to the receipt of Major Oakes' note, a revised  
Plan of Sluice fitted with screw shutters was  
sanctioned by the Supt Engineer. 30 Sluices  
will still be required, and the average cost  
including shutters is about Rs. 600.

to 33. Item No. 59. Compensation for land.  
The sum of Rs. 10,000 here provided has not  
been fully paid away yet, but the collector  
considers the whole sum will be required.

to 34. Item No. 60. Damage to Materials.  
This sum was paid to contractor Ragarachari.

to 35. Item No. 61. Tools & Sundries. This  
shows

shows the expenditure to date, no new  
tools will be required.

36. Item No. 62. Rough Stone. The  
principal work on this item has been carried  
out in adding 3 yards of rough stone in rear  
of the retaining wall below the Ancient Apron.  
The addition of this stone was stated to be un-  
necessary by Major Oakes in his note of the 23<sup>rd</sup>  
July 1872, No. 128, on the ground, that there was  
already 33' in width of rough stone below the  
Ancient, and that this was sufficient. No  
doubt amply sufficient, had the retaining  
wall been placed at about  $\frac{2}{3}$  of the total  
length from the cut stone apron. I think  
however, (and you will I believe agree with  
me) that the masonry retaining wall if  
not backed by a small amount of rough  
stone might be damaged or destroyed by the  
action of the River, especially by any lateral  
scour from water discharged through the  
Ancient Under Sluices. Similarly a small  
quantity of Rough Stone has for this reason  
been added beyond the retaining wall of  
the

the Upper Aday dam.

37. Item No 63. Small Channels. The reason for the lump sum Estimate being doubled, is that now that nearly all the distribution channels on the south side, & some of those on the north have been marked out and cut, it is evident that the original provision was quite insufficient. The sum of Rs. 20,000 now entered will cover the cost of small masonry works, such as aqueduct and drops which may be found necessary.

38. I will now notice in order the additional works for which detailed Estimates & Plans are furnished, the minutes quoted refer to those in the list of three works which accompanies this.

39. Item No 1. Raising the Aduicent. Mr. Shepherd R. E. in his Report mentions at length the reasons which have led him to the conclusion that it is necessary to raise the Aduicent  $1\frac{1}{2}$  ft. At the time of the preparation of the Estimate of 1868, the only data of the water supply available were those

recorded.

34 36  
recorded by Colonel Horsley. The observations now recorded prove that the discharge of the river was either over calculated by that gentleman or that subsequent improvements in the upper Aduicent and channels have reduced the quantity of water available at Stravigindum. It might have been predicated from the character of the River and of all the irrigation channels under it that the combination of Tanks with the channels is a necessity, and if necessary with the upper channels still more so with the channels from the Aduicent at Stravigindum the last on the River, & therefore there is not as much water in the ordinary state of the River as was supposed, full advantage must be taken of all freshes by running into the Tanks the full supply of the channels. The revision of this Project which has been carried out by increasing the capacity of the north Tanks during the progress of the work, and by bringing the Badamba Tank into the main system is similar to that which it was found necessary to

to carry out to the Penuaribunt Channel  
in hollows. The capacity for storage has on  
the whole been doubted. The original storage  
was 35 (20 north + 15 south side) million cubic  
yards and is now 70 (42 north + 28 south  
side) million cubic yards. Lieut. Shepherd R.E.  
shows how the proposed arrangements will  
suffice for the areas on each side which are  
commanded & cultivable, but in doing so  
he does not take into account the Rainfall &  
drainage caught by the Sanks. This would be  
but small during the dry (i.e. S. W. monsoon)  
crop, but would be considerable during the  
Peshawar (i.e. N. E. monsoon) crop. The  
height to which it is necessary to raise the  
Anicut, has been determined with reference  
to the head required to discharge the maximum  
supply of each channel through the sluices,  
this is shown by Lieut. Shepherd to be 6'  $1\frac{1}{2}$ '  
= 7  $\frac{1}{2}$ ' above sluice floor on the north side and  
4  $\frac{1}{2}$ ' + 2  $\frac{3}{4}$ ' = 7  $\frac{1}{4}$ ' on the South side. I trust  
that under the explanations given that  
sanction may be granted for the raising  
of

of the anicut.

40. Item No. 11. Bridge to work under  
sluice weirs. This has been provided in ac-  
cordance with your own suggestion when  
visiting the works in 1869. The piers are slight  
but there is no danger in this River from  
either floating timber or from Boats.

41. Item No. 13. Revetment to north  
Sanks. I regret that the explanation origi-  
nally furnished by me when sending on  
the Estimate for this, reviewed by Major Baker  
in his note of the 23<sup>d</sup> July 1872 was not  
communicated when the Estimate was  
forwarded to that Officer. The weak point  
of the whole project seems to me to be the  
material of which the North Sank Banks  
is composed. Every care has I think been  
taken by Lieut. Shepherd to reject sand &  
to use the best soil obtainable but <sup>that</sup> is  
the best. Considering the heavy wind from  
the west which prevails in this District from  
June to the end of September, and these  
Sank Banks run in a N. N. easterly  
direction

direction, I believe the Banks will be a  
constant source of anxiety and trouble  
unless protected. There is of course the question  
as to whether the necessary protection could  
not be obtained by manual planting and  
Mr. Puckle the Collector who has advocated  
planting in discussing the question with  
me, points to the hanel in several of the  
old Sank Banks, as instances of his efficiency.  
But the slope of these old Banks is 3 to 1 or  
even more, & the Sanks shallow  
where this is the case sufficient depth of  
hanel can be obtained to break the waves.  
I do not think this can be done on the steeper  
slope of the new Banks; and even if done, the  
hanel will require more attention and expenditure  
in maintenance than the Rough Stone  
revetment proposed. The Estimate as now  
sent up has been revised, and the cost of the  
Gravel backing included. It will be necessary  
torevet the Sanks only for the length provided  
in the Estimate, for other portions are either  
shallow or already protected by hanel or other  
plants

38  
plants. Major Butler in his notes on the Estimate  
of March 1871 (under No 52) noticed  
that no protection had been provided for the  
interior slope of these Sank Banks, and had  
the above explanation been before him together  
with explanations as to the necessity for the dis-  
parture from the original Estimate by in-  
creasing the capacity of storage and raising  
the Sank Banks he would doubtless have looked  
more favorably on the Estimate for re-  
vements. The raising of the Sank Banks is  
a necessity from the fact that the number  
of days on which a full supply is obtainable  
is less than originally calculated, and the  
revetment of the Banks is a necessity from  
the bad soil of which they are composed &  
their unfavorable aspect as regards the heavy  
winds. Believing the <sup>revetments</sup> essential to the success  
of the scheme, I regret the fact was not earlier  
foreseen and explained.

112. Item No IV. Stone pitching in  
the North Channel. This is provided in ac-  
cordance with your suggestion when visiting  
the

the works. In his note of the 31st July  
he says, Major Baker suggests that this  
movement be carried out for a length of only  
300'. At this point however, there is a sharp  
curve, and the pitching is necessary for  
to some distance beyond it. The Estimate pro-  
vides for 1000'; the work might be carried out  
tentatively, 600' being done the first year  
and added to if found necessary.

13. Item No V. Extending the Pough  
to Stone pitching in South Channel. There is  
now considerable action beyond the curve  
at 950', and the soil being sandy it is des-  
irable to lengthen the pitching.

14. Item No VI. Screw gearing for the  
North & South Head Sluices. This was sanc-  
tioned by the Sup<sup>r</sup> Engineer and has  
been completed. The necessity hardly needs  
an explanation, as nothing can be more crude  
than the needles originally proposed, and it  
is next to impossible to record accurately  
the volume discharged where needles are  
used. Estimates have been framed for  
fitting

fitting all sluices from the main canal  
with screw gearing, as in Item No VII.

45. Item No VIII. Screw gearing &  
shutters for the Upa's Oday dam. The necessity  
is great for having better arrangements for  
regulation than those sanctioned for this im-  
portant work, viz dams staves with either  
loose shutters or a turf Bank. The crest of this  
dam has been fixed at 3' below the full supply  
level of the North Lantik. Supposing heavy  
rains to fall throughout the catchment basin  
of the Upa's Oday, which though stated  
by Major Pendergast R.E. to be 3 1/2 square  
miles, is in reality (found by measurement  
on the Ordnance Map) only 120, it would  
sometimes be impossible to remove the  
planks quick enough or to breach a well con-  
solidated turf bank, and breaches would  
certainly occur: on the other hand an invaluable  
water might be lost from the length of time  
which would be occupied in closing a weir  
600' long with either turf sods or plank  
shutters. If the latter were used they would  
constantly

✓ Report accom-  
panying ori-  
ginal Estimate  
vide Project  
Book.

constantly be washed away and lost.  
It would I think be impossible to work  
the weir satisfactorily unless provided  
with means for speedily opening or closing  
the shutters. The original dam stones  
stopped in the waterway, the pier and  
cast iron standards now estimated for  
reduce the effective water way to 460'.

A depth of 3' of water discharging over  
this length is in round numbers 1,050,000  
cubic yards per hour, the sluices will give  
an additional discharge of 360,000, or a  
total discharge of 1,410,000 cubic yards  
per hour. This would permit of 3 inches  
being run off the whole catchment basin  
in 24 hours an amply sufficient provi-  
sion. The cost of these shutters has been  
obtained from data supplied by the Ge-  
neral Supt. of R. W. Works, they appear  
to be much more expensive than the cost  
of similar shutters at Dowleswarum.

46. Item No. IX. Screw Shutters  
for the Astar Kelpadagay and Korkay  
Head

Head Sluices. This is simply a modifica-  
tion of the general plan of screw shutters  
to suit those sluices constructed some  
time ago.

47. Item No. X & XI. Syphon Sluices at  
Palijat and Ammensuram. These are  
small Syphon Sluices required for the drain-  
age of less than 1/2 square mile in each case,  
which could not be drained into the channel.  
These were sanctioned by the Supt. Engineer  
and have been completed. No. XI is part  
of an arrangement with the collector and  
its construction saved the necessity of pur-  
chasing land valued at Rs. 20,000 which  
would otherwise have been submerged by  
the extended water spread of the Ammensuram  
puram Tank.

48. Item No. XII. Bridge near Alwar  
Tinnevely. You may remember that when  
down here, there was a discussion as to where  
this Bridge should be built to the East  
or West of the town. Its necessity was ad-  
mitted and it will now be placed to the West  
where

where the villagers propose to construct a Road across the Ranjei.

49. Item No. XIII. Raising the Band of the Prungkulam Surplus Channel. The necessity for this has only recently been recognised. Unless the old Bank be raised and strengthened, as now proposed, the Ranjei lands of Prungkulam will be submerged, when the Northern Channel is running full.

50. Item No. XIV. Skew Bridge on the Collow Road over Subicorin Drain. This work was rendered necessary as the Road dam on the old drainage Channel now converted into an catchment drain was on too high a level. vide explanations under Item No. 55, the work was sanctioned by the Sup<sup>r</sup> Engineer from the savings on that item and has been completed.

51. Items No. XV, XVI, XVII are small works now found to be necessary.

52. There seems to be only one important engineering detail to which it is necessary to allude.

82 41  
allude. In Para 27 of Colonel Anderson's Memo No. 549 of the 28<sup>th</sup> September 1868, that gentleman states that further provision for local drainage would probably be required. I will therefore explain how the drainage of each is provided for on the South side, local drainage coming into the South main Channel will be passed on into the leadamba Tank. The balingulak of this Tank is ample, and the water passing over it is discharged down existing channels, which do not require improvement, into a Back-water between the villages of Antar and Arumanganeri. Any drainage finding its way into the Arumangan Tank and Kanam Channel is discharged over the Ellapanaicken balingulak. There is only a small area of about  $\frac{1}{2}$  square mile, which cannot be thus drained and for this a siphon sluice has been provided vide Item No. X of the additional works. Local Drainage below the Arumangan Tank & Kanam channel is discharged in two places by natural

natural channels, near Trichendoot & Arumuganeri. On the north side, the drainage crosses the channels & Sanks at only 3 points. At General a Siphon Sluice (see p. 2) has been provided, the water passing under which is picked up by the Korkay Sank. At Arumugamungalam, the drainage passing the double dam passes over the Arumugamungalam Sank to the sea. The Upar Odai is the third point; the dam and embankments already referred to pass this into tide water. The drainage from the north is caught and diverted by the Taticorin drainage Channel and carried out to the north of that town. Below the north Sank and parallel to the north embankment of the Upar Odai, a small drain 8 yards wide has been cut to pass the local drainage to tide water. The Southern Channel of the Upar Odai will become the main drain for the cultivation under the other Sanks.

53. In his para 12, Lieut. Shepherd A.C. shows that the total amount of the Estimates as now submitted is Rs. 9,57,200, adding the cost of engineering Establishment, the total cost to the State would thus amount to not less than 10½ Lacs.

54. With regard to the sum of Rs. 40,000 entered for Office and Petty Establishment it should be borne in mind, that Colonel Anderson struck out from the original Estimate (see para 29 of his note of the 28th September 1868) the sum of Rs. 26,468 provided for Office and Petty Establishment, remarking that a special Establishment would be required. The extra cost of the petty establishment above the sum originally estimated is due partly to the longer time the works have been in hand, owing to the stoppage of work by contractor Rajavachari and his subsequent imprisonment and partly to what I consider the somewhat extravagant scale for which the Establishments were originally kept up.

55. With reference to the financial prospect of the scheme, having regard to what is now apparent, viz. that it cannot be completed for the sum originally estimated. I would refer you to the last para of Lieut. Shepherd's letter. Mr. Puckle estimates the increase of Revenue at Rs. 1,60,000, hence the net returns will vary from 12 to 14 per cent. The South Channel has already done good service and twice saving the cultivation under the leadamba Tanks and this year the Arumuganungalam and other Tanks received water before the North East monsoon filled the rain fed Tanks. The return to Government in such cases is only indirect.

56. In these Estimates it has been supposed that we shall have to pay Ragavachary only the sums due on the Bills prepared by Lieut. Shepherd R.C. should the Government Lawyers consider that we are likely to have to pay any further sums, it would be well to add sufficient to cover this. You will of course have information

information on this point and be able to add anything if necessary.

57. With these explanations I trust you may be able to recommend all the Estimates for sanction.

I have the honor to be  
Sir

Your Most Obedt. Servt.  
W. Randall  
District Engineer  
Tinnevely.

To the Dist. Supt. Tumacacqui.  
N-1066-25 March 73.

Ch. P. H.

No 200.

From,

The District Engineer  
Tumacacqui

To,

The Chief Engineer  
Irrigation & Joint Sewer  
East P. W. Department  
Madras

Dated 20 January 1893

Received 27

Encls 7.

Forwards for sanction  
the Revised Plans and  
Estimates of Rupees 9,57,200  
for Constructing Strivignam  
Ancient Project  
with certain explanation

June 14/93

Strivignam  
Ancient Project

8.31.60

G.O. 10<sup>th</sup> August 2  
1892. No. 1896.

N-292A.

Note by the Chief Engineer for Irrigation

With a letter, No. 24 of the 20<sup>th</sup>  
January 1893, the District Engineer sub-  
mitted revised estimates, amounting to  
Rupees 9,57,200 in supersession of the esti-  
mates which were in G.O. No. 1520 of the  
21<sup>st</sup> June 1892, approved in place of those  
originally sanctioned. The amount of  
these latter and of what may be termed  
the first revision was identical though  
as shown in the G.O. just quoted the  
alterations in the works were by no  
means inconsiderable.

Very shortly afterwards sup-  
plemental estimates, amounting to  
Rupees 74,070, were submitted for certain  
works reported to be necessary, and  
Rupees 43,700 in addition were reported to  
be required for office and work estab-  
lishments, making altogether an ad-  
dition of Rupees 117,770 to the then sanc-  
tioned amount. Upon this revised  
estimates for the whole project were  
ordered

ordered to be prepared and those sent up in January 1873 were the result of this order.

3 On some points, such as the proposed raising of the Aricut, the amount of storage available, &c the information was insufficient to allow of the modified arrangements being submitted to Government and accordingly the District Engineer's attention was requested to the subject of the water supply, &c and a further report was called for. As a result the estimates have been modified and submitted with the District Engineer's No. 143 of the 13<sup>th</sup> December 1873, their amount is Rupees 9,71,470.

4 Mr. Rundall explains the amount of the present estimates to be made up as follows

|                     |                 |
|---------------------|-----------------|
| Original works      | Rupees 8,11,680 |
| Extra works         | 1,17,790        |
| Petty establishment | 4,200           |
|                     | <u>9,71,470</u> |

but to this must be added the cost of the Engineering establishment

Memo: 25<sup>th</sup> March 1873

\* vide statement

employed up to November 1872 on this project ————— 59,150  
making the total Rupees ————— 10,30,620

5 The variations from the original arrangements of the works up to 1872 are explained in detail in the papers printed in Proceedings Madras Government of the 21<sup>st</sup> June 1872 No. 1520. The District Engineer has not forwarded a comparative statement for the last revision, but he shows that the Comparative statement dated 15<sup>th</sup> January 1873 gives the cost of works included in the first revision as ————— 7,94,590 to which have to be added certain works mentioned in para 35 of his letter No. 143 of the 13<sup>th</sup> December 1873 ————— 17,090 making up the total, of Original works above given, of Rupees ————— 8,11,680

It is to be noticed also that Mr. Rundall does not appear to have any where taken account of the charge to be made to the project for capitalization of the abatement of assessment of lands taken up for the works, though a statement showing

showing the particulars, as also the land compensation, was forwarded with the late Superintending Engineer's letter No. 3250 of the 16<sup>th</sup> October 1872. From this it will be seen that the land compensation is estimated to amount to

Ruppes. 32,739.  
and the Capitalized assessment to — 16,191  
48,930

It is however stated that the whole of the provision for land compensation will be required viz. — 40,000 and maintaining the provision for capitalized assessment, this will be about

20,000  
60,000

Difference Ruppes. 20,000

so that the total of the direct charges on account of the project will amount to Ruppes 10,30,620 + 20,000 = 10,50,620.

In para 24 of the Memorandum on the estimates, printed in Proceedings Madras Government of the 26<sup>th</sup> October 1868 No. 3365, it was stated that to these estimates

\* corrected by 16,181

\* District Engineer No. 24 para

No. 1424 dated 8<sup>th</sup> June 1870

estimated, amounting to Ruppes 831,600, probably not less than 10 per cent. would have to be added on account of extra establishments, and 30,000 Ruppes for drainage channels, and that they would amount then to about 9,77,696 Ruppes. The present estimates therefore are Ruppes 73,000 in round numbers in excess of what the project was originally expected to cost. In para 3 of the District Engineers No. 24 of the 20<sup>th</sup> January 1873 it is remarked that the estimates include an expenditure of Ruppes 36,974, incurred in making good damage caused by the flood of November 1869. How this was distributed is not shown in the comparative statement or referred to in the remarks, but the facts were reported at the time, and will be found in the Order as per margin. Ruppes 5000. Item No. 60, are also shown in the Comparative statement as damage to materials and were the amount

amount paid to the Contractor Raja-<sup>G.C. No. dated</sup>  
-vacharry; Capitalized assessment  
Rupees 20,000 also was not in 1868 com-  
-monly included in estimates; of the  
increase nearly 62,000. Rupees therefore  
are due to causes which could not  
have been provided for. The present  
estimates also contain a large item,  
Rupees 82,800, No. 3 in the list of extra  
works, for the revetment of the North  
Tanks, a safe-guard which was  
not supposed to be necessary when  
the estimates of 1868 were prepared. A com-  
-parison between the works provided  
for in the estimates of 1868, and those  
either carried out or now proposed is  
not easy. A great many changes  
have been introduced, and of these  
a large number received the approval  
of Government in the Order, No. 1520 of  
the 21<sup>st</sup> June 1872, on the first revision  
of the estimates. The remarks now to  
be offered will be confined to the extra  
works or those which have not already  
been fully considered and disposed of

No. 22 - 15<sup>th</sup> Janu-  
-ary 1873 paras  
4 and 5.

\* Memo. No. 188  
25<sup>th</sup> March 1873.

in previous papers.

7. Item No. 4. Rupees 4,400. Raising the  
Anicut. It is proposed to raise the  
Anicut 18 inches in order to admit of a  
full supply being passed into the  
main channels on the two sides of the  
river when the water is flush with  
the crest. This alteration was advo-  
-cated in the District Engineer's letter of  
the 20<sup>th</sup> January 1873 No. 24, para 39, but  
the information therein given and in  
Lieut. Shepherd's report did not appear  
to be conclusive, and as in several  
respects the latter Officer's deductions  
seemed to be incorrect, further details  
were called for and paras 4 to 13 of the  
District Engineer's letter, No. 143 of the 13<sup>th</sup>  
December 1873 deal with this question.  
It is stated that the calculations of  
water supply available which were  
made by Colonel. Horsley, probably some  
time before the year 1855, have to a  
considerable extent been vitiated by  
the improvements subsequently carried  
out in the irrigation under the Upper  
Anicuts across the river, and that the  
extent of these improvements may be

in some degree estimated by the increase of Revenue amounting, it is said, to 3 lakhs of Rupees, therefrom resulting, that as a consequence the minimum discharge of the river at the Shivguntur Anicut, which is the lowest of seven, has been reduced from 198 to 90 C.F. per second.

The information given is not as conclusive as might have been desired, owing in part to Lieut. Shepherd's calculations having been made on data which were, from the varying state of the Anicut then under construction, known only to him, and put into a shape which did not admit of the results being converted into actual quantities of water available on the average of the years over which observations extended. The data professed by this office do not admit of the deficiencies in the information supplied by the local Officers being made good, but it may be noticed that Mr. Rundall states that with the Anicut at the sanctioned height of 6 feet a full supply will

No. 143 - para 12.

not enter the channels until 1.20 mil-  
lions of Cubic Yards an hour are  
passing over the weir to waste, and  
no doubt if any of that water were  
really required for irrigation the  
loss would be undesirable. As far  
however as can be judged from the  
data available it is by no means  
certain or even probable that the  
height of the Anicut as sanctioned  
will be found insufficient. What  
has been termed by the District  
Engineer a full supply in <sup>the</sup> Chan-  
nels is really the maximum sup-  
ply they are to carry, and it was  
not contemplated that this would  
be conveyed for more than a  
short time. This is indeed evident  
from the circumstance that this  
maximum supply is at the rate of  
6.35 C.Yds per acre per hour for  
the North Channel, and 5.66 C.Yds  
an acre for the South Channel.  
It appears to me that the estimate

of water supply required is somewhat excessive. Lieut Shepherd allows for the Har crop  $2\frac{1}{2}$  C. yds per acre per hour for ~~90~~ 90 days. — Peshamm ~~do do do~~ for 150 days.

This not only provides for a full supply of water during a longer period than such is usually needed, for even were the crops on the ground so long a full supply is not required for the whole time, but no account whatever is taken of the rain fall which will be stored in the Tanks. And moreover it is by him supposed that the whole area will be double cropped, and this can hardly be anticipated as probable, though in Timmelly it would appear that lands are re-cropped to a greater extent than elsewhere.

The allowance for the Har crop may be taken at 2 C yds for 80 days. Peshamm ————— 105 — over the whole area. The quantity of

water required will then be

North Channel, 20,000 acres

$20000 \times 185 \times 24 \times 2 = 177.60$  Millions of C. yds

South Channel 13,500 acres

$13500 \times 185 \times 24 \times 2 = 119.88$  — — —

Total — 297.48

With the water flush with the crest of the ament with a height of 6 feet, it has been ascertained that the depth in the North Channel will be a little under 5 feet, and that the discharge may be taken at 690 C. Ft. a second.

Similarly the depth in the South Channel will be just under 4 feet, and the discharge about 462 C. Ft. a second.

In para 5 of Lieut Shepherd's

\* i.e. Water for a maximum supply. North Channel 9536.77 South — 5731.56

Report it is shown that a full supply may probably be depended

upon for  $24\frac{1}{2} + 39\frac{1}{2} = 64$  days in the season. Consequently the supply the channels will carry with the water

water flush with the crest of the weir will be available for at least that time, and  $64 \times 24 \times 153,600 = 235,929$  Millions Cys.

$$690 + 462 = 1152$$

$$384$$

$$153600$$

It is further assumed by that

Officer that for the rest of the season an average of 26,000 Cys.

an hour will be available,

and his season being 240

days, against the 185 here

supposed to be necessary the

supply may be the more

safely be supposed to be

reliable for the shorter pe-

riod, and the quantity

will be

$$121 \times 24 \times 26,000 = 75,504$$

$$\text{Total} = 311,433$$

As this calculation shows an excess of 14 Millions of Cubic yards, and as the additional supply derivable when the river may be above the crest of the Anicut has been left out of the account altogether, I think it may at least be assumed that it is

worth

worth while to ascertain practically whether a 6 feet Anicut will or will not suffice. It will cost a little, but only a little, more to take off and reset the coping should raising be ultimately deemed necessary, than it would to raise the crest at once. It may be that the character or duration of the freshes may be so far uneventful as to make it insufficient that an ample quantity should be conveyed during the season, and this can be determined only by actual experience, or by a calculation of the kind referred to in the memorandum on this subject.

No. 188. 25 March 1873.

The District Engineer has accordingly been informed that for the present it has been recommended that the Anicut should remain at the sanctioned height of

of 6 feet, at which it should be completed. —

8 Item 2. Platform Bridge for working the under Sluice Shutter Pupees 3550. It is more than doubtful whether the proposed arrangement would answer its purpose. I do not think bank or needle shutters could be worked from a platform. This item will therefore be omitted.

9. Item 3. — Revetments to Northern Tanks. Pupees 82800. In connection with this part of the estimates it will be advisable to consider what amount of storage capacity has been provided to supply the irrigation between the freshes in the Tambrapoorany. Originally it was proposed that the tanks on the North side should hold 15 millions of cubic yards or 750 cubic yards per acre; and on the South side 20 millions or nearly 1500 cubic yards per acre. Then Lieut. Shepherd on a considera-

consideration of the circumstances of the water supply suggested alterations of the Northern tanks to raise their capacity to 42 millions of cubic yards, and similarly the capacity of the Southern Tanks was to have been raised from 20 to 28 millions; and these modifications were approved in the G. O. as per margin on the first revision of the estimates and so far as the work then provided for was concerned carried out. It was noticed however by the Acting Chief Engineer for Irrigation that the estimated cost of these tanks was likely to be exceeded; first, because the height of the banks left a margin of 3 feet only above the highest water mark, and secondly, because a stone revetment would probably be found necessary for the large tank of Chinnasawmy Naiken or Korumpullum. For reasons connected with

W 1520-21  
June 1872.

Note Paras  
4 and 7.

with the discharge of surplus at the Upur Oday dam, the full level of this Tank has been reduced from 20.90 to 19.40, and, with the exception of the Harkei and Aramugamungalam Tanks on the North, and the Kodamba Tank on the South, these reservoirs have been contoured and their contents ascertained.

The District Engineer has not stated what storage has been lost by the reduction of the level of the Chinnasaimy Naicken Tank, but as the area of the Tank as shown on the map, is about  $2\frac{1}{2}$  square miles, the reduction is probably not in excess of  $4$  or  $4\frac{1}{2}$  millions of cubic yards, and Lieut. Shepherd's estimate of Capacity must have been much too high.

The following is the acreage under

under each Tank &c.

| Names of Tanks.      | Acreage of Irrigation | Lieut. Shepherd's estimate of Capacity. |           | Revised Capacity    |           |
|----------------------|-----------------------|-----------------------------------------|-----------|---------------------|-----------|
|                      |                       | Total                                   | per acre. | Total               | per acre. |
|                      |                       | Millions of C. yds.                     | C. yds.   | Millions of C. yds. | C. yds.   |
| <u>North side</u>    |                       |                                         |           |                     |           |
| Paycolum—            | 3150                  | 3.500                                   | 1111      | 3.604               | 1144      |
| Marathon—            | 1000                  | 0.500                                   | 500       | 0.583               | 583       |
| Pottakulam—          | 2000                  | 3.500                                   | 1750      | 2.316               | 1158      |
| Chinnasaimy Naicken— | 8100                  | 30.000                                  | 3703      | 15.194              | 1876      |
| Aramugamungalam—     | 2000                  | 4.500                                   | 2250      | 4.500               | 2250      |
| Palayacoyal—         | 3750                  | Put down as under channel               | 3750      | 0.865               | 497       |
| Harkei—              |                       |                                         |           | 1.000               |           |
|                      | 20000                 | 42.000                                  | 2100      | 28.062              | 1403      |
| <u>South side</u>    |                       |                                         |           |                     |           |
| Auvudiari—           | 200                   | 1.500                                   | 7500      | 0.996               | 4980      |
| Autoor—              | 2000                  | 1.000                                   | 500       | 2.094               | 1047      |
| Seenimavady—         | 250                   | 0.500                                   | 2000      | 0.699               | 2800      |
| Ammunpuram—          | 3750                  | 3.000                                   | 800       | 2.892               | 1176      |
| Kanum—               |                       |                                         |           | 0.819               |           |
| Nullur—              | 2200                  | 3.000                                   | 1364      | 0.398               | 318       |
| Keseranullur—        |                       |                                         |           | 0.301               |           |
| Tuluken—             | 800                   | 0.750                                   | 937       | 0.757               | 946       |
| Kadamba—             | 3550                  | 16.000                                  | 4507      | 15.000              | 4225      |
| Ellapanaicken—       | 750                   | 2.250                                   | 3000      | 1.662               | 2216      |
|                      | 13500                 | 28.000                                  | 2074      | 25.618              | 1398      |

It would have been well had the differences which these statements exhibit

exhibit been noticed by the District Engineer, but it may be remarked that on the North side the Paycolum and Marathony tanks are virtually one, and that they will get their supply maintained whenever there is water in the river as the main Channel runs into them. ~~Also~~ the Palayacoyal and Horkei tanks are commanded by larger reservoirs so that their duty will be almost nominal. It may be further observed that had the Chinnasawmy Naiken tank been actually made of the capacity calculated by Lieut. Shepherd, it would have held much more water than is needed. On the South side all the Tanks whose storage capacity is small are commanded by the Hadambae Tank, and there should consequently be no difficulty in making the excessive

57 10  
contents of that work make up for deficiencies elsewhere. Indeed it seems probable that ultimately some of the smaller tanks will be found unnecessary, and if so their beds may be cultivated. On the whole then I think that the arrangements will answer sufficiently well, but they cannot be demonstrated to be altogether suitable in the absence of such a calculation as was called for in para 3 of this Office Memo: No. 188 of the 25<sup>th</sup> March 1873, and for this data are not available. Returning now to the question of the revetments there is, I think, no room for doubt that this protection is needed to a part of the bunds of the Pottakulam, and to a greater length of the Chinnasawmy Naiken Tank, but I am disposed to consider that a reduction may be made if those portions of the bund which are not exposed

exposed to the prevailing winds are covered with Naul grass. While therefore recommending that the estimate be allowed to stand at the amount above named, the District Engineer should give this subject his further careful consideration, with a view to the omission of the revetment wherever it can safely be superseded by the cheaper material. The revised sections of the bund are suitable, and it will be seen that, with the reduced water level in the larger tank, it has been deemed necessary to raise the bund 1 foot, so as to leave a margin of  $3\frac{1}{2}$  feet above the calculated maximum water level.

10. Upar Oday dam. This surplus work has not been included in the list of extra works, but the difference, Rupees 6,400, between it and the former estimate has been included in what the District Engineer terms original works

Rupees 811680

Paras 4 and 5 above.

Chinnasani  
Naickur

works. The revised plan is a return to the general arrangement of the original design. This latter consisted of a body wall  $4\frac{1}{2}$  feet high with a flush, or unobstructed, crest and a number of sluice vents 4 feet wide: the estimated cost was Rupees 36,640. Then it was proposed to raise by Calingulak posts the level at which water was to be retained to 3 feet above the crest, and the revised estimate amounted to Rupees 35,500. The removal of the shutters in time on the occurrence of freshes appearing doubtful, Mr. Randall wished to substitute shutters worked from a bridgeway, and the estimate for this arrangement amounted to Rupees 32,700 + 17,450 or together Rupees 50,150. Either of these revisions would have necessitated the maintenance of a considerable establishment, and as, in a case of this kind where a large drainage, 120 square miles, has

to be dealt with, it is much the better plan to have a self acting escape, it was intimated to the District Engineer that this kind of work was considered preferable, and the result is the present design which, except in some minor details differs from the original only in the height of the crest, which is 6 feet instead of  $4\frac{1}{2}$  feet above the 1<sup>st</sup> apron, the level of which latter has not been altered. The maximum flood discharge from the drainage basin may be taken at 13,685 C. F. for a second and leaving out of account the sluice vents which might not be opened when most required, the depth passing over the crest 600 feet in length will be 43 inches, the top of the band being  $5\frac{1}{2}$  feet above the crest. The margin is enough but none too much, and it is evident that had it been necessary to retain water at  $1\frac{1}{2}$  feet higher level a considerable additional outlay on the tank would have been necessary.

D-562.5.11

+ 1 foot

W. 24, para 42.

54 12  
With the 24 sluice vents open  $2\frac{1}{3}$  feet on the crest will be the maximum W.L. The only modifications considered desirable are the raising of the wings to the level of the top of the band as sketched on the plan, and the keeping of tops of the sluice shutters flush with the crest of the dam.

11. Items 4 and 5 are -

Pitching to North Channel Pipes 4,440

South — do — — 1,100

The heads of both the main channels are in very sandy soil, and at the North channel the District Engineer has proposed to carry the pitching for a length of 1000 feet. Major Oakes wished to alter this to 300 feet, but it has been explained that here there is a considerable bend, and Mr. Rundall has suggested that this work should be carried out tentatively for a length of

of 600 feet and accordingly the estimate may be reduced from 4440 to Rupees 2660.-

12 Items 6, 7 and 8 are for screw gearing for sluices and require no special notice.-

13 Items 9 and 10 are small works for passing small drainages, and they were reported to have been completed prior to January 1873.-

District Engineer's  
No. 24 - 20 Jan 73 -  
Rupees 31750.  
1873 - para 4

14 Item 11, Rupees 3,200, is for an accommodation bridge over the South Channel for the large village of Alwar Tinnevely. The circumstances were enquired into some time ago, and the necessity for it admitted. The mean width of the Channel is 45', so that 3 spans of 12 feet each are not suitable. The width, 18 feet, of roadway seems unnecessarily great: 13 feet, that of a bridge for a 2<sup>nd</sup> Class District road, will probably suffice. The design should be altered to 3 spans of 15 feet or two of 22½ feet, and with the diminished width of roadway the amount of the estimate

estimate will be about correct, as the rise, 4½ feet, of arch allowed for the 12 feet arches will be enough for either of the other spans, and the level of the roadway will be about the same.-

15 Item 12, Rupees 2500, for a bridge on the Cotton Road over the Tuticorin drain. The necessity for the work is explained by the alterations noticed in the District Engineer's letter as per margin, and it has been already completed on sanction given by the late Superintending Engineer under the circumstances noticed, and the total cost of the revised arrangements has been less than the estimated amount of those before sanctioned.-

District Engineer's  
No. 143 - para 29.

16 Item 13. Rupees 3500. Raising bund of Perungolum surplus Channel. This provides for remedying an omission from former estimates. The North main Channel crosses the surplus from the Perungolum Tank, and the water is received into the Channel, part

part being carried along the latter, and excess discharged into the Aramugam-mungalam Tank. The banks of the surplus channel are at present below full supply level in the main channel, and it is therefore necessary to raise them. It is necessary to remark that the relative levels of the water and banks are not marked on the longitudinal and cross sections, and that the margin of the latter above the former appears to be insufficient. The sections do not scale accurately, and exactly what this margin is cannot be ascertained, but it would seem to be 18 inches. Another foot may be provided by side ridging at a small cost.

17 Items 14, 15 and 16 are

Inlets - Rupees 1440.

Dam near Kulpadaigai 240.

Head Sluice ——— 240.

Dam in Porur Channel - 540.

and provide for petty works found necessary

Memo: No. 188  
para 7.

District Engineer's  
No. 24 - para 14

do. - No. 143.  
para. 26 + 27.

District Engineer's  
No. 24 - para 25.

14 necessary during the progress of the work.  
18 An additional estimate, Rupees 860, termed Repairing the Ammenpuram and Hanium tanks but which should be called improving them is requisite in consequence of the amalgamation of these small works. It was pointed out in connection with the remarks on the proposed arrangements that the difference in the level of the bunds appeared to have been overlooked, and the District Engineer has now provided what is needful.

19. General Siphon Sluice or under tunnel. This work is for passing the drainage of 5 square miles under the North main channel, and the original design provided one vent of 4 x 5 feet. It was next proposed to substitute 3 vents of 14 feet with a water-way of 56 square feet, and at the time this was reported the foundations had been laid. This waterway being considered

considered insufficient, and the level of the floor admitting of much more capacious work, the design was altered to one span of 12 feet and 9 feet high to the soffit of the arch, thus giving 92 square feet, and the under-tunnel has been so constructed. The present estimate amounts to Rupees 8840 of which Rupees 8050 were sanctioned in the first revision of the estimates, and Rupees 750 are included in the item No. 811,680, paras 4 and 5 above. No provision was however made for carrying off the water through the under-tunnel, and in the list of extra works Rupees 3800 are entered for cutting an outfall channel with a bottom width of 30 feet. A part of this work has been carried out. The water will run into the Lorkei tank which is reported to have an escape adequate to the charge of the surplus if necessary.

20. As the District Engineer has not submitted a complete abstract of

of the revised estimates the following list of works is subjoined to show clearly how the total amount recommended for sanction is made up.

N.B. The items in this list are taken from the Comparative Statement dated 15<sup>th</sup> January 1873, the District Engineer's Letter No. 143-13<sup>th</sup> December 1873 para 35 and the list of Extra works therein with forwarded.

vide para 36 of Dist. Engineer's No. 24-20<sup>th</sup> January 1873. The whole item has been put down to the Ancient.

| No. | Description             | Amount | Stems  |
|-----|-------------------------|--------|--------|
| 1   | Strivaguntam Ancient    | 172000 |        |
|     | Rough Stone             | 3000   |        |
| 2   | Groynes                 | 1540   | 175540 |
| 2   | South Channel Head      | 11796  |        |
|     | Sluice                  |        |        |
|     | Screw gearing for do.   | 754    | 12550  |
| 3   | South Main Channel      | 63956  |        |
|     | Stone pitching - do.    | 1100   | 65056  |
| 4   | Colasagarampatam        |        |        |
|     | Road Bridge             | 4085   | 4085   |
| 5   | Tricalore Siphon sluice | 1830   | 1830   |
| 6   | Tricalore Bridge        | 6042   | 6042   |
| 7   | Hadambar Head sluice    | 3115   | 3115   |
| 8   | Antur Head Sluice       | 1696   |        |
|     | Screw gearing for do.   | 250    |        |
|     | Antur Channel           | 16870  |        |
|     | Drop in - do.           | 1084   |        |
|     | do. in - do.            | 940    | 20840  |
| 9   | Trichendoor road        |        |        |
|     | tunnel                  | 1140   | 1140   |
| 10  | Yeral road - do.        | 1140   | 1140   |
| 11  | Aqueduct across         |        |        |
|     | old Antoor Channel      | 3690   | 3690   |

|    |                           |       |       |  |
|----|---------------------------|-------|-------|--|
| 12 | Gathuvoyal Calingulak     | 1559  |       |  |
|    | Rough stone pitching      | 1210  | 2769  |  |
| 13 | Poriur head sluice        | 3070  |       |  |
|    | Screw gearing - do -      | 720   | 3790  |  |
| 14 | Poriur Channel            | 7277  |       |  |
|    | - do - do. Bridge         | 3260  |       |  |
|    | Dam in Channel            | 540   | 11077 |  |
| 15 | Improving Annuram         |       |       |  |
|    | - puram and Hanam Tanks   | 860   |       |  |
|    | Annurpuram Channel        | 937   |       |  |
|    | Hanam - do -              | 3162  | 4959  |  |
| 16 | Tulukam Channel head      |       |       |  |
|    | Sluice and drop           | 906   |       |  |
|    | Tulukam Channel           | 2560  |       |  |
|    | - do - do - drop          | 555   |       |  |
|    | - do - Tank               | 2590  |       |  |
|    | - do - do. Calingulak     | 920   | 7531  |  |
| 17 | Hanam Channel             | 35450 |       |  |
|    | - do - drop               | 1350  | 36800 |  |
| 18 | Ellapanaikem Tank         | 8411  |       |  |
|    | - do - Calingulak         | 1745  | 10156 |  |
| 19 | Aoudiar Tank              | 6903  |       |  |
|    | - do - do. Calingulak     | 1846  | 8749  |  |
| 20 | Annurpuram dy.            |       |       |  |
|    | - phon sluice             | 964   | 964   |  |
| 21 | Palayut - do -            | 746   | 746   |  |
| 22 | Alwar Timmervelly         |       |       |  |
|    | Bridge                    | 3200  | 3200  |  |
| 23 | North Channel head sluice | 17930 |       |  |
|    | Screw gearing do -        | 1486  | 19416 |  |
| 24 | North Channel             | 95791 |       |  |
|    | Stone pitching - do -     | 2660  |       |  |
|    | Dam in - do -             | 871   | 99322 |  |
| 25 | Haradpadagay head         |       |       |  |
|    | Sluice                    | 1921  |       |  |
|    | Screw gearing for do -    | 250   | 2171  |  |

|    |                        |       |        |  |
|----|------------------------|-------|--------|--|
| 26 | Tattaramungalum Bridge | 4257  | 4257   |  |
| 27 | Mungalakurichy         |       |        |  |
|    | Bridge                 | 4945  | 4945   |  |
| 28 | Horkai head sluice     | 1290  |        |  |
|    | Screw gearing - do -   | 250   | 1540   |  |
| 29 | Yeral undertun         |       |        |  |
|    | - nel 8500 + 340       | 8840  |        |  |
|    | do. outfall Channel    | 3800  | 12640  |  |
| 30 | Yeral Bridge and       |       |        |  |
|    | Calingulak             | 4692  | 4692   |  |
| 31 | Causeway               | 3780  | 3780   |  |
| 32 | Siri Chandu Bridge     | 3550  | 3550   |  |
| 33 | Double dam             | 7160  | 7160   |  |
| 34 | Paliacoil road bridge  | 3503  | 3503   |  |
| 35 | Marathony Tank         | 478   |        |  |
|    | - do - Calingulak      | 2885  | 3363   |  |
| 36 | Puttakolum Tank        | 11998 |        |  |
|    | - do - Calingulak      | 5934  |        |  |
|    | - do. revtment         | 12800 | 30732  |  |
| 37 | Chinnasawmy            |       |        |  |
|    | - ken Tank             | 33644 |        |  |
|    | - do - escape weir     |       |        |  |
|    | called Opar Oday       | 39100 |        |  |
|    | dam 32700 + 6400       |       |        |  |
|    | Revtment to Tank       | 70000 | 142744 |  |
| 38 | Opar Oday embank       |       |        |  |
|    | - ment                 | 26830 | 26830  |  |
| 39 | Tuticorin Channel      | 14112 | 14112  |  |
| 40 | Distribution Sluices   | 18600 |        |  |
|    | - do - Channels        | 29000 | 47600  |  |
| 41 | Bridge on Cotton road  | 2500  | 2500   |  |
| 42 | Perungulum surplus     |       |        |  |
|    | Channel embank         | 3500  | 3500   |  |
|    | - ment                 |       |        |  |
| 43 | Dam near Heelpa        | 240   | 240    |  |
|    | - dagay head sluice    |       |        |  |

Revtment taken out of Estimate for Northern Tanks.

|    |                                                      |             |         |                                                                                                |
|----|------------------------------------------------------|-------------|---------|------------------------------------------------------------------------------------------------|
| 44 | Padugudy Bungalow                                    | 3888        | 3888    |                                                                                                |
| 45 | Land Compensation                                    | 40000       | 40000   |                                                                                                |
| 46 | Capitalized excess-<br>-ment on land taken<br>up     | 20000       | 20000   |                                                                                                |
| 47 | Damage to materials                                  | 5000        | 5000    |                                                                                                |
| 48 | Inlets                                               | 1440        | 1440    |                                                                                                |
| 49 | Sundries including<br>Tools and Plant-<br>Contractor | 31621       |         |                                                                                                |
|    | Departmentally -                                     | 8156        | 39777   | 39777                                                                                          |
|    |                                                      |             |         | Rs 40937 Item No 61 of Compara-<br>tive Statement - 15 January<br>1873 less Contractor - 31621 |
|    |                                                      |             |         | Store shed - 32<br>Overseers Bungalows - 1107<br>uneven item - 1.                              |
| 50 | Temporary shed                                       | 3700 + 1159 | 4859    | 4859                                                                                           |
| 51 | Petty Establishment                                  | 42000       |         |                                                                                                |
|    | Engineering - do -                                   | 59150       | 101150  |                                                                                                |
|    |                                                      |             | 1040480 |                                                                                                |

The difference between this total and that mentioned in para 5 above is thus explained.

|                                                                                                                     |        |         |
|---------------------------------------------------------------------------------------------------------------------|--------|---------|
| Total in para 5                                                                                                     | Ruppes | 1050620 |
| Deduct error in the excess amount required for Yeral Siphon since this excess being 8840 - 8500 and not 8840 - 8090 |        | 340     |
| Item for raising Anicut                                                                                             |        | 410     |
| Under Siphon platform bridge                                                                                        |        | 4400    |
| Reduction of stone pitching North channel                                                                           |        | 3550    |
|                                                                                                                     |        | 1780    |
| Revised Total Ruppes                                                                                                |        | 1040480 |

The District Engineer should now prepare an Abstract exhibiting the works in their proper order thus-

- 1 The Anicut and all its works.
- 2 The South Channel and all its works, Each branch of the South Channel with all the works, tanks &c there- to appertaining in their regular order.
- 3 The North Channel and all its works, Each branch of the North channel and all the works, tanks &c belong- ing to it and them, in their regular order.

and then a classified abstract di- viding the works into the heads required to be shown in the Budget and accounts.

Much more time than should have been necessary has had to be devoted to the examination of these estimates, owing to the absence of any abstract estimate, to connected works not being placed

placed together and to unconnected works being amalgamated. Thus the item rough stone 3000 Rupees is stated to belong principally to the Anicut, and to a small extent to the escape (Copar Oday dam) of a tank a great many miles off; and again the revetments of two tanks are put into one estimate without the cost of each being shown separately, although other items for each have to be added to the shares in the revetment estimate. The account Department cannot possibly deal with items thus jumbled up together.

21. With regard to the returns to be expected from this project, the latest information available is contained in the Collector's report to the Board of Revenue dated 31<sup>st</sup> May 1872 No. 224 in which the additional revenue is estimated at 16,000 Rupees or over 15 per cent. Government have called for detailed Revenue Statements in the form

vide para 11  
Lieut. Shepherd  
report No. 22  
dated 15 Jan  
1873-

31<sup>st</sup> May 1871  
11/11/71  
form in which those for the Godavery  
Delta have been prepared; and when these are received and the standard revenue, with which that obtained after the construction of the Anicut or opening of the main channels for irrigation, is to be compared shall have been determined, a more definite idea of the effect of the works will be obtainable.

22 With these remarks this latest revision of the estimates is submitted for sanction.

Potacamund  
25<sup>th</sup> April 1871.

Wm. Lins Lieut. Col. R.E.  
Chief Engineer for Irrigation.

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

Pub. Works 1874 Sept.  
Project for No. 2971

From

The Chief Engr. for  
Irrigation

Dated 25 April  
Received 19 May

No. 292 A

U. No. 165899. 8-6-74

Note on the  
Revised Estimates for  
the Strivigantam Project

No. 143

District Engr's Office, Tirunelveli  
Palamcottah 13<sup>th</sup> December 1873.

From,

J. W. Randall Esquire.  
District Engineer Tirunelveli.

To,

Lieut. Colonel J. Mullins R.E.  
Chief Engineer for Irrigation D.S.W.

Sir,

I have the honor with reference to your  
Memo No. 188 of the 25<sup>th</sup> March last, to retransmit  
the papers connected with the Strivigantam  
Ancient Project Revised Estimate, and to supply  
such additional information as it is possible for  
me to afford with reference to your remarks in  
the Memo under reply.

1. I send also all the plans and sections connect-  
with the first revision forwarded to Major Baker  
by the Superintending Engineer, late 8<sup>th</sup> Division.

2. The Sections have been redrawn and reduced  
to the mean Sea Level. The masonry works and  
other details have been shown as constructed and  
I trust you will now find them sufficiently clear.

3. The first point to be noticed is the question  
of the supply of water reaching the Ancient.

4. Lieut. Shepherd's observations were based on  
a Register of the height of water in the River and he  
knowing the height of Ancient from time to time, -  
deduced the information recorded in the tables at -  
ready

Enclosures. 2  
List, one of  
Plans and Es-  
timates of 1<sup>st</sup>  
Revision and  
one of other  
documents.  
Sent by Dan-  
phy.

OK 121

Ans 8 May 170



data, to be so much more than we have found it.  
For 31 days consecutively in September and October  
the discharge was below 30,000 cubic yards per hour,  
the minimum being 12,000, so that the statement  
in para 3 of Major Prendergast's Memo is clearly  
wrong, the minimum discharge being 90 cubic feet  
per second instead of 198.

14. With regard to the question of storage in the  
Tanks, it was originally proposed. (See Major Prender-  
gast's Report) that the North Tanks should con-  
tain 15,000,000, and the South Tanks 20,000,000 cubic  
yards. During the execution of the work the Tanks  
banks were raised and alterations introduced, by  
which Lieut. Shepherd calculated the storage  
would be increased to 11,200,000 cubic yards on the  
North and 28,000,000 on the South. As however these  
were only approximations, and as it seemed advisable  
that the storage should be accurately known, I  
wished before resubmitting the papers to have the  
Tanks contoured and their capacities properly  
determined. The list which accompanies this  
shows the capacities of the Tanks at the maximum  
level at which it is proposed to maintain them.  
Only 3 Tanks could not be contoured, on account of  
water in them, viz the Kondei, & Anamangamangal.  
One on the North and the Kadamba on the South  
Side. I believe however the capacities given to be  
very close approximations.  
15. The result is that the storage is not as much

as Lieut. Shepherd estimated it to be, on the North  
Side it is 28,000,000, on the South 25,000,000 cubic yards.  
The greatest difference between the actual and  
estimated capacities is in the Kinnaswamy  
Kutchen (or Kinnaswally) Tank, which is shown  
to be 15,200,000 cubic yards against 30,000,000 estimated  
by Lieut. Shepherd. This partly arises from my  
having reduced the proposed maximum level of  
this Tank from +20.90 to +19.40. The reasons for  
this change will be explained when noticing the  
Upper Oday dam.

16. For the Rice or S.W. Monsoon crop, we shall  
have to depend entirely on the River, and cannot cal-  
culate on receiving water from the River falls. I  
forward a statement showing the Rain registered  
at Ottapadaram and Tuticorin during the last 10  
years. The Rainfall at Ottapadaram may be as-  
sumed to that of the Upper Oday basin, that at  
Tuticorin may be assumed to be the amount of  
Rainfall which would assist in raising the crops.  
From this statement <sup>it will appear</sup> that it is only in the North  
East Monsoon, that the Tanks will receive any sup-  
ply, and that principally on the North Side. The  
Kadamba is the only Tank on the South Side, which  
can receive much rain water. The other Tanks are  
bounded by the Sand Hills called the Tiv, off which  
the Rainfall comes only slowly and in the shape of  
springs, which are already used for garden cultivation.

17. On the North side it is proposed to cultivate 20,000 acres, and assuming for the Khar crop 50 cubic yards per diem to be required for 90 days  $\frac{90,000,000}{28,000,000} = 3.2$  times, the Tanks will have to be filled to bring the crop to maturity or for the Peshawar crop of 150 days  $\frac{150,000,000}{28,000,000} = 5.3$  times

18. It will be sometime before the 20,000 acres extent of cultivation are reached but we must now arrange for the total area.

19. Similarly on the South side with 13,500 acres, the Tanks will have to be filled 2.4 times for the Khar and nearly 10 times for the Peshawar crop.

20. It does not seem to me possible to state positively that a certain supply of water will be available in the River for a certain number of days. Situated as the Strickland and Anicut is, the last over River which has already 7 anicuts across it, and on every feeder of which there are numerous Anicuts, the flood water is really what we have to depend on; and as originally designed the height of Anicut and the dimensions of the channels and sluices, are not proportioned one to another.

21. As the cost of raising the anicut will be so small about Rs. 11,000 and the extra affluence and velocity over it will in no way endanger the stability of the work, I trust there may be no hesitation in sanctioning it.

22. With regard to the remarks in para 10 of your Memo under reply, I would beg to state that the

the 13,000 acres of old irrigation, was not cultivated entirely from independent sources of supply. On the north side the cultivation was supplied by the Nilpadugay and Kharai channels, on the South by the Tentupuri and Ahtur channels all of which are merged into the North and South Main Canals respectively. The independent supply was uncertain and precarious being the surplus from the Mawad-Melakul and Melakul.

23. With regard to your para 5 I would beg to point out that the 10 northern Tanks are really divided into 3, with Calingulas between each. The old Puzkulam and Bullanthony Tanks form one, the Pottakulam the second, and the Chinnaswamy Kachent (or Korumpallam for I regret to say it is called by both names) the third. I have, bearing in mind your instructions with regard to the Upper Oday dam reduced the maximum level of the latter Tank by 12'. I think it is very advisable to do this as the material of the bund is very inferior and the Tank very considerable in area & capacity, even allowing the water not to stand as high as was proposed by Lieut. Shepherd.

24. With regard to your para 6, I have the honor to enclose the Statements shewing the details of Petty Establishment as charged month by month to the Anicut Estimate. An G. O. No. 3906 of the 15th December 1868, sanction was accorded to the entertainment of a First Class Range Officer for the Project, and

and this was kept up till the 1<sup>st</sup> December 1872, when Lieut. Shepherd became 2<sup>nd</sup> Range Officer on the general District Establishment. It was of course necessary to maintain assistants to supervise the work under execution, whether by the contractor or departmentally; and the Superintending Engineer was authorized by the Chief Engineer for Irrigation to do so. Vide Col. Anderson's Memo No. 105 of the 30<sup>th</sup> November 1868. I have already in my previous letter of the 18<sup>th</sup> January 1873 stated that I consider this Establishment was on too extravagant a scale, and I reduced it after my arrival.

25. The other Statements you require are also forwarded, viz one showing the cost of engineering Establishment, and one the various items charged off to Sundries. There are some items of the latter on which recoveries can be made and these will be made as soon as possible.

26. With regard to your para 7, I have the honor to state that though the general of the Ammavaram Bund is high, both it and the Kainam Bunds require raising in some places. I have had the levels taken and the longitudinal section of both Bunds is included in the Book of Sections now forwarded. The work required is only Rupees 800, for which sum an estimate is likewise submitted.

27. As requested general Maps, one for the South side and one for the North Side have been prepared; in these all the works as carried out are shown, also the old and proposed irrigation. The part colored yellow indicates rather the position than the precise area of the new cultivation. In some places a much larger <sup>portion</sup> of the ground can be cultivated than in others.

28. The Estimate for General Siphon Sluice has been prepared as directed by you and the work has been completed accordingly.

29. The circumstances of the Perungulam Surplus Channel, will I think be understood from the Map and Sections now forwarded. The Perungulam is the last of the series of Tanks under the Marudai Nilakul and its surplus formerly found its way into the Aramugamangalam Tank, but is now intercepted by the Northern Main Channel. The work called the Bridge and Kalingulak being intended to pass both the regular supply, and as much of this surplus as may be necessary, to the Aramugamangalam Tank. The Perungulam surplus Channel had a small embankment on both sides for part of its length, and for part on the South Side only. This Bank was very low, and would not admit of the water being kept at the intended level in the Main Channel. The raising of the Bank should have been included in

in the original Estimate, but was strangely overlooked both in it and in the first revision. The Perungulam Surplus may amount to as much as 100,000 cubic yards per hour, in which case the North Channel Head Sluice will have to be partially closed, and the water passed on both through the Bridge and balingulah & down the channel to the Paykulam and other Tanks. The longitudinal section of the proposed embankment has been redrawn, and embodied in the general Book of Sections. The Aicut referred to by you in your Memo under reply, is a dam across the channel near its head, for diverting water to the channels on either side. The new Road from Stravigundam to Yeral will pass over the South Bank of this surplus channel. The extra earth to form the Bank to a proper width for a Road has been provided for in the Road Estimate.

30. With regard to the Upar Oday dam I quite think the flush balingula as ordered by you is the best arrangement. The screw Shuttles were proposed by me in lieu of the dam Stones and planks proposed by Lieut: Shepherd, and included by him in his first revised Estimate. Bearing in mind the soil of which the bund is composed, and the considerable capacity of the Tank, I think it would not be advisable to fix the level of a flush escape higher than +19.40. The bunds are already +23.90 and the revetment Estimate provides for raising them

with  
baga was 20-70

24  
to +21.90, with this height the water might be allowed to rise to +21.40. Two feet passing over the weir with the under Sluices open would discharge 11,259 cubic feet per second or 11,259,000 cubic yards per hour; a discharging capacity sufficient in any case, taking the catchment basin of the Upar Oday at 120 Square miles; but ample, I believe, when it is remembered that the Tank itself will act as a regulator. The work has during the past season been built to a height of 14' above the floor of Vents, leaving 2' 0" to be added or such a height as you may determine upon.

31. The Estimate now sent provides for carrying out the work with crest at +19.40 and amounts to Rs 39,100. This is in excess of the revised Estimate. The excess is due firstly to increase in the rate for cut Stone, which we have every where found the most difficult part of the work to get executed, secondly to my having allowed for plastering the wings with Portland Cement, which is necessary owing to salt having already attacked the brick work. The previous Estimate did not allow for the Iron bars to Vents nor for Shuttles for them, Screw Shuttles having been provided in a separate Estimate of Rs 17,450, which will not now be required.

32. Lieut: Shepherd omitted the 2<sup>d</sup> Drop in the Aicut Channel & shewed the amount of the Estimate as saving. This drop is in my opinion necessary, and I forward plan and Estimate amounting to Rs 970 for it. Without it the fall would be too heavy in the sandy channel below.

below the first drop, between it and the S. theroyal  
channel.

33. The Estimate for the Siphon Sluice at Goral  
amounts to Rs. 8,840; the increase is due to there  
having been no proper allowance in the previous  
estimate for making up the banks over the sluice  
for the centerings & for baling.

34. I must also ask you to increase the sum for  
field channels to Rs. 29,000. These channels have now  
been marked out and the levels taken. We had previ-  
ously calculated on the ground being of a tolerably  
uniform slope, but find that in many places,  
heavy embankments have to be made, and that on  
an average the cost will be about Rs. 1,000 per mile  
including drops and sluices. The length of channels  
altogether will be 29 miles.

35. In Lieut. Shepherd's Comparative Statement  
forwarded with my letter of the 18<sup>th</sup> January, Rs. 7,94,590  
is given as the total of the old estimates, to this must  
now be added the increased amounts noted above viz

|                                    |         |        |
|------------------------------------|---------|--------|
| 2 <sup>nd</sup> Drop Akkur Channel | Rs. 940 | ✓      |
| Increase on Siphon Sluice          | 750     | ✓      |
| Upair Oday Dam                     | 6,400   | ✓      |
| Small channels                     | 9,000   | ✓      |
|                                    |         | 17,090 |

This will make the total of the works originally in-  
cluded in the first revision Rs. 8,11,680, or less than the  
original estimate by Rs. 19,920.

36. Four of the extra estimates prepared by Lieut.  
Shepherd have been revised by me viz

1. Raising the amount increased to Rs. 11,000.  
this is due to the rate for brick work having been  
altered to Rs. 11-5-0.

II. Perungulam Surplus embankment Rs. 3,500  
instead of Rs. 3,100, the increase here is chiefly due  
to the extra provision for protecting the Village of  
Sicathundar.

III. Dam in Purur Channel Rs. 540. In this I  
have lowered the floor as Lieut. Shepherd allowed  
a fall of a foot in the surface in the lower part of  
the channel, even when the Ammanpuzam Tank  
was full, the fall would be greater with the Tank  
empty, and would probably cut up the channel.

IV. I have also revised the estimate for the Tank  
revetments first because I think that in Lieut.  
Shepherd's estimate the 2 to 1 slope was commenced  
at an unnecessarily low level, and that a saving in  
quantity could be effected, and secondly because  
I do not think the work can now be done at the rates  
allowed. It could have been done for Lieut. Shepherd's  
rate, had the work been carried out simultaneously  
with the bunds. Both the Kattumallay & Puthukottai  
Hills from which stone and gravel will have to be  
brought are situated above the Tank, and thus  
stone for the greater part of the work will have to be  
carried round it. At the return of the Bank, where  
the water will be shallow, I have allowed only gravel

or small stone pitching. The estimate now amounts to Rs. 82,800 against Rs. 75,900.

37. I have also added two more estimates, one for the Annampuram and Kananur Tanks already alluded to, and one for deepening out the Tachce from the Goral Siphon Sluice to the Koonchi Tank. The old channel was quite insufficient to pass the water off. In your memo under reply you say Major Ryce's formula would allow for a drainage of 8 inches in 24 hours through the Siphon Sluice but supposing this rain all to occur, it would hardly run off puddly land all at once, the field banks would assist in retaining it. As the ground above the Siphon Sluice is flat, the water would stand back for a considerable distance. It is proposed to make the channel from the Siphon Sluice 30' at bottom with slopes 2 to 1 with 9" fall per mile, to carry after unusual, but not extraordinary, rains 3 1/2'. The water level in the channel would in this case be 1.6 ft above the rear cistern wall, and in front the water would stand 1.6 ft + 1.25 = 2.85 above the upper cistern wall, that is about 2' over the cistern. This would only be for a short time. In order to render the Siphon Sluice effective this year it was necessary to clear the old channel partially this has been done by digging the channel for the first 1/2 mile to half width. It will be seen that the water from the Siphon Sluice is picked up by the Koonchi Tank, the Calingula of this Tank is capable of discharging the surplus should much

much water come down when the Tank is full.

38. The estimate amounts to Rs. 8,800 and should have been included in the original estimate.

39. The total of the extra estimates thus comes to Rs. 117,790.

40. In all the extra estimates forwarded provision has been made for the petty establishment required, but to cover past expenditure the whole sum required will be about Rs. 14,000, the total expense of the Project may therefore be considered to be

|                     |                 |
|---------------------|-----------------|
| Original works      | Rs. 8,11,680    |
| Extra works         | 117,790         |
| Establishment Petty | 14,000          |
|                     | <u>9,71,470</u> |

41. This is Rs. 14,000 more than Lieut. Shepherd's Total, but the corrections made are all necessary and such as my present experience of the work leads me to believe to be essential.

42. I should mention that the following extra works sanctioned by the Superintending Engineer & late 8<sup>th</sup> Division from anticipated savings have been completed.

|                                                         |              |
|---------------------------------------------------------|--------------|
| Screw gearing for North & South H <sup>rs</sup> Sluices | Rs. 2,240    |
| Do. Puri's Head Sluice                                  | 720          |
| Siphon Sluice at Palihak                                | 746          |
| Do. Annampuram                                          | 964          |
| Bridge on Kotton Road                                   | 2,500        |
|                                                         | <u>7,170</u> |

43. A portion of the work on the Perungulam Surplus Embankment

embankment of Sycamore Sluice Tailrace have  
also been carried out, as the water could not have been  
let down the North Channel without the work being  
done.  
I shall feel obliged if you will let me have the  
Books of Sections back to have tracings made from it  
for my Office. The sections are all drawn to the previous  
datum (Head Sluice floor) and I am unwilling to  
retain these papers any longer while copies are being made.  
I regret the time which has elapsed in answering  
your Memo, it was only in November that the Tank  
Contours were completed by Lieut. D. B. D. with-  
out which information the papers could not be sent  
to you.

I have the honor to be  
Sir

Your Most Obedt Servt

H. W. Rindall  
District Engineer  
Truro

21/11  
No. 105 230 Nov/68 sent with the Ch. Engr  
date printed with No. 1498-8 Jan'y 4.

Thom.

The District Engineer  
Sincerely,

To,

The Chief Engineer  
for Irrigation.

Dated 15<sup>th</sup> }  
Received 15<sup>th</sup> } December 1873.

Retransmits the  
papers connected to the  
Sitting ground of the  
Project with additional  
formation.

No. 1498 & 1499 4/8 Jan'y 4

No. 1498

MEMORANDUM.

Requested for reference the under-mentioned papers :-

No. 105 230 Nov/68 sent with the Ch. Engr  
date printed with No. 1498-8 Jan'y 4.

OFFICE OF THE CHIEF ENGINEER  
FOR IRRIGATION,  
11-5-1873.

D. H. Williams

Head Clerk.

To

The Registrar of the *W. L. S.*

The undersigned has the honor to acknowledge the receipt of the letter No 24 of the 20 Inst. last ~~with~~ from the D.E. Trimmely forwarding a revision estimate further stringency amendments, and to request that the following observations may receive early consideration

2. In reply letter No 106 of the 3<sup>rd</sup> July 1872

- 4. Major Oakes asked that the plan & estimate of the 1<sup>st</sup> revision might be returned when the 2<sup>nd</sup> revision was submitted. This plan of Supplement has not been done and the Chief Est. is at Lyral.
- Sheet Longitud. of the left unable to understand the topographical section of Bank of Perungallem given in the letter of the D.E. and the surplus channels of the river are given.
- Sheet Cross Section of do - do - The information given does not enable Mr. Stephens' calculations of water supply to be checked. A number of statements of annual crop & days on which there will be a full supply and a half supply have been submitted, but what is really required is a statement of the quantities of water in each month reaching the Anicut, showing also what remains of it or of that portion not in excess of the capacity of the channels, what quantity will remain

at the commencement of the season of cultivation,  
 in the tanks, <sup>with</sup> the receipts and disbursements  
 of water up to the close of the season - The  
 Sanyama Project in India <sup>is</sup> a very similar  
 scheme and the balances connected with it  
 showing how the calculations of water available  
 & required were made are herewith forwarded  
 no correct deductions can be made from  
 statement, which do not profess to deal  
 except in a rough way with half & whole  
 day supplies. There are no signs of the river in  
 this official in the absence of information as  
 to the state of the river in each month  
 in calculations can be made here. It  
 Shepherd has made careful observations for  
 5 years there must therefore be particulars  
 of the discharge of the river for a period over which  
 a tolerably reliable average for each month may  
 be founded - ~~There is a certain amount of~~  
~~which is not to be taken into account~~ When it has been  
 shown for how many days in each month the  
 water will stand at the lower end of the  
 amount with the supply which will be drawn  
 off by the upper and lower channels respectively  
 and kept on for many days the water will be  
 above the crown with the crown bounding supply

30. 1870  
 of 27 July 70?

1870 &  
 1871

in the channels, the total <sup>river</sup> supply <sup>with</sup> <sup>the</sup> <sup>total</sup> <sup>supply</sup>  
 known - It may, as has been shown elsewhere,  
 be assumed that it will suffice of the total supply  
 required by the lands under irrigation in any  
 10 days be provided during that period, but is  
 that a short supply for a long part of this  
 limited period will do no harm if compensated  
 for in the remainder of that period. Also that  
 2 cu. ft. an acre an hour will be enough for  
 the field channels and that on the average  
 the ear crop will want water for about 75  
 to 80 days and the Peshawar for 105 to 110  
 days - The Kistna experiments at Chubole  
 show that the quantity of artificial supply  
 required is much less than has generally  
 been assumed to be the case - It will not  
 do to ignore either the rainfall supply of the  
 Tanks or that which the fields obtain directly  
 and the average rainfall of this part of India -  
 Valley should be taken into account in estimating  
 the state of the supply in the Tanks in any month  
 though it will be best to assume that only a fourth  
 or a fifth at most of the drainage due to rainfall  
 will be utilized, while where the catchment  
 basin is sandy a considerable portion of the  
 water is lost.

4. To the Chief Engineer it would seem that the conclusion arrived at in the 6th item of Col. Lefebvre's letter No 22, viz that an average supply of 25000 cgs of water will suffice only for the 13,000 acres of land irrigated by the Ancient was constructed, is very strong evidence that this officer's deductions are not to be relied on. ~~It is not evident that the~~ ~~the supply~~ That area was before cultivated from independent sources of supply and the water thus obtained must be an important element in the calculations. Until much more detailed reliable information is obtained that into a shape which will admit of its being thoroughly understood it is impracticable to say either what amount of storage <sup>needed</sup> is required or whether the present level of the Ancient is adapted to the requirements of the cultivation.

5. With regard to the proposal to unite all the northern tanks & as the undersigned supposes, to have one watercourse from end to end, it must not be forgotten how serious a matter a breach under such circumstances would be and it may therefore be desirable to connect them only by sluices or weirs, so that their whole contents may not be lost should an accident occur at any point in a long line of

- many miles of bank.
5. In view of the 16th of the 3 July Major O'Brien requested that a statement showing the details of the Petty and Officer establishments provided for the period estimate might be forwarded and this should be done, and in addition to this there should be a further statement showing the cost of the Engineering staff up to date & better future up to the completion of the work. It should at the same time be explained how the provision for sundries has been disposed of, as it would seem that the former part of not all of the Petty etc. employed on the work themselves should have been paid from this source. The authority for the continuation of the Petty establishment with duties should be explained.
6. In connection with item 2 of the minute estimate, it may be remarked that the original Provisional Section shows a difference of level of 2 1/2 feet between the Ancient passage to Carnam Tanks, but no item for raising the level of the latter can be traced.
7. The remark against item 3, in the comparative statement appears to show that the whole of the amount of the estimate ought not to have been entered as a deduction, seeing that it was not substituted.

g. A general map of the project as carried out should be prepared. Without this it will hardly be practicable to make the alterations which have been made intelligible to the Govt. of India. Longitudinal sections showing the channels as excavated, with all the masonry works duly noted, are also required and the horizontal section of these should be made as to allow of all necessary information as to levels being clearly entered upon them.

1. The Goral Syphon sluice.
2. - embankment of Perungulam  
Surplus channel
3. - raising of the Othar Odai dam  
to crest level.

water, but when an opening is made under a canal for the purpose of drainage it should either be of ample capacity or it may in some cases be considered advisable to allow a breach in extraordinary seasons rather than incur the expense of providing sufficient waterway. Here Major Reyer formula would allow for drainage of 8 inches in the 24 hours, and in such a flood the water would rise considerably above the level of the top of the banks, before the head would be sufficient for the discharge. As the floor has been placed at below a level it will be as well to utilize the space available and instead of 3 vaults of 4 feet one vault of ~~12~~<sup>12</sup> feet with abutments 5 feet high & a round rim of 4 feet should be substituted and the waterway will then be about 92 instead of 56 sq. feet: the abutments may be made 4 ft high with 20 ft walls at the base on the outside of thick ~~at 2 ft spacing~~ <sup>with 20 ft walls at the base on the outside of</sup> 6 ft at floor level, and the work on this arrangement may be done as with wheels as the bricks are reported to be good the cut stone facing to the abutments may be omitted & plastering substituted for the surface. A round section - the crown of the arches will be 6 inches below bed level & can be covered with thickening of concrete.

2<sup>nd</sup> work: the circumstances of this are not understood - no water lines or levels are shown on the sections, and no work of any kind is shown on the original longitudinal section of the North Channel - a sketch survey with the levels marked elsewhere and in the elucidation of the arrangements. Judging from the rough ~~original~~ general plan forwarded with the original project the North Channel crosses the embankment close to the river and the ancient marked on the longitudinal section would be in the right bank of that channel, but if so the section is anything but clear - the sections are returned herewith.

Before Odey dam - From 45 of the D.E.'s letter before to this - in it in speaking of the sanctioned work it is said that the dam stones stopped  $\frac{3}{16}$  of the water way below the design shown in the Migration Series No 4 there are no dam stones, but on the contrary a flush crest with 20 vents of 4 ft in it. The undersigned thinks that a flush escape, self acting, is the proper description of work as, in dependence of the cost of the shortening & paring, a considerable establishment would have to be maintained to

work these latter - probably from the fact of the ~~work~~ ~~being~~ until it has been finally determined what extent of storage is required on the north side of the river it is not practicable to determine the exact height of the crest of this work, but the D.E. is authorized to raise it to such a level as may be necessary to retain water for the requirements of next seasons cultivation, and it is presumed that by so doing no reduction of height is likely to be afterwards necessary.

Bye. 28/3/73

From the St. George's Harbour  
Rec 650-22 of 173.

No 188.

From the St. George's Harbour  
13 Dec 70 A 11:2171

To The District Judge  
New Timmerly

dated 25<sup>th</sup> Mch 1873  
Depd - 4 " " "

Operations on the revised  
estimate for the Stee-  
riguntum Ancient works -

Paper estimated

Rec 106. 8.20 Aug 73-4.26.

Rec 406. 1.21 Aug 73-4.57.

8 June 1874 1498  
1499

Enclosures to No 1499, dated  
8<sup>th</sup> June 1874 regarding the  
Streevigoonthan Ancient Project.

- 1 Detailed & Ab. Estimates. (No, stitched into 3)
- 2 Statement shewing the capacities of the Tank
- 3 Estimate for constructing Surplus Channel
- 4 Statement shewing the cost of Engineer  
ing Establishment
- 5 Comparative Statement shewing the  
differences between the sanctioned  
& Revised Estimates.
- 6 List of extra works required.
- 7 Specification & Detailed Estimate for  
rebetting the Northern Tanks.
- 8 Detailed & Ab. Estimates for constructing  
a Siphon Sluice at Yerabali.
- 9 Specification & Estimate for constructing  
a Drop at the end of the Poroor Channel.
- 10 Specification & Estimate for enlarging  
the race from Siphon Sluice  
at Yerabali.
- 11 Specification & Estimate for repairing  
Armanpuzha & Karanam Tanks.
- 12 Detailed & Ab. Estimates for con-  
structing a dam across the  
Elpari Odan.
- 13 Specification & Estimate for construct-  
ing a Drop in Northern Channel.
- 14 Statement shewing the various items  
charged off to sundries.
- 15 Statement shewing the Rainfall  
in each month from 1863 to 1872 at  
Ottapedarum & Tuckearin.
- 16 Particulars of working Establishment.
- 17 Diagram shewing the daily supply  
in Tambapuzha from June to Oct 71.

18. General Plan of Inlet.
19. Plan of Dam required near Keelpa-  
dagay Head Sluice.
20. Plan of Dam in Porier Channel
21. Plan showing Section of proposed  
acretment to Northern Banks.
22. Plan of Upas Oday Dam
23. Plan of 2<sup>d</sup> Drop proposed to be  
built in Arthur Channel
24. Plan of Drop proposed to be  
built at the end of Porier Channel
25. Plan of Syphon Sluice under  
Northern Main Channel at  
Geral.
26. Map showing the old & propo-  
sed New Irrigation under the  
North Channel.
27. Plan of a Syphon Sluice to be  
constructed at Ammimpuram
28. Plan Section & Elevation of proposed  
Bridge near Alvarunnavelly.
29. Plan of a Syphon Sluice to be  
constructed near Piliput.
30. Section showing Rough Stone Pitch-  
ing in North Channel near  
North Head Sluice.
31. Plan of a Flatiron Bridge of  
6 vents each.
32. Details of Shutter for North &  
South Head Sluices.
33. Details of Shutter for the Arthur  
Keelpadagal & North Head  
Sluices.
34. Details of Shutter for the  
Porier Head Sluice.

The above referred  
to the Govt of India  
18/7/74

1498 P. M. D.

# Proceedings of the Madras Government

From The Chief Engineer for } H.E. to 7 25 April 74  
Irrigation

Ordered that the  
Government of India  
be requested to sanction  
the revised estimates  
for the Struviguntam  
Anicut project amount-  
ing to Rs 10,40,480,  
which sum includes  
all direct charges  
on account of this  
system of Irrigation.

2. The remarks of the  
Chief Engineer for Irrigation  
should

should receive the atten-  
-tion of the District  
Engineer, Tinnevely  
who will be careful  
that the Chief En-  
-gineers and Controller's  
offices are furnished  
with general and classi-  
-fied abstracts of these  
revised estimates at  
an early date -

Wm. 9/5/74  
C.M.

To the Chief Engr. for Govt.  
• D. E. Tinnevely ✓  
• Controller ✓  
• Revenue Dept. ✓  
S. Copies despatched 16/5/74.

Ad - 18 May/74 121-123.  
RD 18/5/74  
C.M. 9/5/74

1499.

To

The Secretary to the  
Govt. of India P. B. D.

Sir

Adverting to the corres-  
-pondence quoted in the mar-  
-gin, I am directed by His  
Excellency the Governor in  
Council to submit plans  
with revised estimates amount-  
ing to Rs. 10,40,480 for the  
Shrirangapatna Ancient Bazar  
in the Tinnevely District.  
The original estimates for  
which

From

Govt. of India No. 5337/11 Feb 7/79.  
" " " 10160 3742 Aug 1/79.  
" " " 143 3726 April 7/72.  
" " " 181 3718 Aug 7/72.

which amounted to Rs.  
8,31,600 and was sanctioned  
by the Government of  
India in their letter no.  
531 dated 11<sup>th</sup> February 1867.

The accompanying  
<sup>Note</sup>  
~~Explanatory~~ by the Chief  
Engineer for Irrigation with  
the Proceedings quoted  
therein will explain the  
history of the Project since  
its original sanction, and  
the deviations which have  
from time to time been con-  
sidered necessary. ~~and~~  
The information  
will it is hoped be found  
given ~~is~~ full and complete, and  
~~it is unnecessary~~  
~~to repeat in this certificate~~  
I am accordingly to request  
that

51  
that the sanction of the  
Government of India may  
be accorded to the <sup>difference</sup> ~~excess~~  
of Rs. 2,03,000 ~~under the~~

and to point out that, as explained ~~in the~~ ~~information afforded~~,  
in para 6 of the Note on the  
estimates, the actual excess above  
the total cost as calculated  
when the original estimates  
would not have been sanctioned  
is about Rs. 73,000 only.

The statement given  
in paragraph 20 of Col.  
Mullins' Memorandum  
shows how the total amount  
recommended for sanction  
is made up, but as this is  
not exhibited under the  
classified Budget heads  
the S<sup>r</sup> Engineer has been  
called upon to submit a  
revised abstract showing  
the works in their proper  
order, and this abstract  
will be furnished for  
record in the Office of  
the

The Chief Engineer for  
Irrigation and the Con-  
troller of P. H. Accounts.

From the latest in-  
formation available the  
additional revenue due  
to the Project is estimated  
at Rs. 15,000 or over 15 per  
cent, but detailed State-  
ments have been called  
for, upon the receipt of  
which a more accurate  
comparison will be made  
and a better idea obtained  
of the effect of the works.

W. 14/5/74

W. M. W.

The Secretary  
to the Irrigation  
Department

6 d. Copies of 25 Copies of present  
proceedings despatched 23/7/74  
(No more forwarded)

Q. 18 July 1874

123

2971

Gobt. of 1874 Madras.  
PUBLIC WORKS.

To  
The Secy to the  
Govt. of Madras

Dated

Recd.

Encl.

6. 8. June 1874  
1498  
1499

Nos.

1231

My dear Sir

2 Government of India  
kind to sanction the  
1 Estimates for the  
Project amounting  
140,480 -

3 I am very re-  
luctant to furnish the  
Chief Engr from  
the Acc'ts with  
the abstracts  
of the same at an early