M.R.O. 14—5,450—22-10-25.

MADRAS RECORD OFFICE.

Government of Madras.

Revenue DEPARTMENT.

G.O. No. 690 Press Mis.

385 386

Dated 22—3—1867

Not to be folded or roughly handled

No. 385. Read the following Proceedings of the Madras Government in the Public Works Department:—

Passing orders on letter from Superintending Engineer, 6th Division, submitting Captain Mead's report on the Cauvery, and drawing the attention of the Collector of Tanjore, through the Revenue Department, to Captain Mead's remarks regarding the supply of water to the more remote lands of the eastern talooks, and requesting the Revenue authorities to take measures for preventing the mischievous waste of water reported to occur through want of careful regulation of the sluices according to the actual requirements of cultivation. (Here enter 14th March 1867, No. 775.)

No. 386. ORDER THEREON, 22nd March 1867, No. 690.

Miscellaneous.

Copies of these papers have been already furnished direct to the Revenue Board, who will instruct the Collector, in communication with the Superintending Engineer, to make the best arrangements in his power to prevent waste in the distribution of the water.

(True Extract.)

(Signed) J. GROSE,
Under Secretary to Government.

To the Board of Revenue, with Proceedings Public Works Department, No. 775.

Exd. S. T. Augustin.

No. 301. Read the following letter from the Superintending Engineer of the 6th Division:—

(Here enter No. 1,111, dated 15th December 1866.)

No. 302. ORDER THEREON, 14th March 1867, No. 775.

CIVIL WORKS, No. 31.

1. The Revenue Officers of Tanjore have for many years past urged upon the attention of Government the very considerable falling off of cultivation from the Cauvery in the eastern talooks of that district, in consequence of the river below Combaconum obtaining no proper supply of water except during its higher freshes. These occur only at intervals, and are of too short duration to afford a sufficient supply. Attributing the evil to a gradual filling up of the river channel with sand, which, it was alleged, had been allowed to accumulate through the neglect of the Public Works Department to perform the usual clearances since the conservancy of irrigation works was transferred to its charge, it was proposed to expend a large sum of money in attempting to carry out those clearances.

See G. O., 7th March 1865, No. 625.

The Government did not however concur in this view. They were aware, from the reports of Colonels H. C. and A. Cotton, as well as from those of other professional Officers who had successively been in charge of Tanjore, that the ever-shifting nature of deltaic rivers, like the Cauvery and its branches, tended to produce changes in the relative capacities and levels of their respective effluent streams, which must necessarily result in a new and unequal distribution of their waters, (such as that which had taken place in the Cauvery) unless timely and effectual measures were adopted for permanently regulating the heads of all those streams. The heads of the Cauvery and Vennaur had already been provided with dams which permanently defined the respective capacities of those streams, and it was believed that, by the construction of similar dams at the heads of all the other main branches, the river might be restored to its normal state, and all cause for complaint of the non-supply to the eastern talooks removed. The Government accordingly declined to sanction any partial measures of relief, but expressed their willingness to take into consideration any complete scheme of works which might be designed on properly prepared data obtained from carefully conducted surveys and levels, and they desired that these should be prepared and submitted to them, with full information regarding the state of the river and its branches not only below Combaconum but throughout the delta.

2. The duty of collecting this information and of carrying out the requisite survey and levelling operations was entrusted to Captain Mead, an Officer of Royal Engineers in every respect qualified for the work. The papers at the head of these Proceedings are the result, and the Government have much pleasure in recording their appreciation of the able and thorough manner in which the information they require has been brought together and placed before them.

3. Assuming that twenty cubic yards of water per hour are ample for the irrigation of a valie of land, and this is unquestionably a very liberal allowance, Captain Mead shows, by comparing the quantity of water passing the Cauvery dam at the

1 valie=6¾ acres.

head of Serungum, at various states of the freshes, with the area of wet cultivation dependent on that water, that, when the river is flowing five feet in depth over the Serungum dam, there is a full supply entering the delta for all purposes. As the Cauvery, on an average of years, attains that, or nearly that height, on a sufficient number of days during the cultivating season from June to November to ensure, with the assistance of local rain-falls and drainage, the bringing to maturity all the crops dependent on it, it is only in these exceptional years when the local rains entirely fail that any absolute scarcity of water is experienced. If it does not reach the eastern talooks it is because the system of providing regulating works, similar to the dam which was so sucessfully constructed at the head of the Vennaur in 1851, has not been extended to the heads of the other main branches, viz., the Codamoorty, the Arasalar and the Veerasholen.

4. The water-way allowed to the head of the Vennaur by the dam built in 1851 is so much less than that left to the Cauvery as to prevent the former receiving a share of water proportionate to the extent of cultivation under it compared with that under the Cauvery, but, nevertheless, no failure of crop occurs under the Vennaur in ordinary seasons. Neither would there be any scarcity in the Cauvery but for the disproportionate drain on its waters caused by the Codamoorty, which, having a channel as large as the Cauvery at the point of bifurcation, carries off much more than its proper proportion of water in low, and three times as much as is needed in high freshes. A dam at the head of this stream to limit its capacity to such dimensions as will allow it to take off no more than a full supply when the river is not more than five feet in depth over the Serungum dam, is the work which is manifestly most urgently required to prevent the great waste of water that now takes place.

5. The other main branches, the Arasalar and Veerasholen, are found not to abstract much more water than the cultivation dependent on them requires, and Captain Mead does not propose, in providing them with regulating dams at their heads, to diminish their capacity in the same way as he circumscribes the dimensions of the head of the Codamoorty. On the contrary, by contracting the outlet by the Codamoorty, the Cauvery will carry down so much more water than it does at present, that both the Arasalar and Veerasholen will obtain fuller supplies. They in their turn, however, will then have a tendency to enlarge their heads, and to prevent this, as well as to secure the supply of the Cauvery lower down, it is necessary that the system of regulation by masonry works should be extended to their heads as well as to the Codamoorty.

6. The statistics collected by Captain Mead show that at present in a five feet fresh on the Serungum dam, the three main open branches of the river take off the following quantities of water:—

The Codamoorty $\frac{3}{4}$ths more than a full supply.

The Arasalar about a full supply.

The Veerasholen less than half a full supply, leaving only $\frac{1}{4}$th of a proper supply in the Cauvery for the lands east of Combaconum. In higher freshes the proportionate quantities of water withdrawn are,

By the Codamoorty three times a full supply.
" Arasalar nearly double a full supply.
" Veerasholen nearly double a full supply.

Proceedings of the Madras Government, Public Works Department,
14*th March* 1867.

It is not till the river reaches a depth of from six and a half to seven feet on the Serungum dam that the Cauvery below the Veerasholen obtains a full supply, and as the Cauvery attains that height on not more than about thirty days each season, the eastern talooks cannot possibly be sufficiently watered under the present state of things, and it is necessary that no time should be lost in carrying out measures for correcting it.

7. The regulating works proposed by Captain Mead to be constructed are similar to those provided for the regulation of the Cauvery and Vennaur in 1851, and being designed on well ascertained levels, and after the fullest inquiries, they appear to be well calculated to effect the object sought to be accomplished, and the Government accordingly authorize their construction to be proceeded with next season from the grant of Rupees 50,000 made for the purpose in the Budget of 1867-68, on the undermentioned estimates, which, together with the estimate of Rupees 9,550 for minor new masonry works, are hereby sanctioned:—

Regulating dam with bridges for Cauvery and Codamoorty	Rupees	72,300
Cauvery and Arasalar dams	,,	10,000
Do. and Veersaholen do.	,,	7,300

8. Whatever may be the quantity of water in the Cauvery it will be impossible to secure a good supply to the more remote lands of the eastern talooks if proper attention be not given to the working of the numerous sluices between Combaconum and the sea. The attention of the Collector will be drawn, through the Revenue Department, to Captain Mead's remarks on this subject, and the Revenue authorities will be requested to take measures for preventing the mischievous waste of water which it is reported is allowed to occur through want of careful regulation of those sluices according to the actual requirements of cultivation.

9. Besides the works above sanctioned for the regulation of the three main branches which now abstract too much water, the Superintending Engineer points out that other works to control certain minor* streams will be necessary, and he gives approximate estimates of the cost. These works may hereafter be constructed if required, and the Superintending Engineer will submit in due course regular plans and estimates for such of them as he may propose to build.

* Vettaur	Rupees	25,000
Pamaniyaur } Coriyaur }	,,	25,000
Paundaviyaur	,,	7,000
Vellaur	,,	6,500

10. With his inquiries as to the means of dealing with the rivers to restore their proper supply of water to the eastern talooks under the Cauvery, Captain Mead has, in accordance with his instructions, combined an investigation into the subject of the better disposal of flood waters to prevent the damage which is now occasioned throughout the delta when the river rises so high as to endanger the embankments, and, keeping this object in view, his proposals embrace the improvement of the supply of the Vennaur. Basing his calculations upon the fact of not more water being passed down the Cauvery by the action of the upper anicut than is easily manageable till the flood reaches a height of about eleven feet on the register at the Serungum dam, he proposes to prevent more than an equivalent to the quantity thus entering the Cauvery flowing further than the grand anicut, by

constructing at 200 yards below that work a vented dam across the Cauvery, which should be so arranged as not to affect the discharge of the river in low freshes, but, opposing an obstruction to its passage as it rises in flood, would cause all surplus water exceeding what would produce a 10½ feet fresh to be passed over the grand anicut into the Coleroon. This vented dam would likewise give the means of better supplying the Vennaur when necessary; and, to secure sufficient water for the Cauvery, Captain Mead would raise the tambogee which now exists in the body of the upper anicut to the level of the rest of the work. He would further heighten the grand anicut by ⅞ths of a foot, and close the Coviladi surplus calingulah which is situated two miles below the grand anicut.

11. The Government do not see any reason to question the soundness of the principles on which these proposals are based, but, looking to the scouring effect of a discharge through the vented dam of a large volume of water under a head of four feet, they have misgivings of the stability of the structure, and they think that it would be necessary to strengthen the work by the addition of a very much larger quantity of rough stone than Captain Mead or the Superintending Engineer contemplates using. His Excellency the Governor in Council too is not satisfied as to the expediency of diminishing the water-way over the upper anicut by closing its tambogee. He fears that the measure would be distasteful, if not injurious, to the cultivators of lands under the Coleroon, both in Tanjore and South Arcot, and, seeing that the object of preventing damage by floods in the delta may be as effectually attained by the construction of reservoirs, which, intercepting rain-fall, would lessen the volume of those floods, while at the same time providing a reserve of water for the better supply not only of the Vennaur but of all the delta streams, his Lordship deems it advisable to defer the further consideration of this part of Captain Mead's suggestions, till the investigations, which have never been lost sight of, for suitable sites for reservoirs on the upper basin of the Cauvery are completed.

(True Extract.)

Colonel, R. E.,
Secretary to Government.

To the Superintending Engineer, 6th Division.
,, Revenue Department.
,, Board of Revenue.
,, Controller of Public Works Accounts.
,, Accountant General.

Ed. T. C'Connor.

No. . Read the following letter from the Superintending Engineer, 6th Division, to the Secretary to Government, Department Public Works, dated Tanjore, 15th December 1866, No. 1,111.

With reference to the Orders of Government noted in the margin,* I have the honor to forward Captain Mead's Report on the Cauvery and its enclosures. The information contained in the enclosures is very complete both as regards the present condition of the Cauvery, and the effect of the works proposed, and great labor and research has been necessary to admit of the subject being treated of so fully.

* G. O., No. 2,712, 17th September 1864.
G. O., No. 2,892, 7th October 1864.
G. O., No. 3,105, 28th October 1864.
G. O., No. 3,185, 5th November 1864.

2. It appears to be unnecessary for me to recapitulate the history† of the Cauvery, and to trace its gradual improvement‡ from the period when the Province of Tanjore was made over to the British Government in 1800, to the present date. I will confine myself to the present condition of the river and of its branches, and to the method proposed to obviate their defects, which may be stated as follows :—

† Captain Mead's Report, paragraphs 1 to 8.
‡ 9 to 21.

1*st.*—That the waters do not reach the extreme limit of the cultivation in the east of the delta, especially under the main stream, the Cauvery itself, until nearly a double supply for the delta is entering the Cauvery at its head; and,

2*nd.*—That in extraordinary floods the means of getting rid of surplus water are inadequate, and consequently numerous breaches occur in the delta.

3. With regard to No. 1, it will be observed that, with the exception of the Vennaur, the first branch taken from the Cauvery, and to which I will revert below, there are no masonry regulating works at the heads of the main branches, and the consequence has been that on some occasions a branch, and at others the main stream, has been found to carry away a far larger proportion than its proper share of water when the rivers were low, while owing to irregularities in the beds of the streams the proportion conveyed away by each stream during high floods has often been reversed: to obviate this defect, it has been proposed to construct regulating dams at the heads of the Codamoorty, the Arasalar, and the Veerasholen rivers, so arranged as to regulate the supply to the main stream and to the branches as nearly as possible in proportion to their actual requirements in times of scarcity, or when the rivers are low, and according to the capacity of the rivers, to dispose of their surplus water when the rivers are in flood; while the regulating work proposed to obviate the second defect prevents a larger quantity of water than is represented by a 10½ feet fresh on the Cauvery gauge, at the Serungum head, from entering the delta; experience having shown that the deltaic rivers are quite capable of discharging the water brought down by a 10½ feet flood.

Form M.

4. Form M. shows in juxta-position the proportion of their theoretic supply which the various streams now receive, and that which they will receive when the regulating works are completed, when water on the Serungum gauge at the Cauvery head stands at 6½, 6, 5½,

20 C. yds. per hour per valie of 6-6 acres.

5, and 4½ feet, and it will be observed that with a 5 feet flood, each stream, with the exception of the Vennaur, will receive a full theoretic supply, while at present only two out of the six streams receive a full supply in a 5 feet flood.

	M.	Ft.
At	60	2,530

Below the Veerasholen head the Cauvery becomes a mere channel, from which small streams branch, some of which are provided with head sluices, while others have open heads; here, as at the tails of all the streams, to ensure a proper supply to each channel, the head sluices or mouths must be closed by turns, for sluices cannot be constructed so as to convey away the precise share of each channel under all circumstances or states of the rivers for reasons already given in letter No. 1,018, dated 26th November 1866.

5. From enclosure Z., it will be observed that there is a very good fall in the Cauvery bed throughout its course, and the banks are in good order, with a few trifling exceptions. The banks can be secured, and the irregularities in the river bed can be rectified below the point at which it is proposed to construct the vented dam described below, from the ordinary allotment for repairs.

Paragraphs 34, 46, 50, 53, and 54.

6. The Cauvery itself has not deteriorated, but its supply to the eastward has diminished owing to the two main branches east of the Vennaur head, viz., the Codamoorty and Arasalar, having drawn off a far larger share than was due to the lands dependent upon them, and there can be no doubt that the regulating works at the heads of these streams must be supplied, and that they may at once be undertaken independently of any other works which may eventually prove to be necessary to prevent the waters, brought down during unprecedentedly high floods, from entering the delta proper.

7. I would strongly urge the necessity of providing an allotment of Rupees 30,000 for these works in the Budget of 1867-68, for if no allotment is made for them in 1867-68, the commencement of the works is practically postponed till 1869, for the works cannot be commenced in April 1868, even should an allotment be made for 1868-69, unless large quantities of materials are collected and preliminary arrangements are made in 1867-68. The plans of these works, as prepared by Captain Mead, are forwarded, but certain modifications are suggested in my Memorandum Y., for reasons therein stated.

8. It will be observed from the foot-note in Statement M. that if the Munniyaur is permitted to draw its supply from the Cauvery instead of from the Coleroon, the lands under the Cauvery and its main branches will, under the arrangements proposed, receive a full theoretical supply when the water at the Cauvery head stands at 5 feet, but, with the water wasted through the western sluices, at this height, water would not reach the eastern limits of the delta; and Statement F. shows that, while 5 feet of water is passing over the Cauvery dam, one-seventh of the total supply is lost to the Cauvery and is passing over the Tambogee or lower section of the south branch of the upper anicut. It is proposed to close this Tambogee, or to raise the anicut 1 foot over it, so as to bring the crown to a uniform level throughout the southern section of the anicut.

Codamoorty.
Arasalar.
Veerasholen.
Cauvery, east of Veerasholen.

9. The channels, &c., dependent directly on the Coleroon below the upper anicut are,

1st.—The Munniyaur.

2nd.—The Ponairy.

3rd.—The Veeranum tank and the North Rajah Voikal from the lower anicut in the South Arcot District, and

4th.—The South Rajah Voikal and Kumike Munniyaur in Tanjore from the same anicut.

10. The injury to the Munniyaur need not be considered, as it is to be supplied from the Cauvery. The Veeranum tank and the Rajah Voikals from the lower anicut will not, I think, suffer. The tank is supplied by an open channel immediately above the lower anicut, and draws its chief supply from the river when the river is in flood and water is running to waste over the crown of the anicut; but judging from the water returns at the upper and lower anicuts, it would appear that when water at the former stands below the crown of the anicut, and a very small quantity of water is passing over the Tambogee, the water at the lower anicut, derived from percolation and from wasted or surplus water from the Cauvery, stands within a few inches of the crown, and with this head the Rajah Voikals and Kumike Munniyaur receive more than a full supply when all their sluices are open.

Paragraph 88, Statements H. and M.

11. The Ponairy channel may suffer somewhat; but it is doubtful whether the supply it receives, when water is passing over the Tambogee of the anicut only, will be appreciably affected, for on such occasions the bed of the river near the Ponairy head appears to consist of a large plateau of sand with one or more channels winding through it, and if it is found that the Ponairy channel supply is materially affected by the closing of the Tambogee, it will always be possible to supplement the supply by opening some of the upper anicut sluices.

12. From Statement M. it will be observed that while, under the proposed distribution of water, the Cauvery and its main branches will receive a full theoretical supply when the water stands at 5 feet on the Cauvery dam at the head of the Scrungam island, the Vennaur will receive only 0·6 of a supply, and it will not receive a full supply till the water on the Cauvery dam gauges 6 feet, or when 1·7 of the full supply due to the lands in the delta is entering the Cauvery head, and till the Cauvery and its main branches are receiving 1·9 times the theoretical supply required by the lands under them. At present the supply the Vennaur receives is even worse, and is as follows:—

Gauge on Cauvery Dam W. level.	Theoretical supply.		Number of days water stands at the heights represented in Column 1.	
	Now.	Hereafter.		
6·5	1	1·1	*66	* Includes higher freshes.
6·	·9	1		
5·5	·7	·8	49	
5·	·5	·6		
4·5	·3	·4	38	

Thus, out of a season of say seven months or 214 days the Vennaur now receives a full or nearly a full supply for 66 days, about three-fifths of a supply for 49 days more, and less than one-third of a supply for 38 days, and notwithstanding this the crops, as a rule, come to maturity, and it is only in very bad seasons, when the local rains in the north-east monsoon fail, that there is not sufficient water to bring the crops to maturity; the out-turn must in a great measure depend upon local rains, and the water which will enter the Cauvery at its head, even under the new distribution, will only be sufficient to afford a full supply to the Cauvery for 153 days, and for the Vennaur for 66 days. It is, therefore, very desirable that reservoirs should be formed in the basin of the Cauvery to supplement the supply when the river unassisted does not bring down a full supply for the lands in the delta.

Letter, No. 133, dated 25th May 1866.

13. It must be observed that the 6·5 and 6 feet supply is not received for 66 days consecutively, and when the supply exceeds that required, the water is often stored in the fields; the number of days for which a supply can thus be stored, depends entirely upon the state of the crops. And again, as the eastern lands in the delta are cultivated later in the year than the western lands, and as there is often a difference of one month's growth in the plants on the high and low level lands in the same village, it is probable that the full theoretical supply is never required for all the lands in the delta at the same time except, perhaps, late in July and early in August, when the rivers are charged with far more than a full supply for the whole of the irrigation in the delta.

14. Though the area of the lands supplied by the Cauvery and Vennaur below the point at which the latter branches from the main stream are nearly the same, and though the actual supply received by the two branches under different heads of water is very much in favor of the Cauvery, the lands under the Vennaur seldom suffer more than those under the Cauvery when the freshes fail, and this is owing to the fact that while the Cauvery, east of the Vennaur head, receives no supplemental supply from surplus streams with one trifling exception,* and that near its extremity, the Vennaur and its branches receive the drainage of a large area of country, and the Vettaur,† its main branch, receives and is chiefly supplied in times of scarcity by the surplus water from the lands irrigated by the Cauvery. This will give some idea of the manner in which water is wasted by the proprietors of lands under the Cauvery in the western part of the delta.

Vennaur, 53,805 valies.
Cauvery, 53,452 ,,

* Iyavianaur.

† Cultivation, 13,293 valies.

15. In constructing the regulating dam at the Vennaur head in 1851, notwithstanding that the cultivation under the two branches, the Cauvery and the Vennaur, was nearly equal, a waterway of 936 feet was provided for the former, and 558 feet for the latter, this was done to prevent the flood waters in high freshes passing down the Vennaur and into the delta to so great an extent as to injure the Vennaur and its branches which have no means of

Paragraph 30.

discharging surplus waters, such as are provided in the Cauvery, in the grand anicut the Coviladi calingulah, and the Vaduvagudi surplus sluices, and thus while the Vennaur and its branches are in a great measure secured from injury, except in unusually high freshes, by the contraction of the head of the Vennaur, their supply in low freshes is not in proportion to the cultivation under them; to remedy the latter it has been proposed to lower the Cauvery dam at the Vennaur head, and to supply a sluice and a branch channel from the vented dam described below, but as the Cutchamungalum anicut, eight miles below the Vennaur head, probably raises the Vennaur bed above that of the Cauvery, it may be impossible to supplement the supply from the vented dam when the rivers are low without raising the head of water considerably in the Cauvery, and this would increase the head considerably during floods, and render the construction of the vented dam unsafe.

Paragraph 80.

Section on Plan II.

16. It is proposed to construct this vented dam across the Cauvery at about 200 feet below the grand anicut, for the purpose of providing for the second point adverted to in paragraph 2 of this letter, viz., the discharge in extraordinary floods of such proportion of the surplus water as experience has shown the delta streams cannot discharge with safety.

17. A 10½ feet fresh on the Cauvery dam at Serungum head may be regarded as a safe fresh, while the damage done even in an 11 feet flood is, as a rule, limited to the minor streams in the extreme eastern limits of the delta, or to the streams which draw their supply from the Codamoorty, the supply to which, by the regulating dam at its head, is to be very considerably reduced.

Vide Statement M.

18. The vented dam even in a 12·3 feet fresh (the highest known, with the exception of the extraordinary floods of 1858) is to limit the supply below it to an equivalent to a 10·7 feet fresh under existing circumstances, and the average number of days in a season at which the floods rise above 10 feet on the Cauvery dam is only two; a 10 feet flood will be equivalent to an 8·5 feet flood. The Cauvery and its branches will thus be rendered safe in high floods, and below a 7 feet flood the water now supplied will not be practically diminished, indeed in a 6·5 feet fresh it will be increased.*

Vide column 2 of lower Statement K.

Duration of floods in a season.	Present flood.	Equivalent below vented Dam.
2 Days.....	12·3	10·7
	12	10·5
	11	9·6
4 ,, ...	10	8·5
	9	7·7
8 ,, ...	8	7·3
16 ,, ...	7	6·8
35 ,, ...	6·5	6·6
	6	6
50 ,, ...	5·5	5·5
	5	5

* Statement K, Columns 8 and 13.

19. A proper theoretical supply to the lands under the Cauvery is 1,110† thousands of cubic yards per hour. As now regulated, the extreme eastern lands do not get a sufficient supply till there is a 7 feet flood on the Cauvery dam, or till 2,881 thousands of cubic yards per hour are passing down the Cauvery below the grand anicut. The vented dam will not affect the supply until the waters rise above

† Column 7, Statement A.

a 6·5 feet flood when 2·3 of a supply is passing into the Cauvery, and the maximum supply which will be permitted to pass down the Cauvery below the vented dam is 4 instead of 5·6 of a supply in a 12·3 feet flood. Thus, while the vented dam will not affect the supply to the Cauvery till it is receiving 2·3 times the supply it theoretically requires, it will, as the waters rise above the level which provides this 2·3 supply, allow that supply to rise to four times the theoretical supply, and this without danger to the banks.

Statement K.

20. The reasons for placing the vented dam in the position selected, for raising the crown of the grand anicut by ·7 of a foot, and for closing the Coviladi calingulah, are given in paragraphs 75 to 77 of Captain Mead's Report, and the work itself is described in paragraph 78 in detail. It may be said to consist of thirty vents of 20 feet span and 4 feet rise with piers 3¼ feet high, and of one vent of 25 feet span and 4 feet rise with piers of 11 feet in height. This vent is supposed to provide for the passage of boats, and is proposed to be placed in the centre of the bridge or vented dam. In the highest floods the head of water above this work will be 4 feet, or there will be a difference of level of 4 feet in the water above and below the dam, while the vents will be submerged as shown in the margin: owing to the enormous cost of turning the arches of 20 feet span with cut stone, it is necessary to construct the work with brick in chunam, and as the action of the water on the edges of the brick-work as it passes through the submerged arches will be very considerable, it is proposed to protect the up-stream faces of the arches and of the piers by extending the piers 2 feet and turning a ring of masonry (2 feet square in section), with a rise of 3 feet instead of 4 feet, and springing from 3 feet instead of 3¼ feet above the floor. This ring it will be possible to renew at a small cost when necessary, and it will admit of the waterway of the work being increased from 3,000 to 3,600 square feet should it be found necessary hereafter, under changed conditions of the stream below, &c., &c., to increase the waterway. The floor of this work will be on a level with the mean bed of the Cauvery, and will be provided with two aprons 9 feet and 12 feet broad respectively, the former 1 foot, and the latter 2 feet below the level of the floor, and the work will be further protected by an extended rough stone apron of about 18 feet.

Flood.	No. of days.	Vent Ring submerged.	
12·3 ft.	2	4 feet 6 inches.	5 ft. 9 in.
9 ,,	4	11 ,,	2 ,, 2 ,,
5·5 ,,	84	From 11 ,, to 1 foot above W.L.	From 2 feet 2 in. to 3 in.

Paragraph 78.

Rupees 900.

21. In paragraph 79 Captain Mead states what he conceives to be the probable objections to this work, and refutes them in detail; they are as follows, with my remarks opposite to them:—

(1.) Difficulty of building a work to stand a difference of level of 4 feet of water.

(1.) A mere question of expense—far more rough stone will be required than Captain Mead provides for.

(2.) Danger of river silting in rear, and thereby altering the conditions by reducing the head.

(2.) The silting, if any thing, will be very slight and may practically be disregarded.

(3.) Danger of raising the flood water level in the Cauvery.

(3.) Immediately above the vented dam the surface level of the water will be raised only 1·4 feet in a 12·3 feet flood, and with a surface fall of 3·4 feet per mile; the dam will not affect the surface level of water a mile to the westward of the dam.

(4.) Decrease of water in the Cauvery tending to silt it and to destroy back-waters.

(4.) Vide remark to No. 2. The highest floods are those most laden with deposit; keeping a large proportion of their waters out of the delta would be advantageous rather than otherwise.

(5.) Injury to navigation.

(5.) Navigation has not been sufficiently provided for. Boatmen, with the unwieldy basket boats, would not be able to hit off the solitary arch of 25 feet span in mid stream. The experiment might be tried of placing one or more arches for the passage of boats adjacent to the south abutment, but it will probably be found necessary to construct a lock in a channel branching from the south bank, and in this channel and above the lock the supplemental sluices for the supply of the Vennaur adverted to in paragraph 15 may be placed.

22. With regard to the non-regulation of the supply to the various lands in proportion to their actual requirements in times of scarcity, the wastage of water by the proprietors of the western lands in the delta, and the state of the Law on the subject, I addressed you so recently that it is unnecessary to recur to the subject, further than to observe that the supply might in a great measure be regulated by altering the head sluices, instead of constructing separate dams for each channel as proposed by Captain Mead; either work would be equally opposed by the proprietors of the channels. I think the appointment of a special officer for the purpose of attending solely to the irrigation works, and the regulation of the supply of water, unnecessary. Not being gifted with ubiquity, he would be able to do far less by way of regulating the supply in times of scarcity than the Range Officers can do. All that is required is legal sanction for interference when the necessity arises.

Paragraphs 94 and 95.

No. 1,018, 26th November 1866.

Paragraph 96.

Paragraphs 97 and 98.

23. With regard to the vented dam, and the method to be adopted to supply the Vennaur, I would suggest that a Committee of Engineer Officers should be convened to decide, and that Captain Mead should be placed on the Committee, or that he should attend it, to afford information and to explain the Statements drawn up by him, &c., &c.

24. The investigations hitherto made, and the works proposed, are confined to the Cauvery and its main branches; but regulating works at the points at which the Vettaur, the Pamaniyaur, the Coriyaur, the Paundaviyaur, and the Vellaur are thrown off by the Vennaur, are also required to regulate the supply to the southern

half of the delta; this may be done with comparative facility, and until orders are received on this Report, I purpose employing Captain Mead in surveying the strip of land between the Cauvery and the Vennaur as far down the latter, as the Cutchamungalum anicut, and in taking levels down the Vennaur, to ascertain whether the supply in the Vennaur, when the rivers are low, may be supplemented by a sluice above the vented dam, and in preparing designs for the regulating works at the heads of the main channels branching from the Vennaur.

25. The probable cost of all the works required, I estimate roughly as follows:—

Appendix B.			Rs.
	No. 1.	Raising Tambogee of upper anicut.	1,020
* Memorandum Y.	,, 2.	Cauvery vented dam	67,000*
	,, 3.	Raising crown of grand anicut $\frac{7}{10}$ of a foot.....	765
	,, 4.	Closing Coviladi calingulah.....	960
	,, 5.	Regulating dam with bridges for Cauvery and Codamoorty.....	72,300*
	,, 6.	Cauvery and Arasalar dams.....	10,000*
	,, 7.	Cauvery and Veerasholen do. ...	7,300
	,, 8.	Supplying Munniyaur, nothing required.	
	,, 9.	Closing Pillay Voical head sluice, may be omitted, see Memo. Y.	
	,, 10.	Minor new masonry works.....	9,550
	,, 11.	Repairing banks, and improving river bed, from upper to grand anicut.....	24,420
	,, 12.	Permanent Establishment for five years.....	7,440
		Amount of estimates prepared.....	2,00,755
		Approximate Estimates.	
		Sluice above vented dam for supplemental supply to Vennaur and channel.....	17,500
		Lock and channel for navigation below vented dam.....	7,500
		Vettaur regulating dam.....	25,000
		Pamaniyaur do.	25,000
		Coriyaur do.	
		Paundaviyaur do.	7,000
		Vellaur do.	6,500
		Raising banks and improving Vennaur, east of Vennaur dam.....	10,745
		Total...	3,00,000

The following enclosures accompany this Report:—

Captain Mead's Report with two Appendices:— A., explanatory of the Statements, and showing the co-efficients, &c., used in calculating discharges, &c., &c., and B. containing estimates of works proposed in his Report.

Ten Statements marked A, B, C, D, E, F, H, K, L, M.

Two Diagrams—(1), showing height of water when above 7 feet on the Cauvery dam at the Serungum head from 1845 to 1866; (2), showing height of water from June to December 1865, on all the regulating works in the Cauvery.

Five Tracings—

I. Sections of the upper anicut, and of all the regulating works in the Cauvery.

II. Plan and Sections of the Cauvery near the site of the proposed vented dam, and Plan and Sections of the vented dam.

III. Plan and Sections of Cauvery and Codamoorty, and regulating dams, &c., &c.

IV. Do. do. Cauvery and Arasalar and regulating dams.

V. Do. do. Cauvery and Veerasholen and regulating dams.

Z. Memorandum of fall of surface level of water in Cauvery and Coleroon when in flood.

Y. Memorandum on Masonry Works, &c., proposed by Captain Mead.

A Plan of the entire river Cauvery with cross sections, a mile apart, will be forwarded as soon as they can be copied; the submission of the Report is not postponed till the Plan and Sections are ready, lest the delay should prevent an allotment being made for the works adverted to in paragraph 7, during 1867-68.

REPORT UPON THE RIVER CAUVERY IRRIGATION.

General Description.

1. The Agunda or Great Cauvery at the head of Serungum is a river about 4,100 feet wide and in high freshes or floods, about 12 feet deep. It branches off into two rivers, the Coleroon and the Cauvery, the island of Serungum, about 17 miles long and 2 miles wide, being between them; at the end of Serungum there was a very old work called the Grand Anicut, about 1,100 feet long, it was a calingulah between the two rivers and used as an escape for the Cauvery water into the Coleroon.

Enclosures.
2 Appendices marked A. & B.
10 Statements marked A, B, C, D, E, F, H, K, L, M.
2 Diagrams marked Nos. I, and II.
5 Tracings marked Nos. I, II, III, IV, and V.

2. The Cauvery throws off several branches, the first, the Vennaur, the head of which was 3 miles west of the grand anicut; this river was badly supplied owing to there being a ridge of rock crossing the Vennaur about half a mile below its head.

The land cultivated by the Vennaur river was about two-fifths of that under the Cauvery below its head.

At 9½ miles below the grand anicut another branch, the Codamoorty, was thrown off, the cultivation under it being about the same as that of the Cauvery to the eastward. At 20 miles below this the Arasalar river was taken off, the head was originally in the Cauvery, but it has been frequently moved and made to take its supply from the Codamoorty; the head is now restored to the Cauvery; the cultivation under it was about two-fifths of that of the Cauvery. Sixteen miles to the east of this the Veerasholen river was taken off, the cultivation being about the same as that of the Cauvery east of its head. From the above it will be seen that the Cauvery, below the head of the Veerasholen, has been reduced by the four rivers taken from it, to about one-eleventh of what it was at its head.

3. Below the Veerasholen the Cauvery takes its course to the sea, a distance of 37½ miles; it throws off numerous channels, many of which had open heads. Where it reaches the sea, it is not

more than six yards wide, and in extreme freshes it is about 4 feet deep. Tradition says that the river was very much larger at its end than it is at present; but from the records it does not appear to have deteriorated for the last fifty years.

4. Throughout its course the Cauvery receives only a supply from two rivers east of the head of Serungum.

First, at 8½ miles below its head the Codamoorty river, the drainage area of which is about 800 square miles; and second, at 7½ miles* west of its mouth a small surplus (which, however, is as large as itself at this place), the Iyavianaur.

* 90½ miles below the head.

5. From the north branch of the Agunda Cauvery the Coleroon, a large tract,† was irrigated by two channels, the Peroovallay, the head of which was a short way above the head of the Cauvery, and the Iyen channel, the head being there about 8 miles below. East of this, about 46 miles, the Munniyaur was taken off the south bank, and again 15 miles lower down the Vadavaur supplying Veeranum tank in South Arcot District;‡ and also there were a few minor channels in both banks.

† North side of the Coleroon.

‡ North of the Coleroon.

6. The greater portion of the drainage area of the Cauvery is under the influence of the south-west monsoon. As, however, some of its branches are affected by the north-east monsoon, there are freshes in the river during the months of October and November; these however, as a rule, are not so high as those of the months of June and July.

7. The following is the ordinary state of the supply in the river:—

The first fresh occurs in the middle of June; this enables cultivation to be commenced. The river is fairly supplied until the middle of July, when the great fresh or flood of the season comes down and lasts for not more than four or five days. Small freshes occur during August, and in this month the river is generally well supplied.

In September the river, as a rule, is very low, but local rains keep the crops from withering. In October and November there are usually frequent small freshes from the north-east monsoon, and occasionally heavy floods.

In December the supply is but scanty, and the river is almost dry until the month of April, when local rain frequently causes small freshes to come down; the supply then again decreases until the first freshes of the month of June.

8. Before the upper anicut was built, it was usual, in the months of August and September (and when the north-west monsoon failed in October and November, when owing to the river falling, the supply to Tanjore was not sufficient for the cultivation), for the Collector of Tanjore to go with large gangs of coolies to the head of the island of Serungum, and make a corumboo (or temporary bank of nanul grass and sand) across the north branch of the Agunda Cauvery or Coleroon, and by this means send nearly the whole of the Agunda Cauvery water down the Cauvery. The labor of doing this was enormous, as a small fresh frequently swept away the work which had to be done over again.

Again, there were, owing to the channels cultivating land on the north bank of the Coleroon in Trichinopoly District, frequent disputes as to what extent the water might be sent down the Cauvery to the loss of the Trichinopoly cultivators.

There was great loss in the cultivation in bad years, and also heavy loss in breaches during floods, the last however was much reduced owing to the existence of two large calagums, the Naddootittoo and Govindoo calagums, 55 and 350 yards wide respectively, below the head of Serungum.

Brief History of the Cauvery Works.

9. In 1803 the supply to the Tanjore District was considered to have fallen off from that of previous years, and Captain Caldwell raised the grand anicut, to what extent is not known; however, it was raised to its present height, and dam stones put into it so that by means of Tambogee planks the water could be further raised.

Great advantages ensued, and cultivation is reported to have extended in the delta, especially in Myaveram and Sheally Tálaqs.

10. Nothing further was done, with the exception of cutting calagums at the head of Serungum to get an increased supply down the head of the Cauvery and other minor measures, until 1829, when there was much complaint that the Cauvery was silting, and that the cultivation of Tanjore would be ruined.

Major Sim and Captain A. Cotton were then sent down, and they then appeared to have considered that the Cauvery was silted with sand, and that this sand must be got rid of; they proposed the then novel idea of scouring sluices. The Pullivellem under-sluices were built in the Wyacondan channel at the Codingal surplus as an experiment, and although they were blown up through bad building for want of proper superintendence, the principle was considered proved, and it was adopted.

In 1830, ten under-sluices were built in the grand anicut.

In 1831, a second set of twelve vents were erected at Vaduvagudi, 16 miles east of the grand anicut, and in 1832, a third set of six vents were built at Peroomalcovil, 13 miles lower down. With regard to the last, unfortunately, owing to the surplus of these sluices falling into the Munniyaur river (between the Cauvery and Coleroon) they could not be used until a second set were built in the Munniyaur north (or Coleroon south) bank; these were added in 1834—as, however, the Coleroon water-level in high floods was higher than that of the Munniyaur, these sluices could be used only in low freshes.

The effect of these under-sluices was supposed to be good, but certainly was not that expected of them, as although they locally deepened the bed, they did not draw more water into the Cauvery at the head of Serungum.

11. At the head of the Cauvery two large calagums existed, the Naddootittoo, 55 yards wide, and the Govindoo calagum, 350 yards wide; these could not be closed, as through them the Trichinopoly channels on the north bank of the Coleroon received their supply; much water, however, was wasted through them during low freshes. In 1832 it was arranged* that these calagums should be closed, and a twenty vented sluice† about 2 miles east of Govindoo calagum, to be under the charge of, and worked by the Trichinopoly ryots, should be built; this was done in 1834. Captain Cotton, however, considered this dangerous, and proposed a 300 yards calingulah, 1 or 2 miles below the head, it was sanctioned; but owing to want of labor only half or 150 yards were built in 1834, it being intended to extend it the next year, or build another one of the same length elsewhere; this, however, was not done. In this year, 1834, Captain Cotton sent off his report, and proposed the construction of the anicuts across the Coleroon.

* By Captain Faber.

† 20 vents of 5′ × 13′ or 1,200 square feet.

12. The Vennaur river, owing to the ridge of rock half a mile east of the head, was very badly supplied. In 1829, a portion of this was blasted by a party of Pioneers. In 1834, Captain Cotton built a sluice about three-quarters of a mile below the head of the Vennaur in the south bank of the Cauvery, and cut a channel called the Tovoor cut to the Vennaur below the band of rock.

13. In 1835, owing to the supposed lowering of the Cauvery bed by the action of the grand anicut sluices, the Vennaur supply was considered to be injured, and sluices were built in Cutchamungalum anicut to counteract it.

The Tovoor cut improved much the supply to the Vennaur, but it was not until 1851, when the Cauvery and Vennaur dams were built, that there was a proper supply to the Vennaur.

In 1839 a new cut, 90 yards wide, was made south of the rock ridge across the Vennaur, rock however was met with, and it was not cut to its full depth; in 1855, it was improved.

14. In 1836, Captain A. Cotton built the upper and lower anicuts. I do not propose to enter into a description of the progress of these works, their history and success being well known

The original upper anicut was completed at the end of March 1836; there were some accidents to the work, and it was not until 1843 that it was made its present length, height, and form. In 1843, a wooden bridge of cocoanut wood was put up for the purpose of enabling the shuttermen to work the sluices, the repairs however proved heavy, and in 1846 the present narrow masonry bridge was erected.

In 1838, a very narrow bridge was built over the 150 yards calingulah.

In 1839, a new surplus called the Atty or Coviladi calingulah was erected about 2 miles below the grand anicut.

In 1839, a masonry head was built to the head of Serungum; it was originally 12 feet high, but as the fresh of 1840 rose to within 2 inches of its top, a parapet of 2 feet was added in 1841.

15. In 1839, owing to the bad supply in the Munniyaur river, of which Lieutenant Ditmas writes in 1837 that the head appears to have been neglected for twenty years, it was proposed to supply it almost entirely from the Cauvery by means of the surplus sluices at Peroomalcovil; as, however, these sluices were built on a low level (4 feet below the deep bed of the Cauvery) a wall was built in front of the sluices with a second line of shutter stones and shutters, the shutters being plank shutters and closing the lower 4 feet of the vents only, so that these sluices could be used to send comparatively clean water and not sand into the Munniyaur.

16. Before the upper anicut was built, the water communication down the Coleroon was much used; to enable this to be carried on after the erection of the anicut, a lock was built in the north branch of the anicut; it did not however answer, and various means were proposed and tried to pass boats down; none however answered properly until 1841, when a lock was built above (west of) the Peroomalcovil surplus sluices, and a canal cut from the Munniyaur to the Coleroon just above the lower anicut; this canal had a lock at both ends. Boats therefore instead of going down the Coleroon went down the Cauvery, and through the lock at Peroomalcovil into the Munniyaur, down the Munniyaur, and by means of the canal were locked into the Coleroon above the lower anicut. Since this time the Munniyaur has been much improved for navigation by two weirs and locks being built in it.

17. In 1845, in consequence of the head of the Cauvery widening and, it was feared, deepening, the Cauvery regulating dam was built.

In 1846, the twenty vent sluice was abandoned; it had been injured in 1844.

18. In 1851, to avoid the constant loss to cultivation under the Vennaur; and the heavy yearly expense incurred in temporary works (vaganays, calagums, naaul planting, &c.) to send more water down the Vennaur, the Cauvery and Vennaur dams were built, and this is the last masonry work that has been built for the benefit of the river Cauvery or its main branches.

19. The history of the Arasalar river is as follows:—

Before 1831, the head was in the Cauvery; in that year, owing to the scarcity of water in that river, and the improved supply in the Codamoorty, the head was moved to the Teroomuirajen a branch of the Codamoorty, and from this river it obtained its supply until 1836, in which year, owing to complaints of short supply, it was allowed, as a temporary measure, to take a supply from the Cauvery through a small open cut protected with fascine work; this was washed away, and the opening enlarged by the freshes.

In 1838, a sluice was built to remedy this; it was of two vents each 4½ feet wide, it however did not give sufficient supply; and in 1839 a new open cut was made, and the head sluice abandoned; ever since this there have been constant complaints of the Arasalar taking off more than its share from the Cauvery, and a heavy expenditure yearly incurred in temporary measures to prevent its doing so.

20. I have not attempted to follow the history of the Tanjore works, except of those that affect the Cauvery or the heads of the four main branches, nor even to follow the numerous temporary measures (vaganays, corumboos, naaul planting, calagums, &c.), taken to divide the water fairly at these heads. I find, however, that there was a very heavy expenditure yearly on these works, and constant appeals for sanction for masonry heads for the Vennaur, Codamoorty, Arasalar, and Veeracholen; but one at the Vennaur has been built.

21. Throughout the Civil Engineers' Diaries* there are constant complaints of the bad supply of water to the Myaveram and Sheally Táluqs, and the assertion that the Cauvery has silted; also to the fact of large quantities of water being wasted by the ryots taking more than is necessary for their cultivation; and complaints that there is no regulation of water, and that the Revenue authorities do not attend to it as they should; also complaints of encroachments on the rivers and Puddoogays.

* Since 1831.

Description of the present state of the Cauvery and Tanjore Works.

22. The Agunda Cauvery is a stream 4,400 feet wide; from both sides of it there are several irrigating channels taken off† for the supply of Moosery and Coolitallay Táluqs, also the Wyacondan and one minor channel supplying Trichinopoly Táluq. At the head of Serungum it divides into two branches, the Cauvery and Coleroon, about 2,000 and 2,400 feet wide respectively. Across the Coleroon is built the upper anicut, a work consisting of two branches, separated by an island about 650 feet wide. The north branch is a dam‡ 7 feet high with a bridge over it, piers being 5 feet high, twelve arches 6 feet rise, the two centre arches have sluices consisting of eight vents 6 feet wide. The anicut has a waterway of 343 feet not including the sluices.

† In Trichinopoly District.

‡ 294·2 above Datum Line.

The south branch is similar, but the dam§ is only 5 feet high, the Coleroon bed here not being so deep as that of the north branch. The bridge over it is of forty arches 6 feet piers and 5 feet rise, they vary in span. There are seven sets‖ of sluices, there being eight vents of 6 feet and nine of 7 feet in width. The centre of the anicut is built 1 foot lower than the rest, this is called the Tambogee; there is an arrangement to raise this by means of planks to the level of the remainder, but this has not been often done, and never of late years.

§ 293·6 above Datum Line.

‖ 4 sets of 2 of 6 feet.
3 sets of 3 of 7 feet.

The waterway of the Anicut is.....	1,102½	running feet.
Tambogee.....	524½	,,
Sluices..... ...	111	,,
South Branch running feet..... ...	1,738	
North do. do.	391	
Total of Anicut do.	2,129	

The head of the island of Serungum is protected by a masonry work 14 feet¶ high, and is connected on the south side with the north wing of the Cauvery dam which is a flooring across the Cauvery. At each end it is raised (in two steps of 75 feet long each) 2·4 feet above the low or centre portion. The dam is 1,950 running feet total waterway, with wings 14 feet high.

¶ Top 302 feet above D. L.

The floor of the dam is on a level with the deep bed of the Cauvery and below the average bed, it is covered with sand on an average of 2·5 feet, so that with 5 feet of water on the Cauvery dam gauge there was in 1865 a waterway of 4,705 square feet or mean depth of 2·5
In 1863, it was 4,555 mean depth of 2·3
In 1864, do. 5,032 do. of 2·6

I regret to say that I am unable to find in the records any sections previous to 1863, and therefore cannot say whether this sand is increasing or not; my own impression is that it is not so, but that it is very much the same as when the dam was originally built.

The difference of level of the water in the Cauvery and Coleroon or the backwater, from the effect of the anicut, taken from a mean of the water returns, which I regret to say are irregular and not entirely to be trusted, is as follows.

Water below 8·3 feet on Cauvery dam, or 2·7 feet on crown of south branch anicut, a clear fall over anicut.

Water at 10 feet on Cauvery dam, or 4·2 feet on crown of south branch Cauvery, 1·9 feet above Coleroon.

Water at 12 feet on Cauvery dam, or 6·2 feet on crown of south branch Cauvery, ·6 above Coleroon.

The fall of the Agunda Cauvery above the anicut is 3·4 feet per mile.

Of the Coleroon below the anicut 3·3 feet per mile.

Of the Cauvery below the anicut 3·2.

23. On the north side of the anicut, above it, two large channels, the Peroovallay and Iyen channels, are taken off; they irrigate Laulgoody division in the Trichinopoly Táluq, in the Trichinopoly District.

24. From the south bank of the Cauvery there are two small channels led off that irrigate a low tract of land adjoining the south bank in the Trichinopoly District.

25. At 1 mile 4,750 feet east of Serungum head is the ruin of the old twenty vent sluices, the superstructure is destroyed, and but a portion of the flooring remains. There were twenty vents of 5′ × 12′ high,* and had therefore an area of 1,200 square feet.

* Sill 283·1 above D. L.

26. At 3 miles 100 feet on the north bank of the Cauvery is the 150 yards calingulah, which is now the first surplus from the Cauvery to Coleroon. The work is a low calingulah† that discharges water when there is more than 6·8 of water on the Cauvery dam gauge; it has a narrow bridge over it, not wide enough for bandies, and dangerous for horses; the piers are 3 feet high; there are nineteen arches of 4 feet rise, and the waterway is 387 running feet. The following is the difference of level of the two rivers at different freshes:—

† Crown 285 above D. L.

12 feet on Cauvery dam, 5·3 on crown of 150 yards calingulah. Coleroon 1·4 below Cauvery.

10 feet on Cauvery dam, 3·3 on crown. Coleroon 2·4 below Cauvery.

9·3 feet on Cauvery dam, 2·6 on crown. Coleroon on level with crown, and therefore clear fall in this and any lower fresh.

27. At 3 miles 5,150 feet the Nauttoo Voical is taken off the north bank of the Cauvery; it is a channel that irrigates the island of Serungum.‡ For about 3½ miles the channel runs just north of the Cauvery bank; this is an extension of the channel, and the bank here is in many places weak, and the Puddoogay requires protection by nanul planting.

‡ 754 Valies of wet cultivation.

28. At 8 miles 3,480 feet the Codamoorty river joins the Cauvery from the south; it has a drainage of about 800 square miles, and is liable to heavy freshes in April, and during the north-east monsoon.

29. At 9 miles east of Cauvery head is the Cauvery bridge on the road from Madras to Trichinopoly; it is a bridge of thirty-two semi-eliptical arches of 48 feet span, 12 feet rise, the waterway being 1,536 running feet. The surface fall of the Cauvery in high freshes is 3 feet, in low freshes 3·2 feet per mile above the bridge.

30. At 14 miles 2,200 feet are the Cauvery and Vennaur dams, built for the regulation of the Vennaur. The Cauvery dam is a work of thirty segmental arches of 30 feet span 5·8 feet rise, with two sets of sluices each of three vents of 6 feet in width. On each side there are two steps of three arches each raised ·5 and 1 foot above the main portion§ (16 arches) of the dam, also the two centre arches are ·5 below, and sluice sills 1 foot below the main portion. There is an arrangement to fasten Tambogee planks (planks placed horizontally on the crest) and so reduce the waterway of the Cauvery and send more water down the Vennaur; they are, however, hardly ever used, as the labor of putting them down and removing them is great; and again, as they can only be put down and removed when the river is low, their use, if used, would not be great.

§ Crown 246·1 of dam above D. L.

The Vennaur dam is of eighteen arches 30 feet span 5·8 feet rise, with one set of sluices of three vents of 6 feet in width each, the fifteen centre arches* are ·2 of a foot below the Cauvery dam, the sluice sills 1 foot below, and three arches are ·5 above the main portion.

* Crown of dam 245·9 above D. L.

The Cauvery dam is built with sluice sills 2 feet above its deep bed.

The Vennaur ones about 1 foot above its deep bed. The waterways are 936 and 558 running feet respectively.

31. Between the two dams, and connected with the wing walls of each, is the Pillay Voical head sluice; this channel has another sluice below in the Vennaur just above Cutchamungalum anicut. The channel is not in good order, and the main supply is at present drawn from the lower head sluice, and this is especially the case when the river is low.

32. The Vennaur takes about 22 per cent. in high, and 30 per cent. in low freshes of the water.

This division is hardly fair to the Vennaur, as it does not get a full supply of water until there is 6·5 on the Serungum Cauvery dam, or 2·7 times the proper supply in the Cauvery; as, however, the Vennaur and its branches receive the drainage of the land south of it, and the Cauvery no drainage except that of the Iyavianaur, 76 miles to the east, this division is not so disadvantageous as it appears. Again, the Vennaur has no surplus, and even with its present share of water it cannot hold it in extreme freshes, and therefore breaches, not however as soon as the Cauvery does in its present state. About half a mile below its head, owing to the ridge of rock, the waterway, including that of the new cut, is only 600 feet wide. This is very advantageous as it backs up the water in high freshes, and reduces the surface fall of the Vennaur† from 1·6 feet per mile in ordinary freshes, to 1·2 feet in high freshes. The surface fall from the rock ridge to Cutchamungalum anicut is 2·7 feet per mile.

† Below the dam.

33. Cutchamungalum anicut is an old Native work solidly built on rock; ‡ it has a waterway of 567 feet run, the centre, for 123 feet, being 2 feet lower (built with dam stones). There are eight sluices in it, with a waterway of 115·75 square feet. There are two channels taken off from the south side, and one, the Pillay Voical, from the north; this channel, as before remarked, has another head above at the Vennaur dam.

‡ Crown 228·7 above D. L.

34. The north bank of the Cauvery, from the Serungum head to the Nauttoo Voical head sluice, belongs to Tanjore District. The bank is high and of good section, the front well protected with stone vaganays, and the nanul between them is strong and good. In Trichinopoly District, the north bank extends to the grand anicut; the south bank, to within a mile of the Vennaur head. The bank throughout is in fair order as regards height and section, but I regret to say that there is a great want of nanul protection, and this especially for 2½ miles east of the Nauttoo Voical head sluice; there are several heavy sets that require attention. The river from the upper anicut to the grand anicut is very irregular, and might with advantage be planted with a belt of nanul on both sides. It varies in breadth from the upper anicut to the Vennaur head from 3,000 feet to 1,300 feet, the average being about 2,000 feet; below the Vennaur head§ from 1,800 feet to 1,100 feet in width, the average being about 1,300.

§ Up to the grand anicut.

35. At 15 miles 5,200 feet is the head of the old Tovoor cut; the head sluice is destroyed, and the channel closed. The new Pillay channel flows through a portion of the old cut.

36. At 17 miles 650 feet is the grand anicut; it is an old solidly built work supposed to be constructed of sand, with a casing of rough stone; it is not straight; the crown also varies slightly in height‖ the gauge Zero¶ is ·6′ below the average crown. There is a road bridge over it of 30

‖ From 240·7 above D. L.
to 241·2 ,, ,,
Mean 240·9 ,, ,,

¶ 240·3 above D. L.

arches, piers 5 feet high, rise of arches 6 feet, span 32 feet, owing to the irregular shape of the anicut this bridge had to be built crooked.

The anicut has dam stones on it 2·3 feet high to enable the crest to be raised by means of Tambogee planks; these, however, are but seldom used, and as the labor of putting them down and taking them up is great, and the leakage through them considerable, I do not think they are of much use.

The waterway of the anicut is 960 feet run, but is reduced to 735 feet below the level of the top of the dam stones.* There are ten under-sluices under the two eastern arches of 4 feet × 3 feet or 120 square feet area, the sills being 10 feet below the crown of the work.

* 2·3 feet high.

The surface fall from the Cauvery dam to the grand anicut is, in high freshes, 3·4 feet per mile; in low freshes 3 feet. That of the Coleroon, from the upper anicut to the Coleroon bridge, road No. 9, is 3·3; from that to the grand anicut 3·1—there is therefore but little difference of level in high freshes between the Cauvery and Coleroon, and this to a certain extent lessens the value of this powerful work. The following are the differences as nearly as I can determine from means of the water Returns:—

Height on Cauvery Dam, Seringum.	Height on Grand Anicut gauge.	Difference of level of Cauvery and Coleroon or Head.
1858...13·3	8·1	1·5
12	6·1	2·
11	5·3	3·1
10	4·3	4·1
9	3·6	Clear fall.

37. At 19 miles 2,900 feet is Coviladi calingulah; it is 300 feet long,† and has a bridge built separate from the calingulah, which is 150 feet from the north side of the Cauvery; it discharges almost direct into the Coleroon. The bridge springing level is only 2·5 feet above the crown of the calingulah. There are nine arches of 30 feet span and 5 feet rise.

† Crown 234·3 above D.L.

It is provided with dam stones and Tambogee planks, but the last are but seldom used. The waterway is 300 feet run, but below the top of the dam stones (2·2 feet high) it is reduced to 254 feet.

In high freshes the fall of the Cauvery water from the grand anicut to this work, owing to the great discharge of water by the grand anicut, is 3·1 feet per mile, in the low freshes 2·7; the difference of level of the Cauvery and Coleroon is therefore but small.

There was no gauge in the work, nor any to show the height of the Coleroon water in high freshes, but the following is the difference of level of the Cauvery and Coleroon, as nearly as I can determine them:—

Height on Cauvery Dam.	Height on crest of Coviladi Calingulah.	Difference of level of Cauvery and Coleroon.
12	5	·7
11	4·1	1·6
10	3·3	3·2
below this		Clear fall.

38. At 26 miles 4,100 feet the Codamoorty river branches from the south side of the Cauvery; it has an open head.

The land irrigated by it and its branches, as compared with that by the Cauvery east of its head, is 31 to 69; the waterhere divides, however, very unfairly to the Cauvery, as in high and ordinary freshes the Codamoorty takes 46 per cent. of the water, and in low freshes from 50 to 54 per cent. The surface fall of the Cauvery above this head is 2·9 feet per mile, below is 2·8; that of the Codamoorty 2·7.

39. The Cauvery north bank, and Codamoorty south bank, are artificially banked, but there is no bank between them for 11 miles east of the head, the ground, however, is high, and it is only in extreme freshes that it is in any way covered with water, and even then the waters do not mingle except to a very small extent.

The Codamoorty below its head branches into several rivers, the principal of which are the Teroomulrajen and Moodycondaunaur.

40. At 33 miles 1,000 feet are situated the Vaduvagudi surplus sluices; they are solidly built and consist of twelve vents of 3' × 4' each, or 144 square feet, with a calingulah* with dam stones over them; the waterway being 95·5 above the top of the stones, and 74 running feet below their top—they are 2·7 high. The surplus channel to the Coleroon is about 1 mile long, it is much overgrown by brushwood, and has not sufficient waterway to carry off the surplus water rapidly at a low level; this prevents the sluices from acting as powerfully as they would were it larger.

* Crown 196·1 above D. L.

The following are about the differences of level of the water above and below:—

Height on Cauvery Dam.	Height on crown of Vaduvagudi Calingulah.	Difference of level.
12	4·5	5·9
11	3·2	6·6
10	2·8	6·5
7	1·6	6·5

There is always a clear fall over the crown of the calingaluh.

The fall of the Cauvery surface below this is 2·6 per mile.

41. West of Vaduvagudi there are a few sluices, but not much irrigation. East of it the irrigation from the Cauvery really commences, and there are numerous sluices.

42. At 37 miles 2,630 feet the Cauvery is crossed by the Triviaur bridge of nine arches of different spans, the centre being 54 feet, the end arches of 34½, the total waterway being 391 feet run. The level of the springing† is 4·9 feet above deep bed; a fresh of 5 feet on the Cauvery dam, Seringum, causes water to rise to the springing of this bridge. East of this bridge the Cauvery is banked on both sides.

* 184·7 above D. L.

43. At 46 miles 150 feet is the Peroomalcovil lock‡ to pass boats to the Munniyaur, and at 46 miles 370 feet are the surplus sluices; they are six vents of 4' × 3' each, or 72 square feet in area.§ From these there is a canal or surplus channel 2,400 feet long to the Munniyaur. In the north bank of the Munniyaur, 1,450 feet below the junction of the surplus channel with it, is another surplus sluice of four vents‖ of 5' × 7½' or 150 square feet; this discharges into the Coleroon by a channel through the Puddoogay 1,400 feet long.

‡ Zero of gauge 156·9 above D. L.
Lock upper Sill 156·9 „ „
Lower..... 147·9 „ „

§ Sill 153·9 above D. L.

‖ Sill 144·8 above D. L.

44. It was originally intended by means of these sluices to pass surplus water and to discharge sand from the Cauvery through the Munniyaur into the Coleroon. As, however, in a fresh of 9·8 feet on Cauvery dam, Seringum, the Coleroon surface at these sluices is at the same level as the highest safe level of the Munniyaur,¶ these sluices are useless as a relief for the Cauvery when in danger, for a 10 feet fresh, although a high one, should not be, and is not in any way a dangerous one.

¶ Munniyaur deep bed 147 above D. L.
Safe water 152·8 above D. L.

They cannot also be used to remove sand from the Cauvery, as were they used so, the sand would be only taken from the Cauvery and for the most part deposited in the Munniyaur, and this, of course, cannot be thought of.

Owing to the great difference of level of the Cauvery and Munniyaur, about 10 feet, and the present silted state of the surplus or boat channel to the Munniyaur, it is necessary when boats are passing to fill this channel by means of these surplus sluices, and frequently, owing to there being little or no water in the Munniyaur, these sluices are absolutely used to fill the Munniyaur from the Cauvery so as to enable boats to pass down it, and this at times when no water can be, or should be spared from the Cauvery.

45. The head of the Munniyaur is now in very bad order; this channel has been much injured by the upper anicut, which prevents small freshes from passing down the Colercon. The records, however, show that before the anicut was built, the supply was bad, and I believe the Munniyaur* has always drawn its main supply from the Cauvery. It certainly does so at present, not only by means of the surplus sluices which are very powerful and capable of discharging 110,000 cubic yards per hour with a 6 feet head, which is nearly always available, but also from the surplus of the lands irrigated by the Cauvery.

* Irrigates about 7,000 yalies. Water required at 20 yards per valy, 140,000 cubic yards per hour.

At present water enters the Munniyaur head when there is 7 feet on the Cauvery dam, or 1·7 going over the south branch of the upper anicut, and this is only for an average of thirty days in a year.

46. The north bank of the Cauvery, from the grand anicut to Euchengoody sluice, at 40 miles 3,420 feet (limits of Tanjore Taluq), has been put in thorough good order; the south bank is in fair order; and the Codamoorty south bank, up to road No. 4, is in capital order.

Nanul and Neernochee are being planted at the sets most of which have been reduced.

The banks up to Peroomalcovil, although generally in fair order as regards height and section, are in places weak. Nanul planting has been much neglected, and there are many severe sets that require attention.

The following show the breadths of the river, which vary considerably :—

	Greatest.	Least.	Mean.
Grand Anicut to Covladi	900	650	800
Covladi to Codamoorty head	1,700	600	1,000
Codamoorty river	1,900	400	500
Cauvery from Codamoorty head to Vadivagudi	1,000	475	550
Vadivagudi to Triviaur bridge	900	400	500
Triviaur bridge to Peroomalcovil	900	400	500
Arasalar river	200	130	150

47. At 46 miles 3,500 feet the Arasalar river branches from the Cauvery; it has an open head. The surface fall of the Cauvery above the head is 2·4 feet per mile, below it 2·3.† The Arasalar takes 39 per cent. in high freshes, and from 50 to 100 in low freshes.

† Fall of the Arasalar 3 feet per mile.

The cultivation under the two rivers, allowing 3,370 yalies as that in the French territory, is in the proportion of 39 to 61, the division therefore in high freshes is good, but in low freshes very unfair to the Cauvery.

48. At 58 miles the Cauvery is crossed by the Combaconum bridge ;‡ it consists of 54 eliptical arches, the spans varying from 33·4 to 45 feet, that of the centre arch, the rise from 6·3 to 7·3. The total waterway is 187 running feet. The river bed is 5·1 feet below springing level of arches.‖ Six feet of water on the Cauvery dam, Springum, brings water about level with the springings, and 11 feet nearly within 1 feet of the crown of the centre arch.

‡ Built 1836.
Springing 15·4 above D. L.
Deep bed 9·4 „ „

The surface fall above the bridge in ordinary freshes is 2·3 feet per mile.

49. At 60 miles 2,530 feet the Veerasholen river is taken off.

The surface fall of the Veerasholen at the head is 3·3 feet per mile. In high freshes the Veerasholen takes 56 per cent., in moderate 50, and in low freshes only 33 per cent. of the water; the cultivation under the two rivers is almost equal.

Below the Veerasholen head there are no rivers taken off the Cauvery, but there are numerous channels.

50. The Cauvery banks below Peroomalcovil to the head of the Veerasholen, although generally in fair order, are in places weak; they are, however, capable of standing any fresh not above 11 feet on Cauvery dam, or 9 feet on the Cauvery bridge gauge; when water exceeds this the banks are in danger, more especially at some of the sluices; the top of the face walls of a few of which are almost on a level with the water at this height.

There are a few sets that require attention, nanul plantation having been much neglected.

The following show the breadths :—

	Feet.
Greatest breadth	800
Mean greatest	400
Least	160
Mean 47 to 54 miles	250
54 to 58 miles	200
58 to Veerasholen head	200
Veerasholen	150
Cauvery below Veerasholen head	150

51. Below the Veerasholen head the Cauvery gets smaller and smaller.

Below the 66th mile, although the river is properly banked, there are several channels* taken through the bank without sluices in it, but have separate banks and sluices at some distance from their heads; this is not only a bad arrangement for the conservancy of the channels, but necessitates two banks being kept up. New sluices, therefore, should be built at the proper heads of these channels.

* See list of minor works required.

The river here also has been encroached upon by plantain gardens.

At 73 miles 1,530 feet the river is crossed by Cootalem bridge ;† it is of three arches of 30 feet span, six feet rise. The surface fall from the Combaconum bridge to this is 2·3 feet per mile.

† Springing 10·8 above D. L.
Deep bed 99·3 „ „

52. At 80 miles 3,380 feet the river is crossed by the Myaveram bridge‡ of three spans of 26 feet, rise 5·5. At 86 miles 4,240 feet is the last sluice (the Rajandra channel sluice) that ever receives a supply of Cauvery water from the head, except in high freshes (above 7 feet on Cauvery dam), above this the Cauvery is on an average 25 feet wide, below it about 15 feet.

‡ Built 1836.
Springing 88·3 above D. L.
Deep bed 81·4 „ „

The surface fall from Cootalem bridge to Myaveram bridge is 2·2 feet per mile.

From Myaveram bridge to the Rajandra channel head sluice 1·9 feet per mile.

53. The banks in Myaveram Taluq are in fair order; the sets here, owing to the reduced fall and depth, are never serious; much nanul has been planted, and most of the sets have been reduced.

54. Below the Rajandra channel sluice the Cauvery is a narrow winding stream, on an average about 15 feet wide.

At 88 miles 1,430 feet a small surplus from land irrigated by the Cauvery enters it; it is, however, only about 6 feet wide. Above the 90th mile the river is banked, below it is not, but the bed is on an average six feet below level of ground.

55. At 90 miles 3,360 feet, the Iyaviaaur joins the Cauvery; this river has its head with a head sluice in the Palavaur, (the drainage stream of Combaconum Taluq a large and well

supplied river.) The Iyavianaur receives all the drainage of the land irrigated by the Cauvery in Myaveram Taluq; it, however, has numerous channels taken from it, and just above its junction with the Cauvery, the Muneycurnikyaur river is taken off, and for the supply of the latter an earthern dam is constantly put across the Iyavianaur, and therefore the Cauvery never receives a supply from the Iyavianaur, except during heavy local rains or in high freshes.

The Iyavianaur is only 12 feet wide at its junction with the Cauvery.

56. At 91 miles 3,580 feet the Cauvery is crossed by the bridge on road No. 28; it has one arch of 33⅓ feet span, and 7·5 feet rise; the bed of the Cauvery is 1·6 below springing*. This bridge was originally of two vents of 15 feet span; it was altered about twenty years ago. At 93 miles 4,200 feet there is a calingulah built across the Cauvery for the supply of two channels in the north bank; it has a waterway of 24 running feet and a Tambogee 3 feet wide and 3 feet deep, the floor of the Tambogee† is about the same level as that of deep bed.

* 61·8 above D. L.

† 56·6 above D. L.

57. At 94 miles the road bridge of road No. 32‡ crosses the Cauvery; it has three arches of 15 feet span, 7 feet rise, the deep bed being 2·1 below springing§ level.

‡ Built 1831.

§ 57·2 above D. L.

58. At 95 miles 2,860 feet there is another calingulah for the supply of a channel on the south side of the river; it is 36 feet long with dam stones 2·9 feet high, reducing the waterway to 29 feet run; it has a Tambogee 2′ × 3′ deep, the sill of which‖ is on a level with the deep bed of the river. The villagers always cut the bank above the calingulah in high freshes to prevent the land above being flooded; but this is but seldom necessary.

‖ 54·5 above D. L.

59. At 96 miles 4,320 feet there is another bridge of two arches of 28 feet each, 4·4 feet rise, bed is 1·1 below springing.¶

¶ 53·5 above D. L.

60. At 98 miles it is crossed by the Eastern Coast Canal 50 feet wide; this canal is at present open to the Trimulvassel backwater, which is generally open to the sea, and is about 5 miles north of the Cauvery; the canal is silted and closed south of the river.

The canal receives much of the cross drainage, and has a calingulah between it and the sea, besides the one at the Cauvery mouth, which is built with two piers in it for a bridge, and has three vents of 20 feet each, it has also two sluice-vents of 3′ × 4′ or 24 square feet.

At 98 miles 610 feet is the sea, the calingulah crown* is about 1 foot above mean tide, and the canal bed 4 feet is below the crown.

* 54·1 above D. L.

61. The mouth of the Cauvery is nearly always closed by the sand bar, as when the discharge is small it escapes down the Eastern Coast Canal instead of, as formerly, forcing its way through the bar.

The surface fall of the Cauvery from Rajandra channel sluice to the bridge on road No. 28 is 1·7 feet per mile. From this bridge to the sea is 1·5 feet per mile.

Height of the freshes in the Cauvery and present distribution of water.

62. Accompanying this report are the following Statements, &c. Appendix A explains how they have been obtained:—

A.—Showing the extent of land cultivated by the Cauvery and its branches, also the quantity of water required for its irrigation.

B.—The heights of the water on the Cauvery dam, Serungum, for each month for the last twenty years during the season.

C.—The average number of days that water is at different heights on the Cauvery dam, Serungum.

D.—The approximate quantity of water that enters the different rivers, or is discharged by the surplus works at different heights of water on the gauges.

E.—Showing how water entering the Cauvery on different dates in 1865 was disposed of.

F.—Showing how water entering the Cauvery is disposed of when at different heights on the Cauvery dam, Serungum.

H.—Statement showing the probable result of proposed changes during low freshes.

K.—Showing the probable result of the proposed changes at the grand anicut.

L.—Showing the probable result of raising the grand anicut and Vaduvagudi calingulahs and removing the dam stones.

M.—Statement showing the probable effect of the proposed alterations in the supply in the different rivers.

Diagram No. I.—Showing the height of water on the Cauvery dam, Serungum, during the high freshes for the last twenty years.

Diagram No. II.—Showing height of the water on the different dates on the several gauges for the season of 1865.

Tracing No. I.—Sections of the surplus works of the Cauvery.

Tracing No. II.—Proposed vented dam across the Cauvery below grand anicut.

Tracing No. III.—Proposed head works for the Codamoorty river.

Tracing No. IV.—Proposed head works for the Arasalur river.

Tracing No. V.—Proposed head works for the Veerasholen river.

63. A reference to diagram G will give some idea of what has to be provided against. It will be seen that the ordinary high fresh does not exceed 10 feet; but that occasionally (eight years in twenty) this height has been exceeded, however only in four years has it been up to 12 feet, and in one, 1858, has it exceeded 13 feet.

This last fresh was decidedly exceptional, and I do not think it has ever been exceeded. The freshes of 1818, of which we have no data, were, I should fancy, below this, and those of 1827 and 1832 were lower than that of 1864, which was 12·3 the highest (excepting 1858), of which we have trustworthy data. My reason for supposing this is, that when the Serungum head was built in 1839, it was not considered necessary to have it more than 12 feet high. The freshes of 1832 were considered to be similar to those of 1827, and I should fancy that the height of the 1832 fresh was well known in 1839, and therefore must have been less than 11·6 on the Cauvery dam, as that height gives 12 feet at the head. Again, Captain A. Cotton considered the fresh of 1818 was a cubit or 1 foot 6 inches above that of 1832, and this, therefore, gives 13 feet as the height of the 1818 fresh, and this is below that of November 1858, which was 13 feet 3 inches.

64. From the above, I think, we may safely take the following as true, as regards the height of freshes of the Cauvery:—

First.—The highest known fresh for the last fifty years is 13·3 on the Cauvery dam.

Second.—That in only two years, 1818 and 1858, has the water been up to 13 feet.

Third.—That in seven years out of fifty, 1818, 1850, 1858, 1859, 1864, and perhaps 1827 and 1839, the water has been slightly above or below 12 feet.

Fourth.—That in about one year in three the water reaches 11 feet.

Fifth.—That ordinary high freshes exceed but slightly 10 feet.

65. In the above, I have not in any way allowed for the point mooted by Colonel Lawford, that the Cauvery has of late years discharged its flood waters more rapidly than formerly, nor have I considered the point that the Cauvery bed may have risen.

These points have not been settled, although I think the evidence is at present against them (See G. O., No. 1,894, dated 16th June) as regards the former; and the fact, as regards the latter, that the height of the high freshes on the Moosery groyne 10½ miles above the upper anicut, corresponds with those of former years when compared with the heights on the Cauvery dam.

However, be these questions as they may, it is, I think, necessary that the works in the delta should be safe during a fresh of 12·3 on the Cauvery dam, and they are not so at present.

66. Now a 10 feet fresh, although a high one, is not in any way dangerous to any of the rivers; the surplus works all act powerfully, and the water left in the delta can be safely carried off by the rivers, the depth and velocity is not great enough to cause new and severe sets to be formed.

When, however, the water is at 11 feet owing to the water level of the Coleroon rising faster than that of the Cauvery, the discharge* from the surplus works is not increased in proportion to the increased supply in the Cauvery, and therefore the depth and velocity are much increased. There has been but seldom a fresh exceeding 11 feet without serious damage in the Tanjore District, and I believe that 1865 is almost a solitary year with water over 11 feet, and little or no damage.

Height on Cauvery dam.	Per-centage discharged into Coleroon.
9	37
10	44
11	48
12	46

With water at or over 12 feet breaches must occur, and the damage is always serious not only to banks, masonry works, and the cultivation, but heavy and severe sets forming, take time, attention, and expense for some years to conquer.

67. A reference to Statement F will show that the surplus works are well arranged for freshes under 10 feet, but that they fail when water exceeds this; in a 12 feet fresh the water (if the banks were not to breach as they do) would be 2′ higher at Combaconum bridge, and the quantity more than half as much again as when at 10 feet on the Cauvery dam, and this the river is incapable of carrying off.

It must be remembered that the Cauvery has not had for years, if ever,† an escape to the sea large enough to carry off sufficient flood water to relieve the upper portion.

† Since Tanjore has been irrigated.

It is not, however, only the Cauvery proper that suffers, the other rivers are similar, and unable to hold the flood water; the water in the delta in a 12 feet fresh being about 30 per cent. more than that in a 10 feet fresh.

I need hardly point out that the damage caused by one of these high freshes is not only that of closing breaches, but that the sets on the banks caused by the increased depth and velocity of the water require attention, and heavy expenditure for some years to conquer.

68. I have already shown how the water now divides at the heads of the different rivers, and how it should divide; the result is that in a fresh of 6·5 on the Cauvery dam, there is 1·9 times a proper supply in the Cauvery above the Vennaur.

The Vennaur receives a full supply.
The Codamoorty three times a full supply.
The Arasalar 1·9 of a do.
The Veerasholen 1·9 of a do.
The Cauvery east of do. 1·7

This last now gives a scanty supply to Myaveram Taluq, but none to Shealli.

69. There are in the Cauvery 133 sluices for the irrigation of land directly under the Cauvery; these sluices have not been built with any regard to the extent of land under them, and I regret to say that, at present, there is no attempt whatever made to regulate them. The villagers are allowed, no matter what the supply in the river may be, to take as much water as they choose for their irrigation, the consequence is that the waste of water is enormous; it is not until there is more than 1·7 ‡ of a full supply for the lands irrigated by the Cauvery below the Veerasholen head passing down, that the lands to the eastward are fully supplied.

‡ 34 Cubic yards per Valie per hour, proper supply 20 yards.

70. Before 1857, when the Maramut was done by the Revenue authorities, this point (regulation of sluices) was, to a certain extent attended to, and frequently the western sluices were closed for a few days, and water by this means passed on for the eastward cultivation, Peons being sent along the banks to see that the sluices were closed as ordered.

Now I regret to say that there is nothing of the sort attempted. The regulation of the sluices is under the Revenue Authorities; but as they have no establishment whatever (except the village establishments, which cannot be trusted for this work) to attend to it, and as the Tahsildars are fully occupied, nothing is done.

71. The rule in this District, that irrigating channels are to be cleared only once in five years, has also a bad effect, as when the channels are cleared, they are, as a rule, cut out much deeper at the head than is necessary, and therefore, for the first year or so after clearing, they draw much more than their share to the detriment of the other channels.

72. The regulation of water in the channels is a most important subject, and one that calls for immediate attention. At present, the state of the Law, with regard to distribution of water, is unsatisfactory, and I believe not known in this District.

As far as I can learn it is as follows:—That the Collector, according to custom, has the right to close, or partially close, a sluice with shutters for a time, in order to pass water on to irrigate other lands that he considers require water; but that he cannot (without rendering himself liable to a Law Suit, the result of which would be very doubtful) alter permanently the dimensions or arrangement of any sluice without the consent of the owners.

73. The result of the want of regulation of the rivers is as follows:—

The delta is not fully supplied until water is 7 feet on the Cauvery dam, or until there is 2·3 times a supply at Cauvery dam, this is on an average for thirty days in the season. If the river and sluices took only 20 cubic yards* per valie for the land irrigated by them, a fresh of 5·5 feet on the Cauvery dam would be more than ample to supply the *delta*, and the water is at this height for an average of eighty-eight days in ordinary seasons, and sixty-eight days on the average for the five worst seasons of the last twenty years.

* Per hour.

Works proposed.

74. *First.*—Raising Tambogee of the upper anicut to the height of the rest of the south branch.

A reference to Statement F shows that, with water at 5 feet on the Cauvery dam, about one-seventh of the supply is lost to the Cauvery by passing over the Tambogee of the upper anicut, on an average, water is for forty days between 4 feet and 5 feet on the Cauvery dam, and the water now lost will be invaluable to the Cauvery. By closing this Tambogee, the supply of the Cauvery will be slightly increased to its great advantage in freshes of 6 feet and 7 feet on the Cauvery dam. However, two objections may be made—

1*st.*—Danger of decreasing waterway of upper anicut.

2*nd.*—Injury to cultivation under the Coleroon, viz., Munniyaur, Ponnairy channel, and that under lower anicut

2. With regard to the first, I would remark that the decrease of waterway is so small that it is immaterial.

In a 12 feet fresh on the Cauvery dam, or 6·2 on the south branch of the anicut, the waterway is 12,496·8 square feet, with the Tambogee† closed 11,972·5 square feet, or 4·2 per cent. less. This cannot be considered dangerous, and the result will be an inappreciable rise of the Cauvery water.

† Area 524½′ × 1′=524½ square feet.

Second—Injury to Coleroon cultivation. At present the Munniyaur and Ponnairy channels do not draw water from the Coleroon when the water is so low as to be materially affected by closing the Tambogee.

The Munniyaur now does not get a supply from Coleroon until there is 7 feet on the Cauvery dam, and I fancy the Ponnairy is somewhat similar. I do not, therefore, think they will be much affected by the change. With regard to the Munniyaur, as I propose to supplement its supply by 110,000 cubic yards per hour for eighty-eight days in season, it will benefit by the changes.

I do not think the lower anicut cultivation will suffer to any extent; that under the Vadavaur is supplied almost entirely by water stored in the Veeranum tank during freshes, and not by

that in very low freshes; that under the north and south Rajen channels will not be seriously injured: they are at present almost the best supplied in the delta.

I would further remark that, should water be required at any time in the Coleroon, more than the discharge over the Tambogee could be sent down by opening the upper anicut sluices.

75. *Second.*—Building a work with vents across the Cauvery below the grand anicut, raising the grand anicut, and doing away with the Coviladi calingulah surplus by a bank put up round it.

At present any fresh above 11 feet is dangerous to the banks and works in the Delta, and one of 12 feet must occasion serious damage. It will prove cheaper and better to discharge more water into the Coleroon, and so reduce that in the Cauvery, than to attempt to improve the numerous banks and works in the delta, so that these freshes may pass off without damage.

At present the surplus works fail in these high freshes, owing to the level of the Coleroon water rising more rapidly than that of the Cauvery, and thereby reducing the head of water, and therefore, the velocity over these works.

In a 12 feet fresh on Cauvery dam, the heads or differences of level of the Cauvery and Coleroon are as follow:—

At the upper anicut	·6
At the 150 yards calingulah	1·4
Grand anicut	2·
Coviladi calingulah	·7,

and, in fact, if we take as safe water in the Cauvery, a fresh of 10·5 on the Cauvery dam; the Coleroon level in a 12·3 fresh is at Coviladi calingulah ·6 feet above safe water in the Cauvery there.

76. I see no way of discharging water above the Vennaur head into the Coleroon, except at an enormous cost, nor can I in any way relieve the Vennaur river, during high freshes, except by lowering the Cauvery dam, and this would render the supply to the Vennaur insufficient (it could however be supplied elsewhere—See paragraph 80). I therefore propose the Vennaur should remain as it is for the present.

To build a new surplus lower down the river is hardly practicable. There are only two places where the Cauvery and Coleroon are near enough for a surplus without destroying much valuable land and irrigation. First, at 25 miles 3,500 feet, 1½ miles above the Codamoorty head or at the present* Vaduvagudi surplus.

* 33 miles 900 feet east of head.

At the latter, although there is an ample difference of level between the Cauvery and Coleroon flood levels, it cannot be done, as it would afford no relief to the Codamoorty river; and again as it is 16 miles below the grand anicut the wear and tear of the banks would be serious.

With regard to the first place 1½ miles above the Codamoorty, as far as I can determine, the difference of level in a fresh of 12·3 on Cauvery dam is 2·9, deducting ·9 as the fall required to take the surplus water across the land and Puddoogay between the two rivers (about one-third of a mile,) it leaves 2 feet as effective head, and even allowing the Cauvery level to be kept up at this height when discharging water over the calingulah, and allowing the calingulah to begin to discharge in a 7 feet fresh, it will have to be 550 feet long, and cost, without compensation for land, if constructed of brick without any stone as a road dam, Rupees 30,000; if with a bridge, Rupees 40,000.

77. The grand anicut has 960 feet run of waterway, and if the Cauvery flood level be slightly raised, we could discharge over this work any quantity of water we wished.

Coviladi calingulah is but 300 feet waterway; the head is but small, and to discharge the water here would prove expensive, as the calingulah would have to be lengthened and the bridge re-built at a higher level.

I propose, therefore, a wall with vents in it to be built across the Cauvery below the grand anicut.† This I calculate will raise the water level 1·4 in extreme freshes, and in a 12·3 feet fresh will discharge 8,195,000 cubic yards per hour over the grand anicut, while it allows only 4,574,000 cubic yards to pass through the vents of 3,000 square feet area with a head of 4 feet. At the same time 1,998,000 will pass through the vents when water is on a level with the raised crown of the grand anicut, the head being ·9 feet.

† 200 feet.

78. The work is to consist of thirty vents of 20 feet span, piers 3 feet 3 inches, rise of arches 4 feet, the piers and floor to be faced with cut stone, the arches to be of brick-work, and 10 feet in width.

The piers to be extended 2 feet beyond the arches* the height here being 3 feet, and an arch ring 2 feet square to be built from pier to pier, the arch ring to have a rise of only 3 feet. I propose this for two reasons: first, that we may be able to increase or diminish the waterway of the vents; and secondly, that as the arches are to be built of brick (cut stones being so expensive) we may be able to renew at a small cost the front portion of the arches where the action of the water passing with a considerable velocity will be great.

* In front.

In the centre of the work there is to be an opening of 25 feet span, piers 11 feet, arch 4 feet rise, to allow basket boats to pass.

The work to have an apron in two steps, faced with rough stone in chunam, 21 feet in width, and beyond this an advanced apron 6 yards by 1 yard deep of rough stone; this will have to be carefully examined and renewed, if necessary, yearly. I have in the estimate allowed for this for four years.

The sill of the work† to be about level with the average bed, the advanced apron 3 feet below it, or level with the deep b d.

† 236 above D. L.

The grand anicut to be raised‡ seven-tenths of a foot, and the dam stones removed.

‡ New crown 241·6 above D. L.

Coviladi calingulah to be closed by an earthern bank put on the south or Cauvery side of it.

79. I am aware that this proposal may be thought rash and injudicious, but the difficulty to be solved is a curious one, and requires a peculiar remedy. It is this, in high freshes to have surplus works that will discharge nearly two-thirds of the water, but which in low ones will discharge a much smaller proportion, and this when the surplus (the Coleroon) is but little lower than the Cauvery.

The proposed wall with vents does this, as in low freshes the whole of the waterway is available; in high freshes, this waterway does not increase, but the waterway of the surplus, the grand anicut, does so.

At present the waterway of the Cauvery below the grand anicut increases as rapidly as that of the surplus (the grand anicut), and has this additional disadvantage, that the velocity of the Cauvery, through this waterway, increases (in consequence of the increased depth) while the velocity over the grand anicut and other surplus work, decreases owing to the head or difference of level of the rivers decreasing.

The following objections may be made:—

First.—Difficulty of building a work to stand a head or difference of level of 4 feet of water.

Second.—Danger of the river silting in rear, and thereby altering the conditions by reducing the head.

Third.—That it is dangerous to raise the flood-water of the Cauvery.

Fourth.—Decrease of water in Cauvery tending to silt it, and destroy backwaters.

Fifth.—Injury to navigation.

First.—This is but a question of expense. The velocity of the water through the vents will be more than 10 feet per second, but there will be then a backwater in the river below the dam 8 feet above sill and 11 above level of apron; this is much more favorable than the upper and lower anicut sluices, when there is often a clear fall through them of 5 or 6 feet in depth, falling on an apron above the level of the water in the rear. There is no fear of the vents blowing up, as there is a weight of more than two and half times the pressure upwards.

Second.—Danger of river silting in rear, &c., I think that most probably the river will, to a small extent, silt in rear of the work (say ¼ mile east of it) and, therefore, to pass the same quantity of water, either the waterway must be increased or the height of water in front of the work raised, so as to give the same head as before.

If it does so, we can increase the waterway by means of re-building, *at a cost of* Rupees 900, the arch rings with a greater rise, so that the vents shall have a waterway of 3,600 square feet instead of 3,000, an increase of one-fifth, and if necessary, by slightly raising the grand anicut; we can increase the head, so as again to make the discharge through the work and the surplus of the same proportion. I do not, however, think the last will be found necessary.

Third.—Danger of raising flood water of Cauvery. This is but slight being only 1·4 feet, and as the fall of the Cauvery is 3·4 feet per mile, the river flood level will be affected for less than a mile west of the grand anicut. This was done to a much greater extent when the Cauvery dam and Vennaur head were built, as the former is 3 feet above the deep bed of the Cauvery.

Fourth.—Decrease of water in Cauvery. The extreme freshes last but a few days, and I think may be left out of consideration, as the mischief they do is more than the good. The decrease in ordinary freshes is but small, that in freshes below 11 feet is 15 per cent., below 10 and above 8, 12 per cent., below 7 and above 6, 4 per cent., the average number of days the water is above 8 feet on the Cauvery dam is fourteen days only in the season.

Fifth.—Injury to navigation. I am unable to find from the returns whether or no boats do now pass by the grand anicut during the extreme freshes. I do not think they do so, as then there would be considerable danger of their being swept over it. I do not, however, think there will be any danger to boats going through an open cut 25 feet wide, when the head of water is 2·5 feet; and if not, boats will be able to pass this in any fresh less than 10 feet on the Cauvery dam, and the freshes above this last on an average only two days in a year, and again when the water is less than 8 feet the head is only 1·9, and freshes higher than this last only fourteen days in the year.

80. The advantage of this work over the surplus lower down is great, as it will save the wear and tear of river banks for more than 8 miles, and I would point out another.

At present the Vennaur does not get its fair share of water in low freshes, and in high freshes more is sent down than it can hold, and I can see no way of providing it with a surplus.

Should it be thought necessary, the Cauvery dam at the Vennaur head could be lowered which would render the Vennaur safe during high freshes; and it could receive a supplemental supply during the low freshes from a head sluice built above this vented dam, and a channel cut from the Cauvery to the Vennaur.

This would not be an expensive work, and could be done at some future time. Should reservoirs be ever constructed on the hills for the supply of the Cauvery, some measure of this sort will be necessary, as unless it is done, the Vennaur cannot be supplied without considerable waste in the Cauvery.

It was proposed by Major H. Cotton to supply the Vennaur in this way by means of an anicut across the Cauvery below the grand anicut, and I have but little doubt that he also considered the advantage to be derived, by raising the flood level of the Cauvery during high freshes so as to pass more water over the grand anicut.

81. I will now try to sketch the probable result of a flood similar to those of 1818 and 1858.

At the grand anicut water was 8·1 on the gauge, the level of the Coleroon being 1·5 below it; if the water be raised by the vented dam across the Cauvery, the result will be that 5,153,000 cubic yards per hour will go down the Cauvery with a head of five feet; this would not endanger the work, and the grand anicut with a head of 2·8 feet would discharge 9,563,000 cubic yards, or nearly two-thirds of the total.

The 5,153,000 cubic yards in the Cauvery would be a high and dangerous fresh, corresponding with about 11·4 on the Cauvery dam; and this is but slightly in excess of that of 1865 in which there was no damage to speak of in the delta.

The Vennaur would be breached and seriously damaged; the Coleroon bank would be probably breached in numerous places, but not into the Cauvery, as the present Cauvery north bank would keep it out.

82. I would further remark that the additional water proposed to be surplussed from the Cauvery to the Coleroon is but small, compared with the Coleroon water as now in flood. In a 12·3 feet fresh I roughly calculate the water passing down the Coleroon below Coviladi calingulah at 22,305,000 cubic yards per hour, the extra amount discharged by the proposed alteration is 1,634,000, or about 7 per cent. in addition, and will not increase the danger to Coleroon banks or works to an appreciable extent.

83. *Third.*—Raising crown of Vaduvagudi calingulah six-tenths of a foot, and removing the dam stones.

The dam stones are never used, and the measure proposed adds ·75 of a foot to the area of the waterway.

By my calculations the discharge is slightly increased in high freshes (any above 2·6 on old crown), and diminished in low freshes; the great advantage* will be that the shutters of the sluices will be able to be kept closed slightly longer than at present.

* 250,000 cubic yards per hour saved by the sluices being shut in a 7 feet fresh.

84. *Fourth.*—Clearing the jungle in Vaduvagudi surplus channel.

This will increase the discharge from the under-sluices in high freshes.

85. *Fifth.*—Dams with bridges across the Cauvery and Codamoorty at the head of the latter.

This work it is proposed to build with a bridge with a six yards roadway over it, as a bridge here is much required; it is in a line with a Railway feeder from Boothaloor station. The dams are to regulate the division of water between the Cauvery and Codamoorty; the water now divides as 57 to 43 in high freshes, and in low as 50 to 50.

The cultivation is as 68 to 32.

In high freshes the areas of the proposed works are as 56 to 44.

In ordinary are as 69 to 31.

In low freshes, when there will be a clear fall over the Codamoorty dam,† as 75 to 25.

† And therefore a greater velocity over the Codamoorty dam than the Cauvery dam.

In consequence of the great difference of proportion of area required, because of the necessity of dividing flood waters as now, I have been obliged to place two sets of sluices in the Codamoorty dam; these have sills one foot below the dams, and will be kept closed in low freshes, and opened in high.

With regard to waterway, the Cauvery has 442 feet run, that of the present bridge at Triviaur has 391, in the proposed Codamoorty bridge the waterway has 414 feet run, in the present bridge on Road No. 4 has 315. The springing line of the proposed bridges‡ is well above ordinary freshes, (that of Triviaur bridge is below them). As regards height of piers the flood of 1865, which was 11·2 feet on Cauvery dam, would be ·3 feet§ above springing, that of 1864, 12·3 feet on the Cauvery dam 1·1‖ above springing level; as, however, it is proposed to surplus more water into the Coleroon, and never have more water¶ than the quantity brought down by a fresh equivalent to a 10·5 feet fresh, this level will be, I think, ample. Should, however, the Cauvery vented dam not be built, the springing level should be raised 1½ feet,* so as to be above a fresh of 12·3 on the Cauvery dam.

‡ 217 above D L.

§ 217·3 above D L.
‖ 218·1 do.

¶ Below the grand anicut.

* To 218·5 above D. L.

As there will be little or no strain on the Codamoorty dam sluices (they being kept closed in low freshes) I have only estimated for cut stone work where the shutters work, and for the floors between the sluice piers.

86. *Sixth.*—Dams across the Cauvery, and Arasalur, at the Arasalur head. Water now divides as follows:—

	Cauvery.	Arasalur.
High freshes	as 61	to 39
Ordinary	,, 53	,, 47
Low ,, ...	,, 40	,, 60
The cultivation is as ...	,, 61	,, 39

The waterway of the Cauvery dam to be 220 running feet, that of Combaconum bridge, the waterway of which is much contracted in high freshes, is 187 running feet. The Arasalur dam waterway to be 140 running feet, that of the Arasalar bridge south of Combaconum, which is ample, is 120 feet run.

The areas of the respective waterways to be—

	Cauvery.		Arasalar.	
Low freshes.....	as 70	to	30	Clear fall over Arasalar Dam.
Ordinary	,, 64	,,	36	,, ,, ,,
High	,, 62	,,	38	,, ,, ,,

The tops of the wings are 2 feet above the highest known fresh.

87. *Seventh.*—Dam across the Cauvery and Veerasholen at the Veerasholen head.

The water here divides as follows :—

	Cauvery.		Veerasholen.
High freshes.....	as 44	to	56
Moderate..... ..	,, 55	,,	45
Low.....	,, 67	,,	33

The cultivation is nearly as 50 is to 50. The waterway of the Cauvery to be 120 feet run, that of the Veerasholen 105, the total being 225, while that of the present Combaconum bridge is 187 feet run.

The areas of the waterway to be as follows :—

	Cauvery.		Veerasholen.
Low fresh	as 50	to	50
Moderate	,, 52	,,	48
High	,, 53	,,	47

The tops of the wings are two feet above the highest known fresh.

88. *Eighth.*—To send a supplemental supply from the Cauvery to the Munniyaur through the Percomalcovil sluices.

As before remarked, at present the Munniyaur does not draw a full supply from its head, until there is seven feet on the Cauvery dam, or on an average for thirty days in the year. The cultivation under it is entirely kept up by the surplus from the irrigating sluices in the Cauvery.

Statement H fully shows the results that may be obtained by the regulation of the rivers, and other proposed changes. Owing to the defective regulation of the sluices, water does not reach the eastern cultivation, until there is 1·7 of a supply east of the Veerasholen head. By the changes proposed, we can obtain almost this quantity, and send 110,000 cubic yards per hour into the Munniyaur when there is 5·5 on the Cauvery dam, which is (from Statement C) for eighty-eight days in the season, and this will, I think, place in ordinary years, nearly the whole of the cultivation under the Munniyaur in safety, as this quantity of water is itself ·7 of a full supply for the cultivation under that river. In the five worst years,* the average number of days is sixty-eight in the season, during which this supply could have been spared from the Cauvery.

* 1851, 1855, 1860, 1861 and 1865.

89. *Ninth.*—That the head sluice of the Pillay Voical at Cutchamungalum anicut, Vennaur River, should be built up, and this channel be made to take its whole supply from the head sluice at the Vennaur head. This channel irrigates 1,109 valies, for the supply of which 22,180 cubic yards per hour should be taken, and I see no reason why this should not be drawn from the Cauvery, which can spare it, and not from the Vennaur which is, and must be, badly supplied; the fall of the channel from the Vennaur head to Cutchamungalum is ample, and a comparatively small expense will put the channel in good order.

90. *Tenth.*—The following minor new works are required.

(1) New head sluice to Kullianapuram channel. The head is in the south bank at 34 miles 5,070 feet, the head sluice being 4,390 feet east of its head with a poke 2,000 feet long.

(2). New head sluice for Tandavan or Vetty channel. The head is in the north side at 66 miles 2,550 feet, the head sluice 5,000 feet east of the head with a poke 1,500 feet long that enters the Cauvery at 67 miles 3,000 feet.

(3). New head sluice for Suryamalasastry or Twily channel. The head sluice is in the north side at 67 miles 3,200 feet. Head Sluice 4,000 feet east of head with a poke 800 feet long that enters the Cauvery at 68 miles 1,270 feet.

(4). New head sluice for Chintamoni channel. Head at 68 miles 2,150 feet, head sluice 1,000 feet north of head.

(5). New head sluice for Kadiramungalum channel. Head at 68 miles 5,050 feet, sluices 6,000 feet east of head, and a poke 700 feet long that enters the Cauvery at 70 miles 160 feet.

(6). Head Sluice for Palankaveri. The head is now in the south side of the river at 76 miles 3,700 feet, the head sluice 3,820 feet east of the head; 150 feet west of the head sluice, there is a calingulah, and Poke to the Cauvery 500 feet long.

(7). Small regulating dams for the Cauvery and Moottapen Cauvery at the head of the latter.

The Moottapen Cauvery head is at 77 miles 2,024 feet. There are five head sluices and channels taken off its north side, there is an open Poke that enters the Cauvery at 79 miles 1,600 feet, and a calingulah with a poke that joins the Cauvery at 79 miles 3,300 feet; the regulating dams should be of 20 feet, and 60 feet waterway respectively.

(8). Head sluice to Puvendran channel. The head is at 81 miles 40 feet, the head sluice 1,900 feet north of it, the channel being between high sand heaps.

(9). Head sluice to Keelayoor channel. The channel head is at 83 miles 200 feet; it has no head sluice.

There are below the Rajendra channel eight small channels taken off,* of these two only (the eastern ones) have head sluices. I do not, however, think it is necessary for these channels to have sluices, and therefore do not propose them; the supply to these channels is, at present, only during high freshes, and I fear, even with the regulation we are likely to arrive at, the supply will not be so regular as to render sluices necessary.

* Irrigating about 400 valies.

91. *Eleventh.*—Banks and protection against sets. In a river, which is liable to floods, having a fall of more than 3 feet per mile, and a depth of 10 feet in floods, with a sandy bed, it is impossible to expect a fixed regime, and changes of bed must be expected; these cause sets, the sites of which it is impossible to foresee, and therefore to be prepared against. Much, however, has been, and can be done, by means of planting nanul grass, which, when two years old, (if well protected when young) forms a mat that protects the bank or river side from almost any set.

When first planted it requires protection from the rush of the stream, and this is generally in sets given it by means of groynes or vanganays formed of stone, or horses of cocoanut wood. Soon, however, the nanul grows up strong, and collecting sand and silt forms a puddoogay, and the protection of the vanganay is no longer required. In deep sets, as the nanul will not grow absolutely in water by means of a vanganny, silt is collected in rear of it, and this being planted, extends yearly, and what was a deep and dangerous set in a few years becomes a belt of nanul.

The success of nanul planting is very precarious, as so much depends on the time it is planted and the season, as should a heavy fresh occur, when the nanul has been planted but a short time, it is destroyed, or should there be no fresh or no rain, it withers. Old nanul is, however, hardly ever destroyed either by floods or draught; it requires, however, care and attention, as it is liable to get thin if not cut and re-planted in places. Again it requires constant watching to keep cattle from it; green food for cattle in the delta is scarce in the dry months, and large quantities are yearly destroyed by cattle eating it.

Nanul is usually planted in November and December, as the water in the river falls, and in the hope of its getting the benefit of some rain in December and January. In low places, it cannot be put down until January or February; but, as a rule, nanul planting in March is useless, as, even if it does grow, it has not, by the time the first freshes of June come down, attained sufficient strength to stand them.

92. As I propose not to allow more water to pass the grand anicut than the equivalent to a 10·5 fresh, I do not consider that it will be necessary to ask for sanction for any extra work

for banks or nanul planting below this place : the present expenditure, (with which so much has already been done) as the damage caused by the high freshes will no longer occur, will prove ample, and more so as it will place the banks and bed in good order, and may, I hope, in a few years be reduced with safety. I have, in paragraph 46, pointed out that the north bank of the Cauvery, east of the grand anicut for 23 miles, is in thorough good order, and will not, therefore, require any strengthening or raising, and, in fact, the whole banks of the Cauvery, and, I believe, those of the rest of the Delta, are safe from any fresh not exceeding 11 feet on the Cauvery dam. As the equivalent to 10·5 is the highest (except in a year like 1858) that is to be admitted, I see no necessity for any measures to be taken, further than carrying on what is now being done, which will (owing to the less quantity of water admitted into the delta reduce the depth and velocity, and therefore the wear and tear of the banks) be much more effectual than at present.

93. The banks to the west of the grand anicut should, however, have special measures adopted to place them in a state so that a fresh of 12·3 on the Cauvery dam may be passed off without danger, but little raising is required ; the great danger is in places where there is little or no puddoogay to protect the bank from the current, and for this nanul planting is required. I do not think it is advisable to attempt by nanul planting to reduce the width of the stream, and make it of an uniform section, as this would increase the velocity, already dangerously great, and probably deepen the bed. I would, however, urge that a belt of nanul, on an average 75 feet in width, be planted on both sides of the river from the head of Serungum to the grand anicut ; to do this some groynes or vanganays will be required, and I think it is absolutely necessary that there should be a permanent establishment of watchmen to attend to it, keeping cattle off it, replanting and watering it when required. The cost of this work will depend much upon what freshes we may have while the work is going on.

94. *Twelfth.*—Regulation of sluices. It is absolutely necessary that the rights that Government have in the water of the District should be clearly laid down, and before any attempt to regulate sluices is made, it will, I think, be necessary for an Act to be passed, so that Government servants may be freed from the interference of the Law Courts, when trying to prevent a village from wasting valuable water, which is urgently required elsewhere.

I would, however, point out that the proper regulation of the sluices would be, to a certain extent, injurious to many of the villages in the delta, for the following reason :—At present the western villagers, even if they were restricted to the full allowance of 20 cubic yards per hour per valie, only when the river was low, would not get the same crops and profits as they now do, as it is well known that a better crop of rice is grown from a constant flow of water than from only sufficient water to keep the land covered, in consequence of the enormous quantity of silt brought to the land by the running water ; but I hardly think it can be the wish of Government that the cultivators of the western portion of the delta should reap this small extra advantage, at the cost of absolute deficiency of water to the eastern cultivators.

95. With regard to the means to be adopted to regulate the sluices, I do not think that doing it by means of moveable shutters would be satisfactory for the following reasons :—

First.—A large establishment is required.

Second.—Difficulty of checking the proceedings of shuttermen and Moniagars during times of scarcity, when water is so valuable ; this would cause much fraud and corruption, which could not be checked or stopped.

Third.—Number of sluices (133 in the Cauvery alone) all of which would require different rules for regulation, would increase the difficulties.

Correcting the sizes of the vents of the sluices would not answer as when the channels are cleared, the conditions are altered so much.

96. I would propose the following, which, I believe, has been done before with success. At about 200 yards below each head sluice a masonry dam faced with cut stone (to prevent its being tampered with) be built across the channel with a notch or Tambogee in it of a length and height to allow when there is a full supply in the Cauvery, a full supply only to enter the channel ; should there be a greater supply in the Cauvery, the dam would, of course, allow more water to pass down the channel. In most cases it would be practicable to arrange for a clear fall to take place over the Tambogee or notch of the dam, but not in all.

I propose about 200 yards down the channel for the site of this regulating dam, as that distance would remove all influence of the rush of water through the sluice.

It should be arranged that the channel from the sluice to the regulating dam, be cleared out yearly, cubes being buried in the channel, will show the depth required ; the channel below the dam being kept (in cases when practicable) so that a full supply being in the channel, there should be a clear fall over the Tambogee or notch in the dam. To do this to all the minor channels (the large channels from the Cauvery about four must, of course, be regulated as now by moveable shutters) will entail much labour, both on account of the number of sluices, and owing to each channel having to be examined separately, and a project for each to be made as the treatment required will vary.

97. I think, therefore, it would be necessary that this work should be done by an officer specially appointed to it. I need hardly point out that the villagers and ryots have a great stake in it, and that the work must be done fairly and judiciously ; there will also be many complaints while the work is going on, especially during the first season that it operates, and these complaints will require careful and, to a certain extent, scientific inquiry. I think that an Officer could do this work for the Cauvery alone in about three years.

98. While on this subject, I would urge that there should be in this delta an Officer to look solely after the irrigation, to whom all the water reports should be sent ; who should examine them and issue orders regarding the opening or shutting of the surplus and irrigation sluices ; who should bring to notice any defects in the regulation, and recommend alterations He would also be able to give the Collector valuable information regarding water disputes, and reports from him on the water returns of the different rivers, with his remarks and explanations, would be useful to the Collector with reference to remissions. During the irrigation season he would be fully occupied in checking water returns, measuring water in the different rivers, and collecting data for improvements. In the dry season he would take levels, surveys, and prepare projects for new improvements.

He should have charge of all the plans, surveys, levels, water returns, &c., of the delta, and would, in fact, be the assistant to the Superintending Engineer with regard to the delta irrigation.

He could, without difficulty from his records, produce evidence founded upon facts, or returns bearing upon any subject regarding irrigation in the delta.

His opinions would be the more valuable from the fact of his looking on projects, as projects in the delta, and not in the ranges, as Range Officers necessarily do, and his time would not be taken up as theirs is, by the necessary attention to the execution of works and the management of a range.

In his office, copies of all levels and surveys taken by Range Officers should be recorded, and these, together with the work done by himself, would, in a few years, be most valuable, and being in one office would always be accessible.

99. It may be said that this work could, and should, be done by the Superintending Engineer. I can only point out that it has not as yet been done, and I do not think he can do it, as he has no time. At present, he frequently loses much time by having to collect information, which the Irrigation Officer would be able to give him without delay, and which would be more trustworthy than that which he can now procure.

The cost of this would be, if the Officer was a First Assistant Engineer, with an establishment of one Draughtsman, one Writer, six Lascars, for survey, about Rupees 10,000 per year, the

Pay of Officers.		Rs.	A.	P.
First Assistant Engineer... ...	...	505	12	0
Establishment.				
Draughtsman...	60			
Writer...	25			
6 Lascars...	42			
	—	127	0	0
Travelling Allowances...		140	0	0
Per month...		832	12	0
Per year.....		9,993	0	0

revenue the Government receives from the land irrigated by the Cauvery in Tanjore alone is more than 31,000,000 Rupees, the per-centage, therefore, is less than ·003 on the revenue of the delta, and this, I think, would be more than saved in remissions in consequence of less waste of water.

Should Government decide upon the sluices in the Cauvery being regulated as proposed, it will be absolutely necessary for an officer to be put on the work for about three years. Should, however, an Irrigation Officer be appointed, he could do this work, and would, by yearly regulating a few sluices in each river after say fifteen years at an expenditure of about Rupees 1,08,000 (not including his pay), have regulated all the sluices in the delta, have collected valuable data with regard to irrigation, and in his office would be stored levels and surveys of almost the whole delta.

100. *Thirteenth.*—Conservancy of the minor channels. The rule of Government clearing channels once in five years has been remarked upon in paragraph 71. I would urge that the channel-clearing should no longer be done by Government except in the large channels, but that the villagers should be bound to do it themselves.

If Kudi Maramut (village labour done by villagers at their own cost) was really done to the channels regularly as ordered in the District (estimates for clearing channels if under 5 per cent. of the revenue* not to be sanctioned, but work to be done by villagers), no channel in the delta would be cleared at Government expense, but as this work is not done yearly as required, an expenditure exceeding 5 or 1½ per cent. of the revenue is necessary, and is incurred by Government.

* For small channels, and 1½ per cent. for large ones.

If the people were told plainly that Government would not clear their channels, the channels, I think, would be kept in better order, as at present frequently they neglect the Kudi Maramut, in the hope of the work being done by Government, and constantly this is not done without delay, owing to money not being available.

It would not be in any way a heavy tax upon the people, as the average expenditure for the last five years has been, in the whole District of Tanjore, on channel clearing, including large and small, Rupees 10,000 per year.

101. *Fourteenth.*—Conservancy of banks and encroachments upon rivers. I may, I think, without hesitation assert that no steps are ever taken for the conservancy of banks† or rivers‡ by the village authorities, except during freshes in the fear of damage to the village lands, or when active steps to force them to do so are taken by the Public Works or Revenue authorities, and in most cases the latter considering that the banks are not in their charge, do not do so unless called upon by the Public Works Officers.

† Such as filling up the wear in banks caused by foot-paths.

‡ Preventing encroachments.

Measures should, I consider, be taken to show plainly to the village authorities that they are expected, and bound to do so, and if they were to have the necessary repairs done, I think that we should not have as now numerous petty§ breaches in bunds caused by foot-paths, &c., that ought to have been filled up before the fresh came.

§ And occasionally serious ones.

SUMMARY OF THE PROPOSED WORKS, &c.

102. Tracing Nos. II, III, IV, and V show the plans of the proposed works, and in Appendix B will be found estimates of the probable cost of the proposed measures, the total amount being Rupees 1,75,300.

The cost of the different works being as follows :—

	Rs.
No. 1.—Raising Tambogee of upper anicut...	1,020
,, 2.—Building a vented dam across the Cauvery below the grand anicut...	61,430
Raising the grand anicut crown and removing dam stones.....	765
Closing Coviladi calingulah...	960
,, 3.—Raising Vaduvagudi calingulah and removing dam stones. ...	135
,, 4.—Clearing surplus channel of do. do. ...	605
No. 5.—Regulating dams with bridges and masonry head for the Cauvery and Codamoorty...	52,310
,, 6.—Regulating dams for the Cauvery and Arasalur. ...	8,780
,, 7.— Do. for Cauvery and Veerasholen...	6,310
,, 9.—Closing the head sluice of Pillay Voical at Cutchamungalum anicut, and improving the present channel from the Vennaur head...	1,575
,, 10.—Minor new works in the Cauvery river consisting of eight head sluices and one regulating dam...	9,550
,, 11.—Planting a belt of nanul grass, &c., and strengthening banks of the Cauvery from Serungum head to grand anicut...	31,860
Total...	1,75,300

Should Government wish the works to be carried out as rapidly as could be done advantageously, the yearly sanction and expenditure should be about as follows :—

	Rs.
In 1867-68.....	32,835
,, 1868-69.....	43,765
,, 1869-70.....	56,950
,, 1870-71.....	35,750
,, 1871-72.....	6,000
Total...	1,75,300

103. The probable result of these measures is fully shown in Statements K and M, and may be summed up as follows :—

(1.) In high and dangerous floods the Cauvery and its branches below the grand anicut will be safe, and there will be no fear of breaches or damage.

(2.) Owing to the diminished quantity of water admitted into these rivers during high floods, the wear and tear of their banks and beds will be decreased, and the maintenance therefore should cost less.

(3.) With the present defective regulation of the sluices, the whole of the cultivation of the Cauvery proper will receive an ample supply of water (1·6 times the theoritical supply of 20 cubic yards per hour per valie) when there is 5·5 on the Cauvery dam Serungum or for an average of eighty-eight days in the season in ordinary years instead of for about thirty days as at present.

(4.) The supply in the rivers, Arasalur and Veerasholen, will be increased, and be similar to that in the Cauvery.

(5.) The supply in the Codamoorty will be diminished, but not so as to injure the cultivation under it.

(6.) The supply in the Vennaur river will be slightly increased.

(7.) The supply in the Munniyaur will be much improved by a supplemental supply of ·7 of a full supply for eighty-eight days in the season, it now receives from its head a full supply for thirty days.

(8.) The Cauvery banks, &c., from Serungum head to the grand anicut (the portion of the river not relieved in any way) will be placed in thorough good order, and I trust that, with proper care and attention to maintenance, will always be safe and free from heavy damage during dangerous floods.

104. I would point out, however, that these proposed measures are not complete, as the Vennaur (although with an improved supply) remains as now dangerous in high floods, and not fairly supplied during low freshes; as already shown in paragraph 80 this may be obviated by destroying the Cauvery dam at the Vennaur head, and probably closing a few of the arches of the latter, so that during the highest floods, the Vennaur should never be in danger, and by supplying the Vennaur during the low freshes by means of a head sluice built west of the proposed vented dam, and a channel cut from it to the Vennaur.

Should this proposal be adopted, I would suggest that the Cauvery vented dam should be provided with vents capable of being open and shut* so that in times of scarcity it would be possible to pass nearly the whole of the Cauvery water down either the Vennaur or Cauvery; this although an expensive addition, would be a most valuable one, as it would prevent much waste of water.

* A Lock to pass boats will also be necessary.

I have not data enough at present to be able to make an approximate estimate of the cost, but I fancy it might be done for an extra amount of Rupees 80,000.

Should this be done, we should have perfect command over the water in the whole delta below the grand anicut.

105. A third and more complete project would be, the building of a head sluice across the Cauvery at the head of Serungum and remodeling the upper anicut, and by this means discharging the whole of the surplus water into the Coleroon at the head of the island. Also building the regulating dams at the heads of the different rivers with vents, capable of being open and shut. This would be a most complete project, but an enormously expensive one, and I fear would never re-pay its cost.

106. Should Government wish the minor channels to be regulated (as proposed in paragraph 96) the cost of doing so in the Cauvery proper (sluices taken from the Cauvery itself) would be about Rupees 14,400,† or for the whole delta (taking the number of the sluices as 900) Rupees 1,08,000 exclusive of the pay of the Officer to prepare the projects separately for each.

† 120 Sluices at Rupees 120 each, Rupees 14,400.

Concluding Remarks.

107. In this report I have endeavoured to sketch a short history of the Tanjore works, to give a detailed account of the present works and state of the river, and have made certain proposals for a project to correct acknowledged faults in the distribution of the water.

I have pointed out that this is not a complete project, but could be made so by an additional expense.

I would urge that Government should sanction the following works at once, as they are much required, and their construction does not in any way entail upon Government the carrying out of the project as now proposed :—

		Rs.
	1*st.* —Raising Tambogee of the upper anicut...	1,020
‡ Discharge not decreased in floods.	2*nd.*—Raising grand anicut crown, and removing dam stones‡ (See Statement L.)...	765
§ Discharge not decreased in floods.	3*rd.*—Raising Vaduvagudi calingulah crown and removing dam stones§ (See Statement L.)	135
	4*th.*—Clearing surplus channel of Vaduvagudi..... ...	605
	5*th.*—Regulating dams with bridges for Cauvery and Codamoorty rivers...	52,310
	6*th.*—Regulating dams for Cauvery and Arasalur...	8,780
	7*th.*— Do. do. for Cauvery and Veerasholen. ...	6,310
	10*th.*—Minor new works in Cauvery (viz., eight head sluices and one regulating dam)..... ...	9,550
	Total.....	79,475

For these works (with the exception of the last) detailed estimates and plans for the masonry works, &c., are forwarded, and should Government decide upon these works being carried on as expeditiously as possible, the following amounts might be yearly sanctioned :—

	Rs.
1867-68.....	20,000
1868-69.....	26,000
1869-70	27,000
1870-71.....	6,475
Total.....	79,475

I would also urge that Government should, as soon as possible, enter upon the question of the regulation of water in the minor channels mentioned in paragraph 94, and I think a special Act will be found necessary.

I would suggest that orders be issued that no channel irrigating less than 300 valies should be cleared or attended to by Government; but that all minor channels irrigating less than this extent of land should be kept in order by Kudi Maramut (village labour done by villagers at their own expense), the revenue authorities seeing that the work is done as required yearly, also that the conservancy of the banks and river beds be properly attended to by the village authorities.

Further, that an Irrigation Officer be appointed to the delta to attend to the distribution of the water both in the rivers and large channels, and also to the duties pointed out in paragraph 98.

108. I have the following works as regards survey and levels done :—

Survey of the Cauvery from Serungum head to the sea (98 miles) plotted on a scale of 6 inches to a mile.

Sections of the Cauvery taken one mile apart at the western portion, and quarter of a mile at the eastern part (total number of Sections upwards of 170.)

Four or five sections of each of the branches of the Cauvery, and survey of their heads for about one mile distance.

The levels of all the sections are connected and reduced to one datum.

With this Report a great portion of this work is forwarded; should more be required, I could soon have it traced and forwarded.

I think, however, that sufficient information is given for Government to decide what estimates they wish to have prepared, and I request that this may be decided as soon as possible, in order that the works may be sanctioned and proceeded with at once, as the loss to Government and the people in Tanjore is yearly a heavy one; and, I think, a great proportion of it might be saved by a comparatively small expenditure.

(Signed) H. R. MEAD, Captain, R. E.,
Executive Engineer.

Tanjore, *3rd December* 1866.

REPORT UPON THE RIVER CAUVERY.

Appendix A.

Explaining Statements forwarded with the Report.

Statement A is prepared from Returns obtained from the Collector of Tanjore.

The water required for a full supply to the land under irrigation is taken at 20 cubic yards per valie per hour, a valie being 32,000 square yards; it is, in the Tanjore District, sub-divided into maws, 20 of which go to a valie, and each maw is divided into 100 goolies of 16 square yards. A valie is, therefore, a small fraction more than 6·6 acres.

The supply of 20 cubic yards per hour per valie* is equivalent to a daily supply of ·54 of an inch in depth over the surface: this supply is generally considered to be in excess of what is required.

* Or 3·03 cubic yards per acre per hour.

In the delta there is much land (13·4 per cent. in the Cauvery) irrigated by the surplus water from other irrigated lands, I have, therefore, allowed 24 cubic yards per hour per valie for the lands under the Cauvery.

The surplus irrigation under the Vennaur is included in the Statement.

Statement B is made up from the Records in the Superintending Engineer's Office.

Statement C is made up from B, and requires no explanation.

Statements D and E are calculated from the data of the Sections and fall of the Cauvery and other rivers, &c., taken by me. In an irregular river like the Cauvery, it is not to be expected that the quantities of water passing down different Sections, can be gauged with any approach to accuracy; the Statements are but approximations, but they do, I hope, give a fair idea of the present distribution and disposal of the water.

I have traced down the river several freshes from the Cauvery to 1 mile below the Veerasholen head ; the results obtained from the different sections, as may be expected, vary considerably, but I have taken what I consider a fair mean, taking care that it shall be less rather than above the average. In many cases, owing to the width of the river at the place where the section was taken being an extreme one, the result was not taken into consideration.

There were difficulties in determining the surface level of water during the different freshes, as it is irregular, and owing to the gauges being so far apart, there being 9 in a distance of 58 miles. The water level at the different surplus works has been taken from means of the gauge readings ; the height of the backwater is not registered at the 150 yards calingulah or Coviladi. The head, therefore, has had to be taken from observation and calculation of the falls of the rivers.

The following are the formula and co-efficients used :—

For discharge through sluices.

Co-efficient $= \frac{5}{8}$

Quantity in cubic yards per hour $= {}^{3}\frac{6}{27}{}^{0} \times \frac{5}{8}$ area of vents $\times 8\sqrt{\text{head.}}$

(1). $= {}^{2}\frac{0}{9}{}^{0}{}^{0} \times$ area of vents $\times \sqrt{\text{head.}}$

In some cases head due to velocity of approach has been added to head.

For that over weirs or calingulahs, co-efficient used as $\frac{6}{8}$ when there are no dam stones ; but when there are dam stones $\frac{6}{8}$ for the flow above them, and $\frac{5}{8}$ for that below them, as the contraction caused by dam stones (about $\frac{3}{4}$ of a foot wide and 3 feet from centre to centre) must be considerable. In case of a clear fall, l = length of waterway, h = depth on crown, h_a = head due to velocity of approach, there being no dam stones.

(2). Quantity cubic yards $= {}^{3}\frac{6}{27}{}^{0} \times \frac{3}{5} \times \frac{6}{8} \times l\,h \times 8\sqrt{h + h_a}$ per hour $= {}^{4}\frac{8}{9}{}^{0}{}^{0} \times l \times h \sqrt{h + h_a}$.

For a submerged weir, d = the head or difference of level of the water, d_2 = depth of backwater on crest, there being no dam stones.

(3). Quantity $= {}^{3}\frac{6}{27}{}^{0} l \times \left(\frac{3}{5} \times \frac{6}{8} \times d \times 8\sqrt{d + h_a} + \frac{5}{8}\, d_2 \times 8\sqrt{d + h_a}\right)$

$= {}^{2}\frac{4}{9}{}^{0}{}^{0} l\sqrt{d + h_a}\,(3d_2 + 2d)$.

For the quantity of water passing through any section of a river.

Velocity per second $= 93{\cdot}3\sqrt{r.s}$

$= 1{\cdot}28\sqrt{f \times f.r}$

f = fall in feet per mile, r = mean hydraulic depth, s = hydraulic inclination.

(4). Therefore quantity in cubic yards per hour $= {}^{4}\frac{2}{3}{}^{0} \times$ area $\times 1{\cdot}28\sqrt{f.r.}$

The velocity of approach to surplus works has been estimated, and the head due to it, taken as follows :—

At upper anicut.....	from	·76 to ·23
150 yards calingulah.....	,,	·6 to ·2
Grand anicut.....	,,	·56 to ·2
Coviladi calingulah.....	,,	·6 to ·1
Vaduvagudi.....	,,	·25 to ·14

The heights on the gauges on the different dates in Statement E are taken from Diagram No. II, and the quantities discharged by the different surplus works or taken off by the rivers entered from Statement D.

Statement F is made up from Statements E and D.

Diagrams Nos. I and II are drawn up from the Water Returns.

Tracing No. I shows sections and waterway of the surplus works.

Statement H shows the probable result of certain proposed changes during low freshes.

Statement K No. I shows the probable result of the proposed changes at the grand anicut, viz., building the Cauvery vented dam and raising the anicut.

The backwater in rear of the dam has been taken at the same height that equal quantities of water would now give on the grand anicut gauge.*

* Depth in river as that now in similar freshes.

The backwater in the Coleroon below the grand anicut has been taken, as that at present as in similar freshes, as I do not think the increased discharge will raise it to any extent.

The head due to the velocities of approach to the grand anicut has been taken similar to the former ones, viz., from ·56 to ·2, the co-efficient being $\frac{5}{8}$.

The head due to the velocities of approach to the vented dam from 0·3 to 0, the co-efficient as $\frac{5}{8}$ for the vents and $\frac{6}{8}$ for the boat arch.

K No. 2 has been made up from K No. 1, so as to compare the results of equal quantities of water approaching the grand anicut.

Statement L requires no explanation, the backwaters are supposed to be the same height in each case.

Statement M is but an abstract of Statements H and C.

(Signed) H.R. MEAD, Captain, R. E.
Executive Engineer.

TANJORE,
3rd December 1866.

Y.

Memorandum on works proposed by Captain Mead.

No. 2. Cauvery vented dam, Rupees 61,430. Sufficient rough stone is not provided for the protection of this work, either above or below ; 820 cubic yards more should be provided, only Rupees 1,460 is allowed for baling. At a depth of 10 feet, it would be most difficult to keep the foundations clear of water, and it might be necessary to lay the foundations in boxes at this depth, this would add considerably to the cost of the work. Rupees 4,570 provided for baling estimate, becomes Rupees 67,000.

No. 5. Regulating dams with bridges for the Cauvery and Codamoorty, estimate Rupees 52,310. Piers and abutments should be raised 1½ feet. The foundations for the abutments, upstream wings and nose between the two rivers should not be less than 10 feet deep. The sections for these portions of the work are insufficient, especially for the nose, along which there would be considerable action. This work must be protected by rough stone, or it would fail, as the Vennaur dam did, until large quantities of rough stone were thrown both above and below it for its protection. The work proposed has this advantage, that its foundations are built solid, while the Vennaur dam was built on wells ; but still without a rough stone apron above and below it, the work would not, in my opinion, be safe.

Baling has not been sufficiently provided for.

The estimate, as revised, amounts to Rupees 72,300.

No. 6. Cauvery and Arasalur dams, estimate Rupees 8,780.

1. If stiff clay is met with, the upper retaining wall may be provided with a straight section, and be sunk 7 feet ; but if sand only is found, it would be well to carry the foundations deeper, and to give them a splay at bottom.
2. It may be found necessary to provide a rough extended apron of stone or cubes.
3. Baling provided for insufficient. Allowing for the latter only, estimate becomes Rupees 10,000.

No. 7. Cauvery and Veerasholen dams, estimate Rupees 6,310.

The remarks on No. 6 are applicable to this work, estimate becomes Rupees 7,300.

No. 9. Closing Pillay Voikal head sluice, and improving channel will probably be unnecessary; the channel will be crossed by the branch from the new head sluice proposed to supplement the supply to the Vennaur from above the vented dam.

(Signed) R. F. OAKES, Captain, R. E.,
Superintending Engineer, 6th Division.

TANJORE,
15th December 1866.

Z.

Memorandum of fall of surface level of water in Cauvery when in flood. Agunda Cauvery above anicut, average fall for 10 miles 3·4 feet per mile.

	Distance in miles and feet.		Surface fall per mile in feet.
	Miles.	Feet.	
From Cauvery dam to bridge at Trichinopoly.....	9		3·2 feet.
Vennaur head	14	2,200	3 ,,
Grand anicut	17	650	3 ,,
Coviladi	19	2,900	3·1 ,,
Codamoorty head	26	4,100	2·9 ,,
Vaduvagudi	33	1,000	2·8 ,,
Peroomalcovil lock	46	150	2·6 ,,
Arasalar river	46	3,500	2·4 ,,
Veerasholen river	60	2,530	2·3 ,,
Cotalum bridge	73	1,530	2·3 ,,
Myaveram bridge	80	3,380	2·2 ,,
Rajendra channel	86	4,240	1·9 ,,
Bridge on Road No. 28	91	3,580	1·7 ,,
To Sea	98	610	1·5 ,,
Paragraph 36.—Fall of Coleroon.			
From Upper anicut to Coleroon bridge...	.....		3·3 ,,
To Grand anicut	.....		3·1 ,,

(Signed) R. F. OAKES, Captain, R. E.,
Superintending Engineer, 6th Division.

TANJORE,
15th December 1866.

Received 1867 - Dept.
Pro of Govt for March
No. 706.

Proceedings in the
S. W. Dept.

Dated 14th March
Received 16th 1867
No. 775

Passing orders on letter
from Asst Engr 6th Div. submitting
Capt. Mead's Report on the Canney
and drawing the attention of the Col
lector of Sanjore, thro' the Revt Dept. to
Capt. Mead's remarks regarding the sup
ply of water to the more remote lands
of the cantonment taluk, and requesting
the Revt authorities to take measures
for preventing the mischievous waste
of water reported to occur thro' want of
careful regulation of the sluices ac
cording to the natural requirements of each
cultivation —

No 690 2nd March

Write Order