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HISTORY

OF THE

PENNAIR ANNICUT AT NELLORE

FROM THE ORIGINAL PROPOSAL TO THE SECOND

FAILURE IN OCTOBER 1858.

PUBLIC WORKS DEPARTMENT,

GOVERNMENT OFFICE,

7th February 1859.



# PENNAIR ANNICUT IN NELLORE.

## ORIGINAL PROPOSAL.

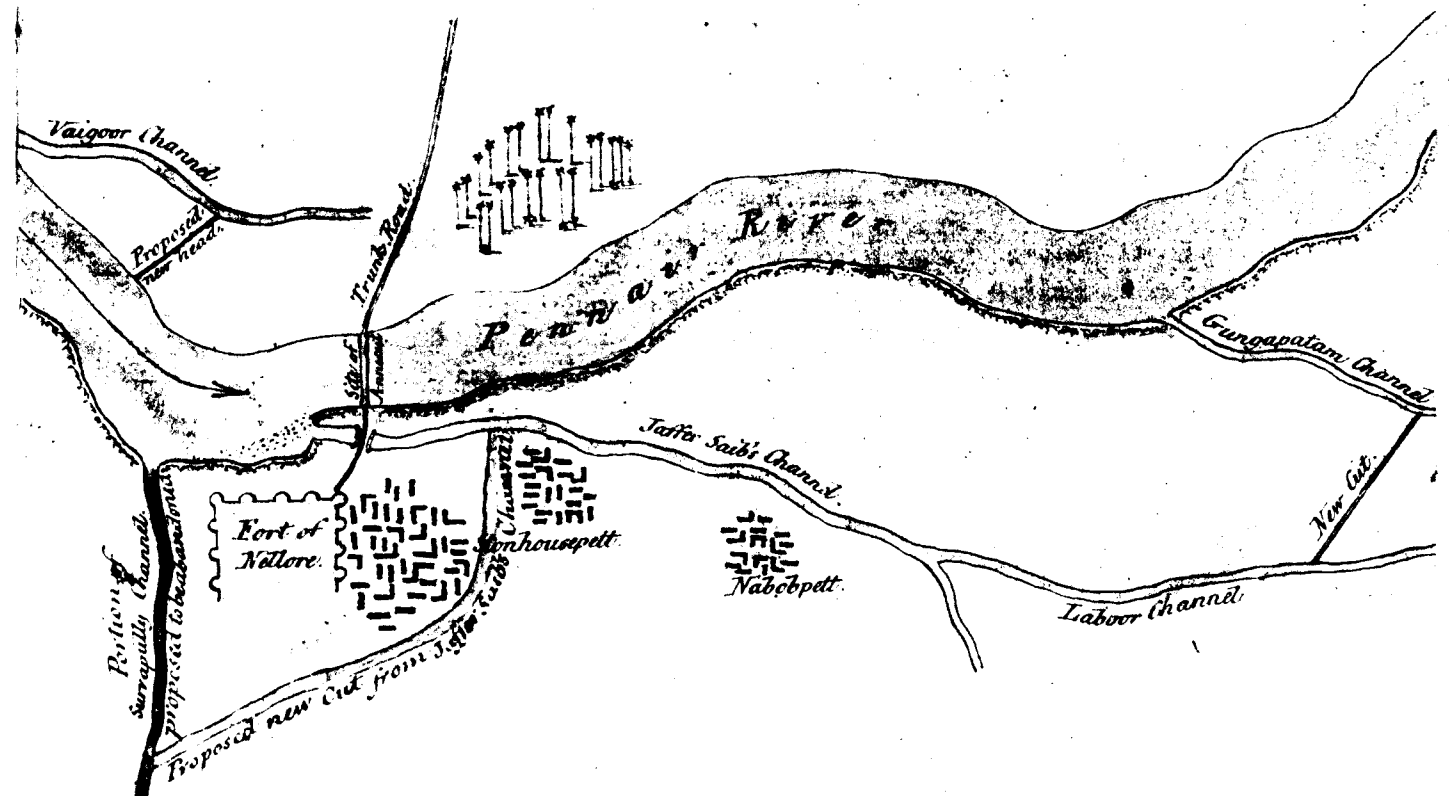
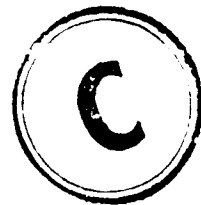
1. The proposition to build an Annicut across the Pennair was originally brought forward in 1849 by Captain (afterwards Major) DeButts\* when Civil Engineer of the 2nd Division. The River supplied water to a certain number of Irrigating Channels, upon which much land was dependent for cultivation; but as these Channels were a source of continual trouble and expense in their maintenance, while the supply of water was fluctuating at best, it occurred to Captain DeButts to arrest by a permanent Dam the valuable stream which ran to waste into the ocean. As to the site, Captain DeButts explained that, as the Channels were "few and far between and the fall of the bed of the river in some places as much as 3 feet per mile," no Annicut could benefit the whole of them; and that in selecting a site for one, he had endeavoured to secure its advantages to as many Channels as possible without injuring any; that such a position was the Ferry at Nellore, where the river afforded natural facilities for the building of an Annicut at comparatively little cost, the South Bank being composed of laterite rock projecting far into the river, whereby its width was reduced from 300 to 520 yards, and the opposite Bank of firm soil which had not receded notwithstanding the advance of the South Bank. The advantages of the site were thus enumerated; viz. : 1, the reduced width of the river; 2, the saving of a wing wall, as the Annicut would abut on the laterite rock; 3, the facility for procuring stone; 4, the site was below the heads of all the Channels but one, viz. Gungapatam; and 5, it was close to the head of Jaffer Saib or the principal of the Channels, and near enough to Survapully; while the Vagoor could be supplied with a new head, and Gungapatam by a cut from Jaffer Saib. A further reason for choosing this site, was that the Annicut would serve the purpose of a roadway across the river through the town of Nellore, in continuation of the Trunk Road on either side. Mr. Purvis, the Sub-Collector in charge of the District, quite approved of this site as "the best that could be selected for such a work, there being no other point in the line of the Pennair through the District which could be fixed upon, so as to beneficially affect so many important River Channels;" and in addition to the advantage the Revenue would derive, he said that "the benefit to the inhabitants of the Town of Nellore from having a constant supply of water, and the advantage to the public generally of the roadway across the river, were very important considerations." The following rough Sketch will serve to shew the site, &c.

\*See his Report dated 19th May 1849 enclosed in his letter 25th September, No. 174, among the papers in Revenue Extract Minutes Consultation, 6th March 1850, No. 232.

Para. 3 of the Sub-Collector's letter, 7th September 1849, No. 105.

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Capt. DeButts estimated the cost at first at Rupees 64,898-14-0, inclusive of the expense of regulating the Channels affected; and the plan was a simple wall nine feet high and nine feet wide, with a retaining wall at twenty-four feet in rear of the main wall, and but two feet high, and for further security, sloping aprons of loose stone both in front and rear. Capt. DeButts

\* See his letter 31st December 1849, No. 220.

however, on a suggestion\* it would appear from the late Board of Public Works, revised his Estimate and Plan. The former he altered to 71,450 Rupees, in order to combine in the work the double advantage of an Annicut and Bridge, viz. 61,602 Rupees for the Annicut, and 9,848 Rupees for the Bridge recommended by him to be charged to the Road Department: the Estimate was altered to 85,547 Rupees in the Board's Office, being 75,699 Rupees for the Annicut, and 9,848 Rupees for the Bridge. As to the plan, the main wall was still to be nine feet high but only five feet thick, as it would be sufficiently strengthened by the Bridge Piers, which were to project sixteen feet beyond it in rear; just outside the cut-waters of the rear end of the Piers, the retaining wall of two feet high was to be constructed, the space between being filled in a slope from wall to wall with rubble stone; the whole to be completed with a sloping Apron of rubble stone in front, and another of rough stone in rear. In respect to the Bridge, it must be mentioned that provision was made in the Estimate only for the Foundations and Piers up to three feet.\*

\* See Specification in the 2nd letter quoted above.

2. As to the project in a Revenue point of view, it appeared from a statement in the margin of para. 5 of Mr. Purvis' letter already referred to, that the Ayacut under the Pennair Channels was assessed at 1,30,168 Rupees, while the assessment of the average dittum of five years was no more than 92,449 Rupees, of which that on the average cultivation was only 66,874 Rupees; thus leaving an Ayacut waste of 63,294 Rupees and a dittum waste of 25,575 Rupees, of which 13,895 Rupees was on land waste for want of water, and 11,680 Rupees on waste from the effects of inundation. Mr. Purvis thought that these results shewed there was a fair field for improvement, but he was unable to state with accuracy what benefit would follow from a better supply of water to be secured by an Annicut, though benefit there assuredly would be both to the Ryot and to the Government by the cultivation of a second crop. Captain DeButts, in his letter, agreed in the impossibility of stating with accuracy the exact return in money from such a work: in his opinion, it would completely change the whole system of cultivation, by advancing it so early as to admit of second crops of Paddy on a large extent of land then yielding only one. But in his Report, he remarked that if no greater return than 20,000 Rupees additional per annum were collected from the Villages which would be benefited by the Annicut, the cost of the work would be more than repaid in three years, and that he could not doubt of the probability of such a sum being realized. The Chief Engineer of the day was Colonel Lawe: he strongly supported the proposition; and said the return expected, about 33 per cent. on the outlay, was of itself a sufficient consideration to undertake the work, but that in addition, there would be the means of extending the Irrigating Channels over the low ground to an extent that could not then be accurately computed. The Board in noticing the several points above mentioned and alluding to the Engineer's expectation of a return of 20,000 Rupees, expressed themselves certain of immediately realizing the dittum waste from want of water, viz. 13,895 Rupees, while there was every probability they said, of a gradual extension of the cultivation over the remaining lands of the Ayacut, assessed at 51,614 Rupees. They added that the existing means of diverting the river water into the Channels permitted the escape of a large quantity; but that the Annicut would greatly increase the supply, and that there could be little doubt that the quantity thus thrown into the Channels would be abundantly sufficient for the entire Ayacut of 30,000 acres. "Eventually," they added, "should the Channel Irrigation be found to be supported by the Annicut throughout the cultivating season, it was not improbable that sum of the Tanks might be dispensed with, their beds brought under cultivation, and the expense of their repairs saved."

See his Report dated 11th Oct. 1849.

From Board, 4th February 1850, No. 97.

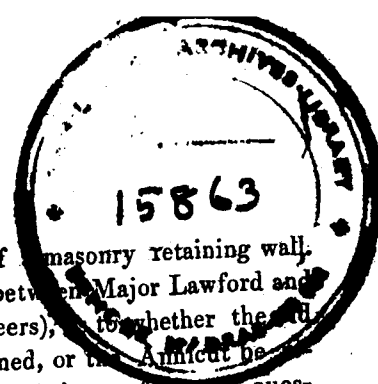
3. The Government at first deferred the consideration of the project; but the Board on the solicitation of the Local Officers, renewed their application, shewing as an example the advantages that had followed from the execution of a new supplying Channel to the Nellore Tank, which in the previous poor year had returned an increase of 746 Rupees beyond the average of nine years, while in the current Fusly notwithstanding an entire failure of the monsoon, the excess was 2,310 Rupees, or a per centage of 7½ and 23 per cent. respectively on the sanctioned cost of the Channel, viz. 9,970 Rupees. The Government were consequently induced to recur to the original arguments in favor of constructing an Annicut across the Pennair, and applied to the Government of India for sanction to the Estimate of 85,547 Rupees. In their Resolution, the Government stated their opinion that it was not unreasonable to expect a return of at least 20,000 Rupees, which would be a per centage of more than 23 on the whole cost, or 26 on the cost\* as a Revenue work. The Government of India in their turn recommended the project to the Honorable Court of Directors, who in their Revenue Dispatch, 18th February, No. 2 of 1852, communicated their sanction to the undertaking.

4. Early in 1853 preparations begun for building the Annicut; and in February of that year, Colonel A. T. Cotton inspected the site of the work, and reported that the section required alteration. A revised section was forwarded (apparently by the Board) to the Acting Civil Engineer Lieutenant G. W. Walker, for his opinion as to the propriety of connecting the Annicut with a Bridge as contemplated in the Estimate; and that Officer decidedly negatived the Bridge, on account of the obstruction it would cause. The revised section was approved by Lieutenant Walker, who expected that the cost would be reduced by leaving out "the Bridge Piers and the rear masonry wall of the old section." Lieutenant Walker's expectation as to any reduction of cost was not however realized; on the contrary, the Board came\* up with an application for a sum of 9,503 Rupees to complete the structure, explaining that "the cause of the excess was not only in the altered section, but also in additional work which would have been required had the old section been adhered to, and in a higher rate for masonry;" and that "a part also was owing to the expense incurred before the section was altered." This sum of 9,503 Rupees formed an item in the Budget\* of 1854-55. In asking for it, the Board said that "the alteration (of the section) was grounded on the experience acquired at the Godavery Annicut, and was indispensably necessary for the stability of the construction." At the date of the Board's Report (September 1854), "the building of the Annicut had made considerable progress under the Executive charge of Lieutenant Ritherdon, though the supply of materials was not very regular." In respect to the site, it may be well to quote Colonel Cotton's words in an Extract from his Report\* of Inspection. He said, "I have no doubt however that it was advisable to build the Annicut as low down as Nellore. Respecting the precise spot, I find the Civil Engineer has chosen the narrowest part of the river, which of course will render a greater strength of section necessary. I am not satisfied with the section allowed for the work, but must consider it further when I obtain some information respecting the fall of the river which I have requested Lieutenant Bean to send me. It will be advisable for me to meet the Officer who is to have charge of the Division, after he has had time to make himself a little acquainted with the localities; and then I could give an opinion respecting various points connected with this work."

\* Para. 2 of Major Lawford's letter 26th July 1858, No. 2212, in Consultation 24th August 1858.

(a) E. M. C. 15th May 1856, No. 706.

5. The Annicut appears to have been completed in August 1855,\* under the two Estimates above referred to, viz. 85,547 Rupees + 9,503 Rupees = 95,050 Rupees in all. Subsequently (a) an additional sum of 12,910 Rupees was sanctioned; of which 7,735 Rupees for strengthening the Annicut, completing Sluices, &c., was authorized for immediate expenditure; and 5,176 Rupees for



cast iron Posts and Strutters was ordered to be entered in the Budget of 1857-58. The following amounts appear also to have been authorized.

|                                                                                                   | Rs.                      |
|---------------------------------------------------------------------------------------------------|--------------------------|
| Chief Engineer's Proceedings (Sanctioned by Chief Engineer to repair 2nd October 1856, No. 6984.) | Sum stated above, 95,050 |
| E. M. C. 16th December 1856, No. 2316 and E. M. C. 7th June 1857, No. 1079, para. 5.              | 1,680                    |
| Extract Minutes Consultation, 5th Feb. 1857, No. 268.                                             | 5,000                    |
|                                                                                                   | 2,890                    |
|                                                                                                   | 9,570                    |
|                                                                                                   | Rupees..... 1,17,530     |

The total sanction on the original work may therefore be set down at 1,17,530 Rupees.

#### First Destruction of the Annicut in the flood of November 1857.

District Engineer's letter 3rd November 1857, in E. M. C. 18th November 1857, No. 2120.  
(a) District Engineer's letter, 9th November 1857, No. 2270.  
(b) Seven feet was the highest the Annicut had previously stood.  
(c) District Engineer's letter, 18th November 1857, No. 2369.

6. On the last two days of October 1857, Nellore was visited by a violent hurricane, which caused considerable damage both to Tank Bunds and Houses. The River rose on the 2nd November (b) to a height of eleven feet above the crown of the Annicut, and did not subside (c) until about the 16th. The Annicut received considerable damage, a breach it was here reported of about 282 feet in length: indeed, Lieutenant Mullins said that, had the fresh lasted forty-eight hours longer, the Annicut might have been almost entirely ruined. As it was, the principal damage consisted in the destruction of the lowest rough stone Apron, of which 557 long x 15 broad x 2 deep, or about 15,810 cubic yards, was swept away. The damage he attributed to the weakness of the section, as regards length of rear or lowest rough stone Apron, and in a greater degree to the very small size of the stone used. (d) It was reported that sixty tons of stone were being daily thrown into the breach out of a small reserve on the North Bank.

#### Proposals to repair the Ruined Structure.

(Para. 3 of his letter, 26th July 1858, No. 3212.)  
District Engineer's letter, 18th November, No. 2369 in E. M. C. 30th November 1857, No. 3211.

Extract Minutes Consultation quoted above.

Estimates, sanctioned the roughly computed expenditure of 56,612 Rupees.

(e) District Engineer's letter, 19th December 1857, No. 2606.  
(f) This included 18,000 Rupees for a Railway, exclusive however of the Rails themselves.

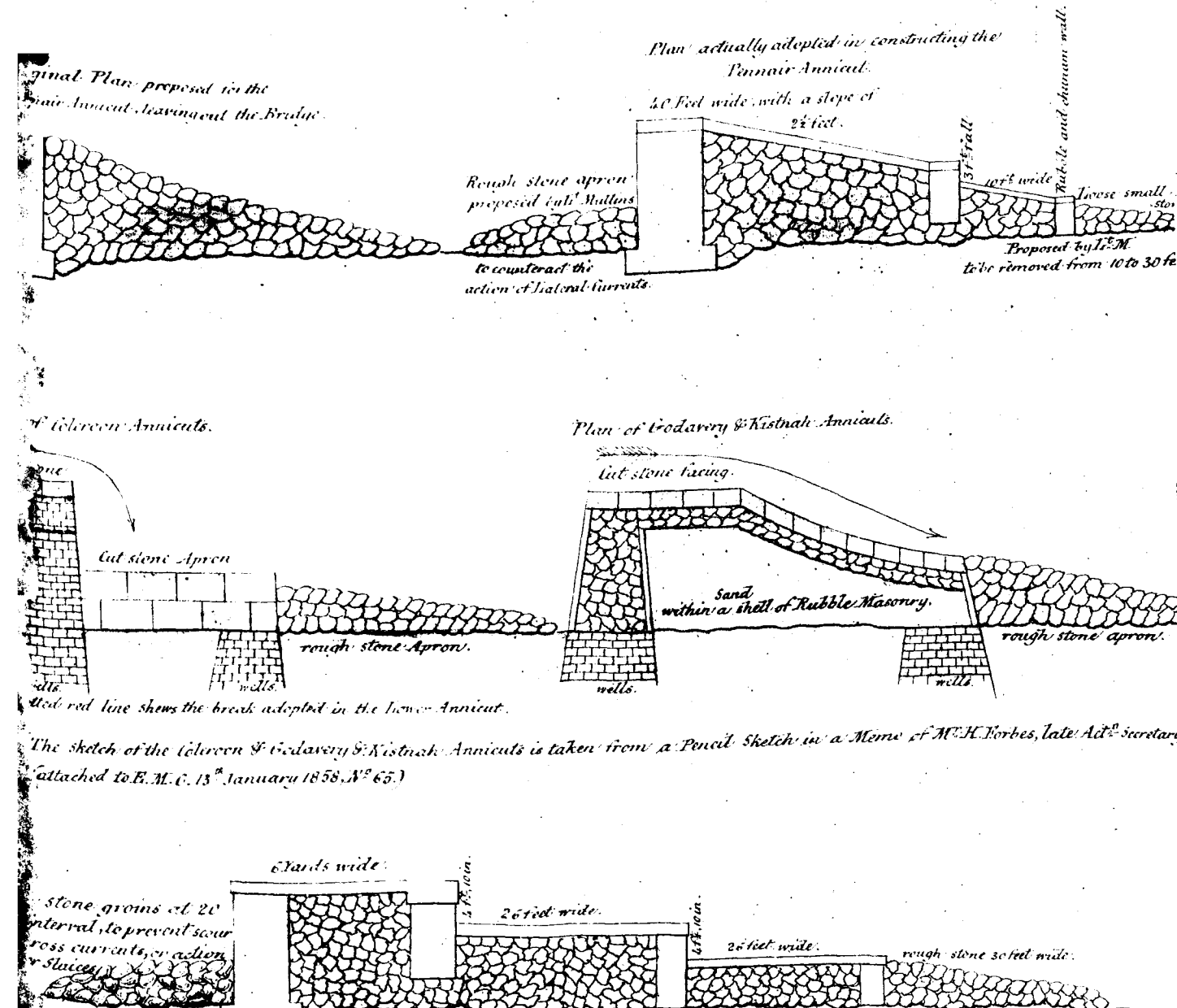
8. Shortly (e) after, Lieutenant Mullins sent in a Plan and Estimate of 66,000 (f) Rupees for improving as well as repairing the Annicut. He was for retaining the old section; and the only alteration he proposed to make was to remove the lower retaining wall from 10 to 30 feet from the middle retaining wall so increasing the width of the lower Apron from ten to thirty feet, in order to prevent the force of the water, in heavy freshes, striking beyond it on the lowest Apron, a part of the work less pre-

tected than the upper Apron which had the advantage and support of masonry retaining wall.

(g) See Minutes of Major Lawford and Captain Orr, in Extract Minutes Consultation, 13th January 1858, No. 66.

Here arose a difference (g) of opinion between Major Lawford and Captain Orr, (Superintending Engineers), as to whether the old section of the work should be retained, or the Annicut be formed on a new section. It was a strictly professional question; not at all one of expense; as it was supposed that it would cost as much to construct an entirely new work, as effectually to repair the old one. The question was whether a perpendicular fall of water, or a sloping fall, would be better for the stability of the structure? The vertical fall, adopted in the Coleroon Annicuts, was advocated by Major Lawford; and the sloping fall, the principle on which the Godavery and Kistnah Annicuts have been constructed, was proposed by Captain Orr. It would appear that the original Plan of the Pennair Annicut was a continuous unbroken slope; but it appears to have been slightly departed from in the actual construction, because the water began to work out the stone in rear of the main wall, and a second retaining wall was therefore added. Captain Orr however held that the failure of the Annicut was due not to its section, or form, but to the small size of the stone used.

The following rough Sketches will illustrate the above.



Above Section subsequently proposed by Major Lawford for the Pennair Annicut. See Plan enclosed in E. M. C. 22nd February 1858, which has just failed.

Lieutenant Mullins' view has been already stated; it is to be only added that he intended to throw out an Apron of rough stone in front of the main wall, to counteract the effects of lateral currents. The Chief Engineer in laying the matter before Government, offered (h) no direct opinion, though he appeared to incline to Major Lawford's views. He proposed that Major Lawford should go to the Annicut, vested with authority to direct such proceedings as personal inspection and enquiry might suggest to him, as the best course to be followed. This the Government sanctioned, on the understanding that his authority was to be limited to such operations, as could be effected within the amount of Lieutenant Mullins' Estimate.

(h) Proceedings of Chief Engineer, 5th January 1858, No. 6391 in Extract Minutes Consultation, 13th January 1858, No. 65.

E. M. C. quoted above.

9. The instructions issued (i) by the Chief Engineer at this time were, that Lieutenant Mullins was to proceed with the preparation of such materials as would be required, whatever section was to be adopted.

10. After Major Lawford's visit to Nellore, Lieutenant Mullins sent (j) in an Estimate of 61,800\* Rupees, which he had prepared for altering the old section in accordance with instructions given him by Major Lawford, who had now abandoned (k) his former idea of constructing a new work in front of the old one, and was for restoring what he called, "the excellent front wall of laterite in chunam, which in itself was quite strong enough for mere pressure." The Annicut he said was unfavorably situated, just below a great bend of the river, which causes an unequal discharge, and if measures were not soon taken for rectifying the bed, matters would become worse, and the Annicut seriously endangered;† so that it was absolutely necessary (l) to connect the Survapully and Jaffer Saib's Channels, and to close up the head of the former‡. His plan, with regard to the alteration of the section of the Annicut, was to make the Dam six yards wide, as it was a convenient road-way; then to let the water fall vertically four feet and ten

(j) District Engineer's letter, 23rd January 1858, No. 134.

|                                                                                                       |        |
|-------------------------------------------------------------------------------------------------------|--------|
| • For the Annicut.....                                                                                | 53,344 |
| For the Railway, without rails, as these were to be debited to the general plant of the District..... | 11,456 |
| Rupees.....                                                                                           | 64,800 |

(k) Major Lawford's letter, 28th January 1858, para. 6.

† This was afterwards confirmed by Captain O'Connell's report. He said, about a mile above the Annicut the river turns almost at right angles, but before reaching the work, it is deflected by a projecting portion of the right bank, and is met midway in its diagonal course by the Annicut, one consequence of which is, that in freshes the stream scours away the sand in front of the Annicut, from the centre towards the left bank of the river. Besides this, the projection of the right bank above referred to reduces the breadth of the river from 800 to 523 yards, so that at the site of the Annicut, the river always flowed with a greater velocity than elsewhere (Paras. 8 and 9 of letter, 28th June, No. 5 in Consultation 24th August 1858.)

(l) Para 5 of Major Lawford's letter, 26th July 1858, No. 2212 in Consultation 24th August.

‡ An Estimate of 35,920 Rupees for the Survapully and Jaffer Saib's Channels is now pending before Government. An Office Memo. also has been prepared on the matter.

inches on a level Apron of laterite 25 feet wide, secured by a brick retaining wall; then another vertical fall of four feet and ten inches, and a second Apron of laterite 25 feet wide; beyond which for 30 feet he would place rough stone moderately large; and in front of the Annicut, he would throw out rough stone groynes at 20 yards interval. Major Lawford approved of the Railway to the Quarries on the north bank, to provide large stone not only for the Annicut, but for the revetment of the Tanks on the south side; and with the concurrence of the Collector and District Engineer, he proposed a Toll at the Annicut to keep it in order. He added that he saw no reason (m) why the Annicut works should not be completed before the freshes, provided Lieutenant Mullins had suitable means of superintendence at his command. This was in the latter end of January 1858.

(m) Para. 12 of Major Lawford's letter, 28th January 1858, No. 256.

(n) Chief Engineer's Proceeding, 29th January 1858, No. 6396.  
(o) Extract Minutes Consultation 22d February 1858, No. 305.

(p) From Government of India, 7th May 1858, No. 2034.

11. The Chief Engineer strongly (n) recommended Major Lawford's proposals; and Government (in February) sanctioned (o) the Estimate of 64,800 Rupees for immediate and vigorous prosecution; but deferred the proposal of a Toll, until the general question came under consideration. This sanction was subsequently confirmed by the Government of (p) India, who at the same time called for a special report on the failure of the Annicut.

(q) See letter from the Officiating Chief Engineer, 26th July 1858, No. 2212, in Consultation 24th August 1858.

As a compliance with this call, Major Lawford sent (q) up a former letter from himself, others from Captain O'Connell and Lieutenant Mullins, and a Memorandum by Captain Ritherdon, the Executive Officer. These papers give a desultory view of the case; but as far as they go, are confirmatory of what has been stated above.

#### *Progress of Work in restoring the Annicut.*

12. The work of repair appears to have commenced immediately after the accident, and was carried on under the executive superintendence of Captain Ritherdon. As the papers on the Records of Government do not contain any information as to the measures for prosecuting the repair of the ruined structure, the Progress Reports of the period (obtained from the Central Office) have been consulted on this part of the history of the work. They range from the month of March to the first week of October 1858. The Reports are

(r) See Major Lawford's letter in Extract Minutes Consultation, 15th June 1858, No.

monthly up to June; but as it was learnt in the Central Office (r) that a fresh had occurred in this month, and an accident befallen Lieutenant Mullins in the Quarries which disabled him for work, Captain O'Connell was sent to Nellore, from which time the Reports are weekly up to the 2nd of October. They contain no particular information however. The progress of work was continuous, but very slow apparently. No particular interruptions occurred, if we except a fresh in the first week of June and another with rain for some days in the 2nd week of September. Although both these freshes appeared to have caused some damage, it was such as was easily repaired, and did not damp the local Officers in their hope of finishing the work before the N. E. Monsoons. Indeed, all the Reports spoke hopefully; and progress of work was pronounced to be satisfactory, except in May when water in the river interrupted excavation for the lower retaining walls, and of course in June and September when the freshes occurred. The fresh in June although only 2½ feet, or just half the rise of water in September, above the crown of the Annicut, appears to have been the more dangerous of the two, because the portions of work finished or in progress were not in a state of security at the time; still the damage was only the loss of about 60 yards of retaining wall. So hopeful indeed was the Executive Officer as to finishing the work in time, that in March he pronounced the progress of work to be satisfactory, the breach having been built up to one foot of the foundations; and he anticipated no damage from the early freshes. In May when the water in the river quite prevented excavation for retaining walls, he said with the materials on hand, he expected to finish ¾ of the Annicut in June, unless a fresh came down. In the 4th week of August, he reported all the masonry of the Annicut between the South Sluice and South Bank as finished: and in

(s) See also the Officiating Chief Engineer's letter of the 21st September 1858, enclosing a report from the District Engineer of the occurrence of the fresh in September, and as far as could be seen, of no serious damage having been sustained by the works.

the first week in September, 3rd Apron from north of south Sluice progressing fairly; retaining walls in rear of South and North Sluices built; ¾ of Railway laid, turn table at river end, and a bit of double line in preparation at the Quarries, but not expected to work before October. Even after the fresh in the 2nd week (s) of September, the Executive Officer wrote hopefully; for he said, he hoped to finish the section up to the 2nd retaining wall; and that this was quite as much as was possible before the beginning of the N. E. Monsoon.

In the 3rd week of September however, he reported that the fresh had damaged\* the 1st and 2nd Aprons and their retaining walls; and that he had only time to repair these before the setting in of the Monsoons, and he would secure them by throwing out rough stones behind the second retaining wall as a temporary Apron, instead of the 3rd cut stone one; but in forwarding this Report, Lieutenant Mullins said in his letter that the damage was repaired, and that he hoped if no water covered the Annicut on the 15th October, the work would be prepared to receive the freshes of the North-East Monsoons. Even in the 1st week in October, the state of the river and progress of work was reported to be satisfactory. At this time, the 1st Apron was nearly completed; the Railway from the Quarries, the construction of which had been dragging all along, was in use up to the ramp leading to the Annicut, the stones being carted thence along the Annicut and discharged at the foot of the 2nd retaining wall. The only drawbacks complained of by the Executive Officer, were, the want of Brick-

\* In para. 6 of his letter 21st December 1858, Captain Mullins mentions that the damage done on this occasion was to the value of 5,000 Rs.

layers, Coolies, and Timber, and occasionally laterite owing to the Wudders going off to work at Tank repairs. To supply the first, application was made to Madras, Guntoor, and North Arcot, but the greatest number present at work never seemed to exceed 132; in respect to the second, 800 men were obtained from cultivating villages, but they only came in in the first week of October; Sleepers arrived from Madras in the fourth week of September; and to bring the Wudders to work, instructions were issued not to employ them at the Tanks. This is as much as can be gained from the Progress Reports.

#### *Second Destruction of the Annicut.*

13. While such was the character of the Local Officers' Progress Reports, the Officiating Chief Engineer (t) laid before Government on the 12th October 1858, a Telegram from the District Engineer of the occurrence of a severe fresh in the Pennair on the 11th and 12th of October, the water having risen 12 feet above the crown of the Annicut, or one foot above the height in November 1857, when the first structure was destroyed. The result of this fresh was that the Annicut breached again, and the country under the Survapully Channel entirely flooded. In a later (u) letter of Colonel Lawford, the Government learn something of the proceedings of the Central Office in connection with the progress of the Annicut repair. The early backwardness of the work Colonel Lawford attributed, not to delay or slackness on the part of the Executive Officer, but to the paucity of workmen and deficient supply of materials; and that Captain Ritherdon did not realize his expectations of finishing frds of the Annicut in June, he said, was due to the freshes of that month, and to the severe accident which befell the District Engineer. Colonel Lawford added that on these untoward circumstances, it was on his representation that Captain O'Connell was sent to Nellore, after which there was an improvement in the progress of work; that this Officer remained in superintendence of the Annicut from the 20th June to the 5th July; that on his representing the necessity of increasing the working parties, he (Colonel Lawford) wrote to the District Engineers of North Arcot, Chingleput, Cuddapah, and the Kistnah, to send as many Bricklayers as possible to Nellore; that he ordered a special weekly report of the progress of the works; and that he omitted no means by which progress could be accelerated. Unfortunately for the Annicut, but much to the benefit of the country, he continued, a very heavy fall of rain from the closing of the S. W. Monsoon, took place in October all over Mysore, Bellary, and Cuddapah, as well as Nellore, and the Pennair rising on the 12th to a height exceeding by one foot the hurricane flood of 1857, overtopped the Annicut by 12 feet, and caused a disastrous result to the structure. The destruction was not confined to the Annicut alone, but the most serious injury was caused by the inundation of the country and bursting of Tanks, chiefly, if not wholly, from the water pouring down the open head of the Survapully Channel; and upon this consideration alone, Colonel Lawford was\* of opinion that it was quite clear the early restoration of the Annicut could not be recommended; indeed, until the Survapully Channel was placed under control, the Annicut was a positive evil. Hence, he recommended the postponement of its restoration, until the Tanks and Channels were in a fit state to receive its benefits. He was also of opinion that the Annicut should be reduced 2 feet, as the head of the Survapully Channel would be lowered to that extent.

14. "In reviewing the Proceedings of the District Engineers, in connection with this work, and considering the causes of its failure," Colonel Lawford said, that he could not but "remark on the want of calculation of the local means of rapid construction which was exhibited. It was not until Captain Mullins' disability led to Captain O'Connell's mission, that any distinct information was received in the Central Office of the scarcity\* of labor and the possibility of failure from that cause; and though it was true that he (Colonel Lawford) personally visited the place in January 1858, yet he could only remain there a few days, and he certainly heard nothing at that time to lead him to doubt the ability of the local Officers to carry on the work with energy and success. This cause of difficulty should no doubt have been foreseen;

(t) From Officiating Chief Engineer, 12th October 1858, No 4415.

(u) From Officiating Chief Engineer, 1st December 1858, No. 5933.

\* Para. 16 of letter, 1st December 1858, No. 5933.

\* This can hardly be said, for although hopeful, the Executive Officer early spoke of the scarcity of labor and materials. This he did in his Reports for March, April, and May.

for not only was the work of the Annicut itself greatly retarded, but the Railway by which the large rough stone was to be supplied, was not completed up to the very last; and yet, it was only 2,600 yards long." Colonel Lawford proceeded to remark that the laterite stones used in the Aprons were not of large dimensions, but that at the same time it was clear that large stones could not be procured and worked in sufficient number. This want of good material would have been an insurmountable objection to the section he had proposed, as on the stability of the Aprons its security depended; and therefore, with the knowledge now possessed of the difficulty of obtaining such material, he could have no hesitation in saying that, in the future reconstruction of the Annicut, that section could not be employed, but that the form adopted on the Kistnah and Godavery must be followed. At the same time, he would not be understood as imputing the recent failure to the use of unsuitable material; for in his opinion, the Annicut failed because it was overtaken in an unfinished state by a flood of greater extent and violence, than that by which the damages were caused in 1857.

Para. 20 of Colonel Lawford's letter, 1st December 1858, No. 5933.

15. Dissatisfied with this report, Government called on the Officiating Chief Engineer to furnish a detailed one, with a brief history of the Annicut from its commencement, the expenditure incurred on it, the extent of damage it had sustained, and the causes which had contributed to the second disaster, and his reasons for his opinion. He was also to report on the sufficiency of any reasons that might be urged by Captain Mullins for the non-completion of the Annicut and the Railway to the Quarries before the Monsoon, and to explain why measures were not taken to ascertain if laterite stone of suitable size was procurable in the District, before recommending the adoption of the revised section on which the Annicut had been re-constructed. This call was repeated on the 8th January of this year, on the Government of India calling for a detailed report of the accident, having observed notice of it in our Printed Proceedings.

#### *Explanation furnished as to cause of Destruction.*

16. The letter from the Officiating Chief Engineer now before Government is dated 21st December 1858, and is a continuation of his letter of the 1st of the month above noticed; so that the detailed report and history called for by Government on the 24th December, are yet to be laid before them by the Central Office. There is not much to be learnt from the present papers, beyond the fact that Colonel Lawford has quite given up the idea of repairing the Annicut at present, having instructed the District Engineer to prepare a complete project for its restoration and for the construction of its subsidiary works, in view to obtaining sanction for the project as a whole instead of piecemeal. Accompanying Colonel Lawford's letter are three communications from the District Engineer with Plans shewing the overfall of water during the freshes. It is not necessary to refer to Captain Mullins' letter of the 20th September 1858, as that was written before the destruction of the Annicut. Neither is it necessary to refer, to his letter of the 13th October, forwarding four Sketches of the appearance of the overfall for although it was written after the occurrence of the fresh which destroyed the Annicut, yet as it was dispatched before the water had subsided, the injuries spoken of were merely guessed at. His letter of the 11th December however was written after the actual extent of injury sustained by the Annicut had been fully ascertained. After referring to an

Captain Mullins speaks of 2 Plans, one shewing the state of the Annicut immediately before the freshes of October, and the other the result of those freshes; but only one Plan is to be found with the papers, shewing the breach that took place.

Estimate sent in by Captain Ritherdon of 74,000 Rupees, as the probable cost of restoring the Annicut, and stating his opinion that the unfinished state of the work and the severity of the flood were the principal causes of the injury sustained, he endeavours to explain why more work was not done. This he does in paras. 4 to 6. He thinks that the work required to be completed to render the Annicut safe for the Monsoon, was too much for one season, (about 8 months), and that an expenditure of 8,000 Rupees a month without any previous preparation or collection of materials, was almost if not

quite an impossibility, taking the resources of Nellore into account, together with the fact that no such work had ever been done before. Captain Mullins then proceeds to justify himself, by stating that he ascertained there were 411 Bricklayers in the District, and as but 200 per day were required to construct the Annicut within the time allowed, and other work was stopped, it did not seem too much to expect that this number would be obtained; that on the 17th January he selected the site for Brick-fields, marked out the Annicut work, arranged for the supply of Stone, Chumam, &c., and then went on his inspection in the South Range; that on his return 10 days after, he found the preliminary work getting on very well, and for the next six weeks, he was employed in looking after Brick-making, laying out the Railway, looking after the details of the Annicut work; experimenting in Hydraulic Cement, working Chumam Kilns, &c. so that about the middle of March finding that the works had a fair start, he left

\* E. M. C., 12th January 1858, No. 53, para. 3.

for the North to prepare the information required by Government in respect to the Trunk Road; that he returned on the 9th April, and finding only 85 Bricklayers at work, he wrote to all

the villages for contingents, and even authorized Captain Ritherdon to write to Madras; that observing the work to be progressing well, so far as the available labor went, he turned his attention to the Railway, and shortly after met with the severe accident in the Quarries, which disabled him for work; that from that date (15th May) to the middle of July he was not permitted to transact any business; that about this time, he saw Captain O'Connell and was surprised to hear that the number of Bricklayers had decreased still more, having been attracted to private work for higher wages and less strict superintendence; that this Officer endeavoured to obtain more Bricklayers, and was so far successful as to get about 40 from Masulipatam and Cuddapah; that all the ready made Bricks were bought up, and apprentices engaged to trim stone, with the view of setting builders free for the retaining walls and Aprons; and that by this means, the number of builders was increased to 200; and that had these measures been taken about 2 or 3 months sooner, there was no doubt the repairs would have been completed before the fresh came down in October; that this was not done was a matter much to be regretted; but that there was no want of care or foresight, as he was not in a position previously to form a correct opinion.

17. In the Officiating Chief Engineer's reply to the above letter, he informs Captain Mullins that the Plans submitted do not convey sufficient information of the actual effects of the last floods; that two-thirds of the Dam appears to have been destroyed, but there is nothing to shew the state of the foundations, nor the manner in which the materials have been left by the river; that as Captain Ritherdon's estimate "provides for none but  $\frac{1}{4}$  yard stones," it is impossible to rely on any such provision, as a sufficient quantity of stones of much smaller dimensions could not be obtained; that he cannot understand why he did not use his knowledge of local resources to calculate the probabilities of success before he commenced the work, or why in the earlier stages, he did not delay any constructive operations until he felt assured of his materials; that in respect to the section of the Annicut, he fully depended on the retaining walls being securely founded, and on the materials of the Aprons being of large size; and if in the course of construction he saw reason to doubt either condition being attained, it was his duty to have stated his opinion at once, and not until after the freshes of September; that as he infers the completed work would, in such a flood as November last, raise the surface of the river five feet, that fact alone should decide the question against the restoration of the Annicut, unless the Survapully Channel is closed; that thus there will be ample time for determining the best section, and bringing forward those subsidiary plans for extending its advantages, which were so greatly overlooked in the original project; and that all that remained to be done immediately, was to collect and secure such material as may be available, to protect the parts still standing, and to store the Railway Sleepers and other plant likely to suffer from exposure. There is nothing to notice in Colonel Lawford's letter itself to Government, beyond what has been already stated.

18. In respect to the progress of work, the following was the rate of expenditure per month:

|                       | Rs.           |
|-----------------------|---------------|
| In February 1858..... | 3,013         |
| March ".....          | 4,319         |
| April ".....          | 7,034         |
| May ".....            | 5,123         |
| June ".....           | 4,845         |
| July ".....           | 8,464         |
| August ".....         | 8,721         |
| September ".....      | 9,068         |
| October ".....        | 10,406        |
| November ".....       | 2,665         |
|                       | <u>63,655</u> |

An examination of these amounts shews that there was no particular interruption to the work after its commencement, beyond those noticed above, as occurring in June and September; but the progress throughout appears to have been very slow. The Estimate was nearly 65,000 Rupees, and there were only about 6 or 7 working months. Hence the progress ought to have been at the rate of about 10,000 Rupees, or more, per mensem, allowing time for the proper settlement and consolidation of the work, before the beginning of the Monsoon season.

(Signed) J. D. BOURDILLON,  
Secretary to Government.



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Exd. Wm. Thomas.