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MADRAS RECORD OFFICE

GOVERNMENT OF MADRAS

Revenue DEPARTMENT

G.O. No.	208	Press
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Dated	29-1-1975	196

Not to be folded or roughly handled

No. 491. Read the following endorsement of the Chief Engineer for Irrigation, dated Carrypetty, 11th December 1874, No. 1,029 :—

From Captain J. PENNYCUICK, R.E., District Engineer, North Arcot, to Colonel G. W. WALKER, R.E., Secretary to Government, Public Works Department, dated Vellore, 29th October 1874, No. 2,088.

I REGRET to have to report the occurrence of serious damage to various works in this district from the floods of the last few days.

2. I had proceeded to Madras on the 23rd instant on the leave granted me in the "Gazette" of the 25th August 1874; but, on hearing that injury was being done by floods, returned by the first opportunity and resumed charge of the district.

3. The bridge over the Palar between Vellore and the Railway Station gave way on the morning of the 27th; sixteen arches have already fallen, and at least two more will have to be removed if they do not fall of their own accord.

4. All communication between the town and the railway was impossible during the 27th, but yesterday it was found practicable, though difficult, to cross by means of rafts, and I and others got over in this way.

5. Although the water has fallen considerably, the rush through the bridge is still too great to enable it to be approached with safety, and no examination of the fallen arches can be made for the present. A detailed report of the nature, extent, and (if ascertainable) cause of injury will be submitted as soon as possible. I fear, however, that more arches will go if the river rises again, as the fallen masonry has regularly dammed up the bed towards the left bank, and there is now a very strong set of the current in the direction of the right bank. The bridge consists of 42 arches of 43 feet span.

6. The Palar Anicut has breached at the middle of the stream, and about 200 yards are said to have been carried away. The water rose to $14\frac{1}{4}$ feet on the sill of the head sluices, being 9 inches higher than the maximum during May 1872, and would doubtless have been higher still if the anicut had not given way.

7. The Caveripak Channel from the Palar Anicut has breached, and the water from it falling into the Govindavady Channel has carried away the greater part of the work done towards the restoration of the St. Andrew's Bridge which fell last October.

8. The Poincy Anicut is reported as "seriously injured," but no further details have been received.

9. From Arnee I have received no intelligence as yet, but I greatly fear that the Cheyaur Anicut has suffered. The water was 15 feet above the sill of the sluices on the 26th; and, as this is 3 feet above the maximum previously recorded, it is almost impossible that the head works should have escaped serious injury.

10. I have as yet heard of the breaching of but three tanks, of which only one—the Poondy Tank—is of importance, but news of others is certain to follow.

11. For the present my intelligence is almost entirely by telegraph, no letters having been received for four days. It is not clear why this should be so, as communication with the Railway was perfectly practicable yesterday morning, and there is no conceivable reason why the mails should not have been brought over by noon.

12. Such further report, as may be necessary, will be made hereafter. It is obvious that these disasters following so close upon those of the early part of the

year will put a very severe strain upon the department, but Government may rely upon every effort being made by the Public Works Officers for the mitigation and repair of damages.

13. A copy of this report has been forwarded to the Chief Engineer for Irrigation.

No. 2,101.

P.S.—Since the above was written a few letters have been received, but the only information of importance is contained in a demi-official from the Collector who informs me of the destruction on the 26th instant of the bridge on the Bangalore road over the Palmanair River, 3 miles from the town of that name.

(True Copy.)

VELLORE,
29th October 1874.

(Signed) J. PENNYCUICK, Captain, R.E.,
District Engineer, North Arcot.

From Captain J. PENNYCUICK, R.E., District Engineer, North Arcot, to Lieutenant-Colonel J. MULLINS, R.E., Chief Engineer for Irrigation, dated Vellore, 23rd November 1874, No. 2,380.

In continuation of my letter, No. 2,101, of 29th ultimo, I have the honor to report that I have inspected the Palar and Poiney Anicuts; but that, at the time of my inspection, there was still too much water in the rivers to admit of any thing like a proper examination of the foundations.

2. At the Palar upwards of 1,500 feet, out of the original length of 2,600 feet, have been destroyed; as far as could be ascertained by soundings with an iron rod, the foundations have been completely torn up to a depth of at least 3 feet below the sill of the head sluices.

3. It is stated that the anicut gave way first at the central under-sluice, and this is probably the case. In the middle of the stream there is no trace of the body wall to be found at present; but for a considerable distance at each side of the breach the wall is lying up-stream, showing clearly that a breach was first formed in the middle, and that the scour produced by the set of the current towards this breach undermined the foundation on the upper side, and thus caused the body wall to fall in.

4. The effect of this scour is very noticeable at the bridge piers which, as you are aware, are built in with the body of the anicut. A hole, 7 or 8 feet deep, is scoured out on the side of each pier furthest from the breach, the sand on the side nearest to the breach being flush with the top of the pier and anicut wall. But the most remarkable proof of the force with which the stream set towards the breach is in the fact of one pier (the 17th from the left bank) having been completely torn off from the anicut wall and carried away, the anicut itself being uninjured at this point, and for about 10 yards beyond it.

5. It is not at all improbable that the breach was directly caused by the existence of vents in the middle of the anicut. A tree coming down the stream might easily be drawn down by the draught through the vents and so be forced against the covering stones and displace them, at the same time loosening the masonry in the neighbourhood. Even if this did not happen, the lateral scour produced by the draught through the sluices must necessarily be injurious to foundations. At the best these vents are a source of constant trouble and expense, and I have never been able to understand their object, as they do not serve the purpose fulfilled by vents near the flanks of an anicut of keeping the head sluices free from silt.

6. With the exception of the anicut the head works have suffered no injury, but, as already reported, the overflow of the Palar breached the Poondy Tank, and the water from the latter breached the Caveripak and Govindavady Channels, and threw an excessive quantity into the Caveripak Tank.

7. Various wild statements, to which I do not attach much credit, have been made as to the level to which the water rose in the latter tank, but there appears to be no doubt that the surplus channel was full nearly, if not quite, up to the crown of the arches of the bridge immediately below the tank calingulabs, so that the discharge must have been very great. The tank sustained no injury, and I think we may congratulate ourselves on the result of the work done to it during the last two years.

8. In my letter, No. 2,101, of 29th ultimo, I stated that the flood water entering the Govindavady Channel had carried away the work done for the restoration of the bridge on the trunk road, but I find that the damage done was very slight, being confined to the destruction of a small quantity of half-finished archwork, the piers being uninjured. As the channel was blocked up with centering pillars, etc., this speaks well for the way in which the work has been done.

9. The Poiney Anicut has been completely carried away from end to end, nothing being left but the under-sluices on each flank, and, as far as can be judged at present, the destruction of the foundations is as complete as at the Palar. No material injury has been done to the head sluices or the anicut channels.

10. I have given orders for the immediate collection of materials for the repair of the two anicuts and for the construction of bunds across the breaches as soon as the condition of the river allows. Every effort will be made to get the restoration so far advanced during the next six months as to enable the June freshes to pass into the channels. I take it for granted that no question regarding funds will be allowed to interfere with the vigorous prosecution of these repairs.

11. I cannot find in this office, or in either of the Range Offices, any plans or sections of either anicut; if any such are in your or the Government Office, I shall feel much obliged by their being sent to me.

12. The Cheyaur head works have escaped material injury, the road embankment having given way and so relieved the anicut and bridge, but the channel, as usual, has been damaged in several places. This channel has only one bank, and acts as a catchment drain to all the country above it, and will never be in a satisfactory condition until it is properly embanked, and arrangements made for passing surface drainage across, instead of into, it.

13. The Poorsay Tank, the terminal tank of the Cheyaur Main Channel, and one of the largest in the Wandewash Taluq, had a very narrow escape. The bund was topped almost from end to end, and was only saved by the fact of the Wandewash-Trivatore Road passing along it, and its being therefore of greater width than ordinary, and metalled on the top. If this tank has gone, it is hardly possible that the Madurantakum Tank could have escaped. I am not at present satisfied as to the true cause of this excessive influx of water to the Poorsay Tank, nor therefore as to the proper measures to be taken for its future safety, but the matter will receive full consideration.

14. Of breached tanks, the following are reported:—

Wandewash	...	...	...	...	...	...	36
Poloor	...	...	...	...	...	...	20
Wallajah	...	...	...	...	...	...	14
Palmanair	...	...	...	...	...	...	3
Chittoor	...	...	...	...	...	...	3

but, with the exception of the Poondy Tank, none of them are of importance.

15. The floods of this year have exposed the imminent danger to which the irrigation works and the country generally along the banks of the Palar and Cheyaur are exposed from the overflow of these rivers. Last year was an unusually dry one, and the evil did not show itself, but this year the damage done has been very great.

16. The road from Wallajahpett to the Palar Anicut has been twice breached by the overflow of the river above the anicut, and on the second occasion the damage described in paragraphs 6 and 8 of this letter, the repair of which will cost not less than Rupees 8,000, was caused. Three times the river has overflowed its right bank above Vellore and breached the road to the Railway Station, causing heavy expense to the Municipality and immense inconvenience to the towns-

people. Near Pallicondah again, about 7 miles higher up, it has overflowed and damaged the road. The Cheyaur has over and over again injured the roads running along its banks, and estimates, aggregating upwards of Rupees 10,000, have been found necessary for the repair of injuries caused by this one river. Apart from the injuries to public works, the damage done to crops by the fields being flooded is very serious, and many complaints are made by the ryots on this account.

17. The left bank of the Palar above the anicut will be dealt with at once in the interests of the anicut works, and estimates for the purpose have already been prepared. With regard to the other points where improvements are necessary, it will be a question how far the charges to be incurred should be considered Imperial and how far Local; this, however, is a matter of detail, the essential point being that the subject should be taken up systematically and completely. It is obvious that any work of this nature must include the construction of head sluices to the numerous open river channels which in their present condition would simply be so many breaches in the embankment.

SUBMITTED for the information of Government.

With a view of obtaining the best information possible as to the cause of the breaching of the Palar and Poiney Anicuts, these works were visited on the 8th and 9th instants.

2. *Palar Anicut.*—The Palar Anicut consists of a body wall 6 feet above the first apron, which is of large split stone 10 feet wide; the second apron is of rubble masonry 36 feet wide, and beyond this there was an outer rough stone apron 15 feet wide.

The excellence of the masonry of this weir I had on previous inspections noticed, and the present state of this work abundantly testifies to the careful way in which it was built. Every part of the masonry, which has been left standing, is in good order; the body wall and the bridge piers held out until they had been undermined to such an extent as to cause lengths of many feet to break off in a mass, and those masses where not buried in the sand remain without the displacement of hardly a brick, and most of the coping is as firmly fixed as ever on the top of the over-turned masses of wall. The bridge piers are about a foot higher than the anicut crest, and are of brick-work unplastered, and I did not see one brick of their top courses missing, except on the lower edge of one of the cut-waters, and this I rather think was washed out long ago. The bridge, it should be mentioned, never was completed, but stands as a monument, like that across the same river near Chingleput, either of want of sufficient consideration, in the first instance, of the needs of the country, or of the absence of that fixedness of purpose without which no good results can be attained. The bridge near Chingleput would have been a work of great utility, and, when all the difficult part of it had been done, it came to a standstill, the less complete but still convenient causeway having been destroyed to make way for the bridge. The Palar Anicut Bridge would never have been worth its cost, its site being 5 or 6 miles below the point, between Arcot on the one bank and Raneepett on the other, where a bridge would have been of great value.

3. *Anicut Bridge.*—As it is certain now that a bridge across the river at the anicut will not again be proposed, seeing that so much of the work before done

has been washed away, it will be advisable to cut down the remaining piers to 2 feet below the crest of the weir, leaving the lower parts to act as small groynes.

4. *Causes of damage.*—It is possible that, as Captain Pennycuik has suggested in paragraph 6 of his letter, the damage to the anicut may have commenced at the under-sluices which occupied a position at its centre. The more detailed examination however, of which the state of the river at the time of my visit admitted, indicates, in my opinion, very clearly that scour below the outer apron working back and engulfing that, then undermining the rubble masonry apron and that of split stone, and so having the main wall open to attack, was the direct cause of the breach. The aprons have received no injury whatever from the overfall; indeed, from the weir wall to the outer edge of the rubble masonry apron there has been no damage of any kind, except the removal of a few square feet of the outer edge of the extended apron at the south side of the southern set of under-sluices; and this was manifestly caused by undermining. The outer rough stone apron has, with few exceptions, disappeared from sight, and in many places a 10-foot pricking rod met with no resistance, but elsewhere stone was found 4 or 5 feet below the surface, and in some places a good deal of stone has merely sunk. The direct evidence of the breaching of the dam having been caused by scour below, it is confined to the visible action of this kind at the southern set of under-sluices above referred to, and to the position of one large mass of the rubble stone apron just to the south of the place which was occupied by the centre set of under-sluices; this mass has the edge which was nearest the weir wall tilted up about 6 feet, and the original surface of the apron is down stream, so that it certainly was undermined and torn off, the lower part falling in a hole of very considerable depth.

5. The position of the breach may have been determined by the action of the water passing through the central under-sluices, coupled with the location of sand banks below the dam; and of this latter there is no record. The different degree of displacement of the rough stone apron below the parts of the anicut still standing shows that the intensity of the action varied considerably, and the scour went on most rapidly where from some local causes, in which may be included a rather marked set off the left bank of the river above the anicut, this action was the most marked. Nothing is known at present as to the dimensions of the breach at first, but probably nine-tenths of the damage were caused after the breach by the undermining on the up-stream side caused by the water rushing towards the breach. The bridge piers, no doubt, greatly retarded the destruction, for they had to be destroyed before the foundations of the weir wall were open to attack.

6. The foregoing details have been dwelt upon at some length, because, in order to provide against future accidents, it is necessary to understand as clearly as possible why this fine anicut has failed. It was built some 20 years ago, and has never before, so far as I am able to ascertain at the moment, suffered any serious injury of any kind, repairs having been confined to pointing the aprons and replacing the sunken or washed-away stone of the outer apron. The level of this destructive flood was from $7\frac{1}{4}$ to $7\frac{1}{2}$ feet above the crest of the anicut, a height from which no apprehensions of damage to it need have been felt.

7. *Old section a good one.*—I am able to suggest no improvement of the old section up to the outer edge of the rubble masonry apron. The central under-

sluices were not of much, if any, use, and they should be omitted from the restoration; but those under-sluices which remain uninjured should be retained permanently. The sets nearest the head sluices should continue to be made use of to keep the channel heads clear, while the others should, as a rule, be kept closed. All the revolving shutters should be removed from the under-sluice vents, and needle shutters should be substituted, the latter being supported at top by a cross stone, with a second stone in front, and below by two 3-inch round bars of iron. It may occasionally be necessary or desirable to lower the water level in the basin above the anicut, and for this purpose the efficient under-sluices should be retained, though at a distance from the channel heads.

8. *Means of rendering anicut safe in future.*—Security against damage in the future will best be obtained by a material addition to the outer rough stone apron and by keeping a reserve of stone on the spot for replacing sunken or removed stone. The District Engineer has been requested to provide in his repair estimate for an outer apron of 30 feet width, or double that of the former one, and this is to have a depth of 4 feet at the junction with the masonry apron and of 3 feet at the outer edge, and its surface is to be placed 1 foot below that of the masonry apron. The reserve of stone should be one-third of the contents of the outer apron, or, say, 3,500 cubic yards, and, for the reasons given in connection with similar reserves in Tanjore, their value should be charged to stock.

As an additional security, groynes 45 feet long and at 90 feet from centre to centre should be run out from the outer edge of this apron and at right angles to it; they may have a width of 1 foot at top and 3 yards at the base which will be flush with the under side of the outer apron; they will prevent the formation of channels running parallel to the apron within a distance which would be of moment. The surface stones of the outer apron should be large; 2 cubic feet or 300 lbs. weight will be a proper size.

Above the anicut groynes 60 feet long should be placed on the river side of the under-sluices next the head sluices or wings, on both sides of the other under-sluices, and at about 180 feet intervals between the latter. At their junction with the remaining piers or body wall they should be 2 feet below the crest of the anicut, and at the outer end flush with the under-sluice sills. They will check lateral currents above the anicut. In other respects the details of the section of the uninjured part of the anicut should be adhered to.

9. *Checkramellore Channel Head.*—Some erosion of the right bank of the river below the weir took place, and the Checkramellore Channel, which has its head in a raised part of the anicut at the southern end, was breached. There has been a proposal to do away with this head, and to supply the channel from the Doosy Channel: the feasibility of so doing should be ascertained at once, and, if it be not practicable, the head sluice of the channel must be raised to 3 feet above the flood of 1874, or 10 feet above crest of anicut, and the wall, which forms the left bank at the head, must be raised in proportion, and the bank in continuation of this wall must, for a distance of 100 yards, be strongly revetted on the river side, care being taken, *first*, that a yard in thickness of good soil, revetted with nanul, is placed immediately behind the revetment; and, *secondly*, that the latter is founded 5 feet below under-sluice sill, and protected by 9 feet width of rough stone apron, 3 feet thick placed with its surface 2 or 3 feet below the sill level.

10. *Head Sluices.*—The walls under the arches of the South Main Channel head sluice have been raised since my visit to the works in May 1873 to 6 inches above the recent flood level, so that no water entered this channel, except through the vents which are regulated by revolving shutters which are very difficult to work. No damage was done.

The similar walls of the northern head sluices should be similarly raised, as they were submerged by the flood water, and thereby an addition was made to the quantity of water which found its way into the channels by spill from the river.

The southern flood bank above the anicut stood well, and suffered only slight erosion of the front slope. Its alignment is not good.

11. *Overflow of the Palar generally will have to be controlled.*—It will be necessary to ascertain at what points throughout the district the Palar overflowed its banks, or breached its embankments, as also the course taken by the water so spilt, for flood banks, which are liable to be turned, are of very little value. Continuous levels of the river bed, with cross sections at intervals and flood levels as often as these can be found out, will be requisite to deal properly with this subject wherever the ground on either side of the river is not palpably well above the necessary level, and it must be borne in mind that some of the affluents will also need embanking for a greater or less distance from the point of junction.

12. *Poiney Anicut.*—The state of the Poiney Anicut is somewhat better than the District Engineer supposed to be the case when his letter was written, as 256 feet remain out of 792 feet. Here, as at the Palar, there can be no doubt of scour in rear having been the cause of the damage, though why this particular fresh should have caused a breach it is difficult to conjecture. The anicut was seen by the Range Officer, Mr. Smithers, just before the fresh, and the aprons were then in good order. The Monigar says that the apron failed first, and the breaching of the weir wall followed.

The aprons were as follow, and certainly those of masonry were very ample:—

First apron 12 feet wide of split stone with a drop of 1 foot at its outer edge.

Second apron 27 feet rubble stone-in-chunam 3 feet thick, with a retaining wall 3 feet deep under outer end and 6 feet wells below that.

Third apron rough stone 12 feet wide, except at the under-sluices where 10 feet additional width was given and 3 feet thick.

The fresh was about 1 foot lower than those of October 1871 and May 1872, and there was no unusual volume of water, therefore, to account for the accident. The river bed has been changed so entirely by the sweeping away of so much of the anicut as to afford now no evidence of its circumstances before the accident. The weir was inspected by me in May 1873, and in a memorandum of instructions

No. 292, of the 12th May.

sent to the District Engineer, it is noted that but little damage had been sustained from the freshes of the preceding year,

and that only ordinary repairs were required. It was remarked that the crest of the anicut was rather weak compared with what is usual (it is rubble stone-

in-chunam instead of large well-shaped stone), but that it appeared to have stood well, and would probably continue to do so if good lime were used for the joints.

A great deal of the body wall fell down stream, which indicates that much of the apron failed about the same time. Some of this wall sank almost vertically, where it stood, and the coping is now but little above bed level.

This anicut was built at about the same time as that on the Palar, viz., about 20 years ago, but its masonry, whether brickwork or stone, is inferior to that of the latter, and it is questionable whether the lime is so good. I saw, however, no reason for supposing that this had any thing to do with the failure, and of course 20 years are a sufficient trial to render it very improbable that faults of construction should have been the cause of the accident.

The disappearance of the outer rough stone apron behind the remaining parts of the anicut show that this was really the weak point, and it may be noticed that this disappearance would seem to have taken place before the breach occurred, seeing that sand was thrown upon the two sides of the river below the dam when the current was concentrated in the middle of the bed.

The remedy will be, as at the Palar, a large addition to the width of this apron which should be made 24 feet wide instead of 12 feet, 4 feet thick at the junction with the rubble masonry apron 3 feet at the outer edge, and the surface should be 18 inches below that of the second apron. Also, at the suggestion of the District Engineer, a retaining wall midway between the body wall and the retaining wall of the second apron will be inserted. Groynes should be run out from the edge of the rough stone apron down stream and above the body wall up-stream, as noticed in detail for the Palar Anicut.

The new body wall should be made somewhat more massive than before, the width of the crest being increased by 1 foot and rounded off at the junction with the old walls. The crest should be of split stone (whole stones) not less than 9 inches thick.

A reserve of stone to the extent of one-half the contents of the outer apron should be maintained.

13. Certain improvements to the head sluices and under-sluices and other precautions detailed in the memorandum above referred to have not as yet been carried out, and they should be attended to at an early date. Had the fresh of this year been a foot higher than that of May 1872, there might have been a good deal of preventible damage done.

14. *Cheyaur Anicut.*—Government have already had before them the information given in the District Engineer's letter, No. 2,088, of the 29th October last. It will, however, be noticed with satisfaction that the head works of the Cheyaur Anicut have not suffered materially, but the facts of this flood must be acted upon at once, and a sufficient margin provided against future contingencies. Each drainage falling into the Cheyaur Anicut Channel should be dealt with according to the circumstances. It is but seldom financially advisable to pass extreme floods entirely under a canal, but about one-third of such floods may, with advantage, be provided for by aqueducts or culverts, and for the remainder fully adequate inlets and outlets are the best arrangement consistent with economy.

Ten feet a second is a safe velocity of discharge through culverts, and the length of the inlets and outlets should be determined with reference to the maximum level to which water in the canal may be allowed to rise.

15. The construction of head sluices to the several open river channels of the several rivers is, as the District Engineer remarks, a necessity if flood waters are to be confined within embankments and prevented from going all over the country damaging cultivated lands and breaching tanks.

16. *Temporary bunds above the anicuts.*—There is nothing now to prevent a bund being thrown across above the breach in the Palar Anicut, and a similar bund will be placed above the Poiney Anicut. The District Engineer is of opinion that all the irrigation has hitherto been fully supplied, and the quantity of water in these rivers being now small, the bunds will be comparatively easy works to construct, and no time should be lost in collecting the large quantities of stakes, brushwood, and nanul or other grass, which will be required before operations can be commenced.

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

No. 492.

ORDER THEREON, 27th January 1875, No. 239.

IRRIGATION, No. 52.

THE foregoing papers contain information regarding the damage sustained by the Palar and Poiney Anicuts and

certain works of irrigation and other works in the North Arcot District in October last, together with the remarks of the Chief Engineer for Irrigation on the probable causes of the serious injury which the anicuts have sustained. The District Engineer will be guided by these remarks in preparing his estimates, and, in the meantime, materials must be got ready with the utmost possible despatch, so that the foundations may be completed during the most favorable season of the year.

2. The work is one of reconstruction rather than of repair, and the Government of India have already been requested to make an additional allotment of Rupees 50,000 to meet its cost, and that of similar emergent works, which must be carried out in anticipation.

(True Extract.)

Colonel, R.E.,
Secretary to Government.

To the Chief Engineer for Irrigation.

.. District Engineer, North Arcot.

.. Controller of Public Works Accounts.

Exd. A. Grubert. *Per Sept.*

Spare Copies

Revenue Department
Sdlt. of 1875 Madras.

PUBLIC WORKS.

To

THE CHIEF ENGINEER FOR IRRIGATION,

Secy. Secy. Secy.

Dated January 27th.

Recd. — a — 28.

Encl.

G. O., 27th January 1875, No. 239.

JANUARY.

Nos 491 492

Handwritten signature

a To the Secy. of the Rev. Secy. of the

(and) Palar and Poincy Anicuts, North Arcot District — Passing orders on papers submitted by the Chief Engineer for Irrigation containing information regarding the damage sustained by the anicuts and certain works of irrigation and other works in October last.

N^o 208
Comm. to the
Board of Revenue

29 Jan 75

Handwritten signature