

(1) Number of pages _____

(2) Date of repair _____

(3) Initials of the Referencer _____

MADRAS RECORD OFFICE.

Government of Madras.

Public Works. DEPARTMENT.

G.O. No. 1388	Press
448-449	~~Mis.~~
Dated 22-5	18 68.

Not to be folded or roughly handled

*Proceedings of the Madras Government, Public Works Department,
22nd May 1865.*

No. 448. Read the following Memorandum from the Commissioner of Mysore, to the Secretary to Government, Public Works Department, Fort Saint George, dated Bangalore, 5th May 1865, No. 68 —

Your Memorandum No. 18, dated 12th ultimo.

Forwards at the request of the Chief Engineer in Mysore, in original, a second Memorandum on the causes of the failure of the Lower Coleroon anicut in Tanjore, for submission to His Excellency the Governor in Council.

(Signed) L. BOWRING,
Commissioner.

Second Memorandum on the causes of the failure of the Lower Coleroon Anicut in Tanjore.

1. Having felt it a duty I owed to the Madras Government to offer some remarks on the repeated failures of the lower anicut and bridge across the Coleroon, I had hoped to be favored with the spontaneous expression of their opinion of my views, but in this I have been disappointed. My Memorandum dated 17th January 1865 having apparently been referred to an Officer who had never before seen the anicut, or been employed in Tanjore, and his report, dated 25th February, having been only communicated to me on my own application, on the 12th April following.

2. I stated in my former Memorandum that a very material cause of danger might be found in the formation of irregular currents, owing to possible accumulations of sand above the anicut, but this view is now declared to be mistaken, as Colonel Greenaway has reported that "the bed of the river above bridge is level, and the channel remarkably straight, there having been no gulches cut by draft from the sluices." Yet in the same paragraph that Officer states: "The only irregularity in the bed was a very objectionable island that lay opposite the 5th and 6th arches from the north abutment (now carried away) and which doubtless was an aggravating agency in the causes to which I attribute the breach." Again, in paragraph 19, it is said, "If any thing should exist to cause an eddy above the work (as the island before mentioned), or a disproportionate amount of overfall (unprovided for) at any particular point, it would evidently accelerate the result."

3. The foregoing extracts contain ample demonstration of the truth of my supposition, that irregularity of overfall did actually occur before the anicut was breached at that very part, and the only difference between Colonel Greenaway and myself appears to be that he regards as secondary that which I believe to have been the primary cause of disaster, while those circumstances, such as the overfall taking place on an empty bed of sand, and the scouring out of holes below the apron which he ranks as *causes*, I consider merely as *effects*, though they unquestionably led immediately to the destruction of the work.

4. Further, Colonel Greenaway alleges that the average level of the river bed at half a mile above the anicut is about two feet higher than the crown, or nine and a half feet above the apron, thus greatly adding to the slope of the river, and increasing the velocity and distance of the overfall, so that the apron which was calculated for a weir of seven and a half feet, and a slope of two and a half feet per mile would necessarily prove insufficient, and it was this rise of the bed which the sluices were expressly designed to counteract.

5. There are three serious inaccuracies in Colonel Greenaway's report, which may be ascribed to his superficial acquaintance with the work he describes, and I

* Paragraph 18. may especially allude to his remark* on the difference in the soil on which the

north and south dams are built, as a reason for the stability of the former, when I know that the entire work rests on a bed in which both clay and sand occur, but the excessive scour through the south branch, for three successive seasons, has doubtless left nothing visible but sand.

6. But were Colonel Greenaway's statement correct, it would not invalidate my belief that the anicut would have stood firm under proper regulation, for the upper anicut of the same section but not quite so high, rests on an unmixed bed of

*Proceedings of the Madras Government, Public Works Department,
22nd May 1865.*

sand, and was breached only in 1859 by a lateral scour from the Iyaur river, which joins the Coleroon immediately above that work.

7. Another inaccuracy to be noted is the statement that there was no rough stone behind the apron, as such a protection to the dam existed for 20 years before 1857, and was annually renewed wherever it had suffered injury. It was about six yards wide, and *at that time* proved sufficient for its purpose; I can only suppose that it has since been destroyed without renewal.

8. A third error is the statement that the retaining wall of the cut-stone apron had no wells to support it, as there were undoubtedly such supports to the original work, though I cannot say whether they were omitted in the recent restorations, but I can hardly imagine so.

9. A very remarkable proof of the correctness of my opinion as to the excessive discharge over the south branch is afforded in paragraph 17, where the bed above the north branch is said to be "covered with an unctuous black earth, and over-grown with grass and weeds," this upper crust over laying the sand being simply a deposit of alluvium, which as well as the vegetation could not possibly be found with a very rapid current on that side, and such was the state of this part of the river in 1853, when the only powerful sluices were at the north end of the dam, the effect of which was to cause a scour along the face of the work, which it was the object of my separate sluices to prevent, by increasing the direct discharge.

10. These sluices, four in number, which Colonel Greenaway styles "small isolated vents," consist of two narrow arches of 6 feet each with sills on a level with the river bed, placed at equal distances of 190 feet, giving altogether 48 feet of sluice way, through which the flood-water is discharged without obstruction, at its full depth, and it is certain they must exert great influence on the upper bed, provided the necessary means are adopted to ensure their effect. Colonel Greenaway has never seen these sluices in action, and judges of their power by the state of the river bed when dry, after the gradual subsidence of the freshes has caused an almost uniform deposit of sand and silt. I proposed these sluices after trial of those of the same character which I designed and constructed in the upper anicut several years previously.

11. In the vindication now attempted of the construction of the Lower Coleroon anicut, I trust it may not be forgotten that I neither designed nor built the original work, but I maintained it in efficiency from 1842 till 1855, and the additional length proposed, but not actually executed by me, can scarcely be supposed to have diminished its security; but no hydraulic work in the Delta of the Cauvery or any other river can stand for many years, if constant attention be not paid to those changes which, as I have before observed, are produced by every year's floods.

12. It may be useful to remark with reference to the statement (paragraph 12) that the bed of the river above the anicut is now very level and remarkably straight, that it was impossible for Colonel Greenaway to judge from his observation of its condition during the freshes, the gradual subsidence of which would tend to cause deposit of sand in the deeper parts, besides which the embankment across the

Paragraph 28

the river* (that is the south branch) would render accurate examination difficult, and considering that for three successive years a broad gap has been formed in this part of the dam, through which the flood-water has flowed, it is impossible to doubt that the tendency of the current in that direction must have increased. The effect would in a degree be the same as that of the upper anicut on the head of the Cauvery, which in 1842 had been dangerously deepened by the increased volume of water thrown into it.

13. If this view be correct, it is to be expected that during the present year the action of the floods in the south branch will be greater than before, and although they will have a freer discharge, owing to the delay in the completion of the bridge, still the result should cause some anxiety, and every effort should be made at once to

*Proceedings of the Madras Government, Public Works Department,
22nd May 1865.*

clear the north branch, and divert the current in that direction before it becomes uncontrollable. The "very objectionable island" opposite the south branch should of course be destroyed, and every endeavour used to restore that uniform discharge which it was formerly my unceasing care to maintain.

14. Before concluding, I may remark that in almost every instance of the destruction of an anicut, even when far more substantially built than the one now under consideration, I have found irregularity of discharge to be the principal cause. This has been lately very evident in Mysore, where the numerous ancient weirs formed of enormous masses of stone, and founded on rock, are generally constructed obliquely across the river, and frequently in a bend, causing the current to act with disproportionate force on the part forming an acute angle with the bank, which has been the first to give way.

15. It is fortunate that the Coleroon anicuts will now be under the care of an Officer (Captain Oakes, R.E.) who has had considerable experience in Tanjore, and who I doubt not will detect those causes of danger which are not always apparent to a casual observer.

16. As the object of this paper is merely to establish the correctness of my own professional opinions, I shall offer no other remark on the propositions contained in paragraphs 26 and 27 of Colonel Greenaway's report, than that I consider them unnecessary and extremely costly. So long as the upper anicut, and the north branch of the lower remain firm, there is no reason yet apparent why the remaining portion of the latter should not be made and maintained equally secure at moderate expense.

(Signed) E. LAWFORD, Colonel, R. E.,
BANGALORE, Chief Engineer of Mysore.
1st May 1865.

No. 449. ORDER THEREON, 22nd May 1865, No. 1,388.
Communicated to the Superintending Engineer, 6th Division, for information.

CIVIL WORKS, No. 65.

(True Extract.)

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

To the Superintending Engineer, 6th Division.

Pub: Works Depart^{mt}

~~Received~~

~~following~~

From the Commissioner
of Mysore

Forwards at the request of the Chief
Engineer in Mysore, in original, a
second memorandum, the causes
of the failure of the Lower Coleroon
Anicut in Tanjore, for submission to
His Excellency the Governor in Council.

14th 5th May, 1865
No 68.

By Order.

As for many years, Colonel
Lawford, our Civil Engineer of the 6th
Division, had charge of the Lower Coleroon
Anicut, with the other irrigation works
in Tanjore, he seems to think that, in
vindication of his professional character,
it is necessary to show that the re-
cent repeated failures of the Southern
section of that Anicut were not due
to any defect or weakness in its
construction, but to changes that have
been permitted to occur in the relative

I don't see that any recollection for expression
of opinion on the part of an officer who has
served in the Tanjore Division, & for up the
Anicut, which he treated as a private concern, &
sent to the Superintending Engineer in the upper
division.

levels of the two branches of the river, which have had the effect of throwing a disproportionate and dangerous quantity of water into the Southern branch, and of directing it irregularly over the Anicut.

It is probable that the shutting up of the under sluices in the Southern section of the Anicut has tended to raise the level of the sand banks in the bed of that branch of the river ^{above} and this may have been one cause of the work being breached, but the undersigned is of opinion that Colonel

Greenaway, although clearly mistaken on some points, has indicated the true causes of failure as having been the insufficiency of piers across and the absence of wells under pier retaining wall. Captain Bates, who is now Superintending Engineer of the G. I. Co., and who is now on the spot, is thoroughly acquainted with the work, and it is proposed simply to communicate this second Memorandum by Colonel Lawford to him for his

send to him for information - but do not call for remarks - He may make them if he will, but do not let his information, and for any reason visit him - or give an opinion - as he may have to offer. - may be lengthy, containing 2/2

Fort St George

May 1865

Col. Lawford

Col. Lawford

The several memos rec'd from Secy to Govt of Madras. Col. Lawford should, I think, be consulted for info. to the extent of his knowledge of the cause in Madras. There may be something in them that Captain Bates will be ready to consider & advise. I am upon, though I believe that Captain Bates' knowledge of ancient affairs & bearings is far less than that of Colonel Lawford.

W. J.

Second Memorandum on the Cause
of the failure of the Lower Coleroon
Ancient in Tanjore.

Having felt it a duty, owing to the
Madras Government to offer some remark
on the repeated failures of the Lower An-
icut and Bridge across the Coleroon, I had
hoped to be favoured with the spontaneous
expression of their opinion of my views, but
in this I have been disappointed, my
Memorandum dated 17 January 1865 having
apparently been referred to an Officer who
has never before seen the Anicut, or
been employed in Tanjore, and his report
dated 25 February having been only com-
municated to me on my own applica-
tion on the 12th April following.

I stated in my former Memo-
randum that a very material cause
of danger might be found in the forma-
tion of irregular currents owing to
possible accumulations of sand above
the Anicut, but this view I now

Declared

declared to be mistaken as Colonel Greenaway has reported that "the bed of the river above bridge is level and the Channel remarkably straight, there having been no gullies cut by draft from the sluices." Yet in the same para that Officer states "the only irregularity in the bed was a very objectionable island that lay opposite the 3rd and 4th Arches from the North Abutment (now carried away), and which doubtless was an aggravating agency in the causes to which I attribute the breach."

Again in Para. 19 it is said: "if anything should exist to cause an eddy above the work (as the island before mentioned), or a disproportionate amount of overfall (unprovided for) at any particular point, it would surely accelerate the result."

3. The foregoing extracts contain ample demonstration of the truth of my supposition that irregularity of overfall did actually occur before the sluiceway was breached, at that very part; and the only difference between Colonel Greenaway and myself appears to be that he regards as secondary that which I believe to have been the primary cause of disaster, while those circumstances, such as the overfall taking place on an empty bed

bed of sand, and the scouring out of holes below the Apron which he ranks as causes, I consider merely as effects, though they unquestionably led considerably to the destruction of the work.

4. Further, Colonel Greenaway alleges that the average level of the river bed at half a mile above the Ament is about 2 feet higher than the Crown, or $9\frac{1}{2}$ feet above the Apron, thus greatly adding to the slope of the river and increasing the velocity and distance of the overfall, so that the Apron which was calculated for a Weir of $7\frac{1}{2}$ feet and a slope of $2\frac{1}{2}$ feet per mile would necessarily prove insufficient, and it was this rise of the bed which the sluices were expressly designed to counteract.

5. There are three serious inaccuracies in Colonel Greenaway's report which may be ascribed to his superficial acquaintance with the work he describes, and I may especially allude to his remark in the difference in the soil on which the North and South Dams are built as a reason for the stability of the former, when I know that the entire work rests on a bed in which both clay and sand occur, but the

a the excessive scour through the South branch
for three successive seasons, has doubtless left
nothing visible but sand.
6. But were Colonel Greenaway's state-
ment correct, it would not invalidate my belief
that the Ancient river, having stood firm under
proper regulations for the Upper Ancient of the
same section but not quite so high, rests on an
unmixed bed of sand, and was breached only
in 1859 by a lateral scour from the Ogish
river which joins the Coleroon immediately
above that work.

Another inaccuracy to be noted is the
statement that there was no rough stones be-
hind the Apron as such a protection to the
Dam would be for 20 years before 1857. And
was annually renewed wherever it had suf-
fered injury. It was about 6 yards wide and
at that time proved sufficient for its purpose;
I can only suppose that it has since been
destroyed without renewal.

8. A third error is the statement that
the retaining wall of the cut stone apron
has no walls to support it as there were
undoubtedly such supports to the original
work though I cannot say whether they
were omitted in the present restoration; but
I can hardly imagine so.

9. A very remarkable proof of the ^{my}no
correctness of my opinion as to the excessive
discharge over the South branch is afforded
in Para 17 where the bed above the North
branch is said to be covered with an ex-
tensive black earth and overgrown with grass
and weeds; this upper crust overlaying the
sand being simply a deposit of alluvium
which as well as the vegetation could not
possibly be found with a very rapid current
on that side, and such was the state of
this part of the river in 1853 when the
only powerful sluices were at the North
end of the Dam, the effect of which was
to cause a scour along the face of the
work, which it was the object of my sepa-
rate sluices to prevent, by increasing the
direct discharge.

10. The sluices, four in number, which
Colonel Greenaway styles "small isolated
works" consist of two narrow arches of 6
feet each with sills in a level with the river
bed, placed at equal distances of 190 feet,
giving altogether 48 feet of sluiceway through
which the flood water is discharged without
obstruction at its full depth, and it is
certain that such great influence

on the upper bed provides the necessary means are adopted to insure their effect. Colonel Greenaway has never seen these sluices in action and judges of their power by the state of the river bed when dry, after the gradual subsidence of the freshes has caused an almost uniform deposit of sand and silt. I propose these sluices after trial of those of the same character which I designed and constructed in the Upper Anicut several years previously.

11. In the vindication now attempted of the construction of the Lower Coleroon Anicut, I trust it may not be forgotten that I neither designed nor built the original work, but I maintain it in efficiency from 1842 till 1855, and the additional length proposed, but not actually executed, by me, can scarcely be supposed to have diminished its security, but no hydraulic work in the Delta of the Carvery or any other river can stand for many years if constant attention be not paid to those changes, which, as I have before observed, are produced by every year's floods.

12. It may be useful to remark, with reference to the Statement (Para 12) that the bed of the river above the Anicut is now very level and remarkably straight, that

Para 28.

it was impossible for Colonel Greenaway to judge from his observation of its condition during the freshes, the gradual subsidence of which would tend to cause deposit of sand in the deeper parts, besides which the embankment across the river (that is the South branch) would render accurate examination difficult, and considering that for three successive years a broad gap has been formed in this part of the Dam, through which the flood water has flowed, it is impossible to doubt that the tendency of the current in that direction must have increased. The effect would in a degree be the same as that of the Upper Anicut on the Head of the Carvery, which in 1842 has been dangerously deepened by the increases volume of water thrown into it.

13. If this view be correct, it is to be expected, that during the present year the action of the floods in the South branch will be greater than before, and although they will have a freer discharge, owing to the delay in the completion of the bridge, still the result should cause some anxiety. And every effort should be made at once to clear the North branch, and direct the current in that direction before it becomes

becomes uncontrollable. The very objection-
able island opposite the South branch should
of course be destroyed and every endeavour used
to restore that uniform discharge which it was
formerly my increasing care to maintain.

14. Before concluding, I may
remark that in almost every instance of the
destruction of an Arment even when far more
substantially built than the one now under
consideration, I have found irregularity of dis-
-charge to be the principal cause. This has
been lately very evident in Mysore where
the numerous Ancient Weirs formed of enormous
masses of stone, and founded on rock are gene-
-rally constructed obliquely across the river,
and frequently in a bend, causing the cur-
-rent to act with disproportionate force on
the part forming an acute angle with the
bank, which has been the first to give way.

15. It is fortunate that the Coleroon Ari-
-ents will now be under the care of an Officer
(Captain Oakes R.E.) who has had con-
-siderable experience in Tanjore, and who
I doubt not will detect those causes of
danger which are not always apparent to
a casual observer.

16. As the object of this paper is
merely

merely to establish the correctness of my
own professional opinion. I shall offer no
other remark on the propositions contained
in Paras 26, & 27 of Colonel Greenaway's
Report than that I consider them unne-
-cessary and extremely costly. So long as
the Upper Arment, and the North Branch
of the Lower, remain firm, there is no
reason yet apparent why the remaining
portion of the latter should not be made
and maintained equally secure at moderate
expense.

Bangalore
1st May 1865

Samuel Colman R.E.
Chief Engineer of Mysore.

1865.

Enclosed in a packet from
the Commissioners of Allogoe
to the Secretary to Government
Public Works Department
Fort Saint George dated 5th
May 1865.

240 1388

Some Memorandum
on the Cause of the
Failure of the Power
Cottons. Ancient in
Europe.

PP 1602/65

Communicated to the
M^{rs} Rogers & Division for inform.
-ten

Frank & George?
22nd May 1865

W. G.

To The M^{rs} Rogers
R. G. 6. Division

23 May

10061263/65

1215 Perry St. Ga 30307

To Mr. J. B. Davis
No. 608 Broadway
New York City

of impulse.

Dated, 19 June 1870

Received of _____
the sum of _____
for _____
Dated _____

Specimen 15

Enclosures No. 1 *enc.*

General No 187

1865-66.
No 3
No 2
No 1

3
Mauritius vander Meer, 23.18
October 12, 1921

Forwarded to the
Director of the Chief Engineer in
Hingham, in argument, a second
introduction on the subject
the future of the above Boston
element is a sample for the purpose
to his Excellency the Governor in
Council.

Adams
Dec. 1888-22nd Aug 1885
Cummisnoan.

Commence
with an order