

IRRIGATION (GODAVERY, &c.)

COPIES OR EXTRACTS OF DOCUMENTS referring
to the Works of IRRIGATION on the Godavery
River and Kistna Annicut, in the PRESIDENCY
of Madras.

(Viscount Jocelyn)

Ordered, by The House of Commons, to be Printed,
15 April 1853.

[Price 6d.]

Under S. 02.

E A S T I N D I A.

RETURN to an Order of the Honourable The House of Commons,
dated 8 February 1848;—for,

COPIES "of a LETTER, dated Vizagapatam, the 22d day of August 1844, from Major
Arthur Cotton, Civil Engineer to the Secretary of the Revenue Board Department of
Public Works, Madras; transmitting a First Report on the IRRIGATION of the
RAJAHMUNDRY District:"

"Of the said REPORT:"

"Of the SECOND REPORT from the same to the same, on the Delta of the GODAVERY;
dated Madras, the 17th day of April 1845:"

"Of a LETTER from the same to the same; dated the 27th day of August 1845 (No. 64):"

"Of a REPORT from the same, to the Board of Revenue; dated Camp Vizagapatam, the
1st day of June 1844, on the SUGAR CULTIVATION of the RAJAHMUNDRY District:"

"And, of a MINUTE OF DESPATCH recorded by Lord *William Bentinck*, relative to the
CONDITION of the PRESIDENCY of MADRAS, and written either before or after his
Lordship's Visit to it in the Year 1834."

East India House,
24 March 1848.

JAMES C. MELVILL.

(*Lord George Bentinck.*)

Ordered by The House of Commons, to be Printed,
11 March 1850.

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N. B.—The Records of the East India Company have been carefully searched, but no paper answering the description of the last document mentioned in the Order has been found.

East India House, }
23 March 1848. }

T. L. Peacock,
Examiner of India Correspondence.

COPY of LETTER from Major *Arthur Cotton*, Civil Engineer, to the Secretary Revenue Board Department, Public Works.

Sir,

I HAVE the honour to forward a first rough Report upon the Rajahmundry district. The state and capabilities of this zillah seemed to justify me in laying before the Board without any delay my opinions and views of what it appears to require, and I trust that the great loss of revenue of late years will be considered a sufficient excuse for my here proposing to the Board a new system of works for it.

Should the Board be pleased to direct the further prosecution of the subject, I shall do my utmost to ascertain the best mode of accomplishing this end. In that case it will, of course, be necessary for me to remain for some months after the monsoon chiefly in the Rajahmundry district.

There is not a great deal of work remaining to be done to the bulwark at this place, but I am obliged to postpone the completion of it till after the monsoon, on account of the sand being entirely swept away at the northern port of the town, leaving no space for the conveyance of the stones. The serjeant of sappers, however, would be competent to carry on this in my absence.

I have, &c.

(signed) *A. T. Cotton*,
Civil Engineer, 1st Division.

Vizagapatam, 12 August 1844.

REPORT on the IRRIGATION, &c., of the RAJAHMUNDY District.

THE principal part of this district forms the delta of the Godavery, and as respects soil, climate and capabilities of irrigation, it can scarcely be surpassed by any part of the world. Such tracts as this, with their immense natural advantages, yet absolutely require the following four kinds of works before their resources can be in any good degree developed, even though favoured with a good supply of local rains in general, as is the case with this delta, probably not one-fourth of the produce of which they are capable can be obtained, by means of local improvement of villagers on a small scale, without the aid of the main works here enumerated:—

- 1st. The embankment of the rivers to secure the crops from destruction by the river floods.
- 2d. Dams with channels of irrigation leading from the river, to bring its water from the level of its bed to that of the surface of the land.
- 3d. Surplus channels to lead off the floods caused by the local rains from the flat lands of the sea.
- 4th. Raised roads and bridges to allow of the conveyance of produce to the markets and to the coast, through a country which is otherwise from its nature impassable during the rains.

It needs no argument to convince that without these means of counteracting the irregularity of the natural supplies of water, and of providing for the removal of produce from where it is grown to the places where it is required for consumption or exportation, only a small portion of what the tract is capable of producing can be secured. One year a portion or the whole of the crop of large tracts is destroyed by the overflowing of the rivers; another year the same losses are sustained from the rivers not rising high enough, though even in the worst years it may contain water enough to irrigate ten times the extent of land forming the delta; in a third year the lower or flatter tracts are so flooded by the local rains that the labour of cultivation is all thrown away; in another the crop is destroyed by a failure of the rains over three-fourths of the district, when not an acre of it need to be dependent at all upon them; and it may happen that the district is suffering from two or three of these visitations at the same time; for instance, one-half of the district suffering from river floods, while the

other half is equally distressed by a failure of the local rains ; and lastly, the most abundant produce is of little use, unless it can be conveyed at a moderate expense, and at the proper time, to the point where there is a market for it.

Of all these four works, Rajahmundry has been hitherto, and is now, wholly destitute. It is entirely without any general system of irrigation, draining, embankments or communications. There are some partial works of this kind, but they are of small extent, and even these have not been kept in an effective state. In the last three or four years something has been done towards the repair or improvement of the old works, but their complete restoration is not what the district needs ; it is the execution of a system of works of a general nature, without which all minor works can effect hardly any thing, comparatively speaking. It is truly astonishing to see this important district in this state, and the more so when considered in connexion with Tanjore, a district of the same kind in the same Presidency. In the latter, from the time it came under the management of our Government, there has been one continued process of improvement carried forward, so that it may now be said to be completely provided with works of all the four kinds above mentioned (though many works of detail may yet be executed with advantage). In Tanjore, when the supply of water in the river is scarce, every drop is let out on the lands. In the severest freshes there has not been any considerable extent of loss sustained by the overflowing of the rivers for the last 10 or 15 years ; only a very small part of the district ever suffers materially from the heaviest local rains, while the crops are so independent of these, that a failure of them, comparatively speaking, but little affects the produce ; and lastly, there is a communication for bundies open throughout the year from every talook to every other talook and to the coast. The results in the two districts correspond with the difference in the attention that has been paid to them. The delta of Tanjore contains a population of about 1,100,000, and pays a revenue of about 45 lacs with so much ease, that it has been constantly showing an increase of every thing which indicates the prosperity of the inhabitants, though it has had no valuable article of export except rice ; while Rajahmundry contains in the whole district only 560,000, and probably in the delta not more than four lacs, and pays at present, with great difficulty, 31 lacs. The delta of the Godavery is indeed smaller than that part of the delta of the Cauvery which is in the Tanjore district ; but on the other hand, the quality of the land is on an average decidedly superior in the former ; it is also much more favoured in respect of its local rains, and the supply of water by the river is probably four times as great, and much more constant. Of the comparative state of the two districts in respect of the wealth of the people, a judgment may be formed by comparing the amount of taxes paid by each inhabitant in the two districts with the aid which each district has received from Government. Taking the total population of Tanjore at 12 lacs, and the revenue at 48 lacs, we have four rupees a head ; and taking those of Rajahmundry at 560,000, and 21 lacs respectively, we have the same, or about four rupees a head. In the first place, there is a difference in the value of money in the two districts ; the price of grain, labour, &c. is lower in Rajahmundry, so that we must consider the four rupees paid in Rajahmundry equal to five paid in Tanjore. We have then to consider the difference between the circumstances of the two in respect of the aid which Government has afforded them. In Tanjore, so complete are the Government works, that I doubt whether on an average 5 per cent. of the crop is lost on the whole district, and at the same time the water is brought free of all expense into each village, above the level of the fields ; while in Rajahmundry a very small portion indeed is supplied with water by the Government, and that portion imperfectly ; and so completely is the district left to the mercy of the seasons, that perhaps on an average 20 per cent. of the crop on the lands now cultivated is lost. By far the greater part of the district is either dependent upon the local rains, or the land is watered by the pecottah, the water being raised from 5 to 15 feet. In one village that I visited in the heart of the delta (and which, if so situated in Tanjore, would have had water supplied to every field at the expense of Government), there are reckoned 90 excavated tanks, some very large, from which the water is raised from 5 to 10 feet. It must be evident that four rupees a head may be paid in the one case with perfect ease ; while in the other, it may be, as it certainly is, so oppressive as to keep the people in a state of the greatest poverty.

I have

I have not yet received a statement of the revenue of Rajahmundry from the time it came under our Government, but in the last 10 years I find it has fallen off about five lacs, while the population, if the returns are correct, has fallen from 740,000 in 1821, to 560,000 in 1842, or one-fourth in 21 years. This very rapid decline is, no doubt, mainly owing to the failure of the cloth trade, which, in 10 years, has fallen from about seven lacs of rupees to three lacs, and which, I am told, was once much higher. A diminution of export trade to the value of four lacs would throw out of employment about one lac of people, and a large proportion of these, no doubt, would emigrate; but the amount of suffering in the district which must have followed upon such a decrease of employment for its population it is impossible to conceive. How far the loss of this trade would have been prevented or delayed, had the irrigation of the district been attended to, is a point deserving of most serious consideration. The price at which any article of trade can be supplied in any country must depend mainly upon the rate at which food can be obtained, and upon the price alone depend the admittances of any article into a particular market. Had rice been obtainable with less labour, when the English cloths begin to undersell those from these districts, the Indian cloth might have been sold at a lower rate, for every thing must depend upon the price of food. We have a ready proof of this in the partial revival of the cloth trade in Vizagapatam in the last few years, doubtless in consequence of the diminished rate at which it is now sold. It will be readily conceived what would now be the effect on England if the land could be made to produce double the quantity of corn it does with diminished labour; all her manufactures would immediately be produced at lower rates, and a moderate fall in price would at once much more than proportionably increase the demand. A country may indeed continue in a miserable state, though food is obtained with little labour in it; but yet abundance of food procurable by the labour of only a small portion of the population is the foundation of all national prosperity. In England, about one-fourth of the population are employed in raising food; if agriculture had remained in the state it was some centuries ago, when perhaps two-thirds of the population were required for this purpose, it is impossible that she could have produced her manufactures at the prices she now does. Now, in Rajahmundry, I have no doubt that a complete system of irrigation would increase the produce from the lands now cultivated by one-half, and that with greatly diminished labour, so that food could be produced at one-half the cost it now is; a difference which I have little doubt would, for the present at least, restore a portion of the cloth trade. It is not, therefore, in my opinion, sufficient to say that the loss of the cloth trade has caused the late diminution of revenue and population in the district, without inquiring further whether that cause itself is not in a great measure the effect of neglecting those means of improving the district which we had in our power. But whether the cloth trade revives or not, it is certain that if food is produced with less labour, the prosperity of the district must increase; either the food itself will become an extensive article of export, or something else will be produced or manufactured with advantage in consequence of the abundance of food. In this case, however, there can be no doubt that sugar will become the great export of the district; on which subject, however, I have already communicated with the Board. There is already a very considerable extent of sugar cultivation in the district, and nothing wanted but the establishment of extensive sugar works to increase the cultivation to any extent, provided that the district is irrigated. I am happy to say that the immediate establishment of sugar works in the district is now, I believe, determined upon by an English mercantile house.

Before attempting an outline of the system of works that would be required to irrigate the district, it will be well to consider what has been done in Tanjore, the cost of the works, and their results. When we got possession of that district, it was in a far more advanced state than Rajahmundry is now; there was already something like a system of irrigation, and especially one main work, the grand annicut, built to prevent the Cauvery rejoining the Coleroon; so that the district, or at least those parts of it which were irrigated, were not dependent merely upon the high freshes of the river, as is the case now in Rajahmundry, but received a supply of water almost as long as there was any in the Cauvery; it was, however, all in a very imperfect state, as is shown by the returns of produce, which in different years varied 50 per cent. according to the seasons. Many tracts were not irrigated at all; many were not drained; much water of the

Augunda Cauvery flowed to waste by the Colleroon; there were very partial embankments to the rivers, and not the trace of a passable road through the district. Soon after the assumption of the country, the grand annicut was raised; by degrees innumerable small works, such as sluices, &c., and new channels were executed; the river banks were extended and strengthened; raised roads, with small bridges and tunnels, were constructed; the ferries were put in an efficient state; many large works, for better distribution of the water within the district, and the control of the level of the beds of the rivers, were added, and at last two new annicuts were constructed on the Colleroon to prevent the escape of any water to the sea when it was wanted in the district. During the 40 years that these works have been constructing, about 32 lacs of rupees have been spent on the irrigation, or 80,000 rupees a year; allowing that one-half of this would have kept the works in repair, the improvements have cost 16 lacs, a most insignificant sum compared with the population of the district, its revenue, and the effects produced: it amounts to about $1\frac{1}{2}$ rupees a head on the population; it is equal to one-third of one year's revenue, and it is less than one year's increase of revenue, if the first years of the period are compared with the last. The average revenue of the first four years of this century was 31 lacs; the average of the four years ending in 1839, which is the last year I have, is $47\frac{1}{2}$ lacs. Still more insignificant does the expenditure appear compared with the saleable value of the lands of the district, which, calculated from the average price obtained from about 80 estates sold in all parts of the district, was, in 1839, about 260 lacs of rupees, and of this about 100 lacs had been added in a few years, so that probably the landed property of the district had been increased in value, during these 40 years, 150 or 200 lacs. That the foundation of all this improvement was the attention to the irrigation is perfectly evident to all those who are acquainted with the district, and there is no other way of accounting for the fact that such improvement has taken place, while every other district in the Carnatic has fallen off. Circumstanced as the eastern side of the peninsula is with respect to the rains, it is impossible that any considerable improvement can take place unless the irrigation is attended to; while the crops are dependent upon the local rains, which are so extremely uncertain, almost the whole population must necessarily be employed in cultivation. Few countries in the world are more liable to the destruction of the crops by drought or floods, perhaps none in the world more sure of abundant harvests, if proper attention is paid to irrigation and drainage. The total quantity of rain in the Carnatic is in general very deficient, being only on an average about 48 inches; but this falls with the greatest irregularity, almost always coming in violent bursts, with long intervals; a fall of 5 inches in a night is very common, and I have known 10 inches fall in one day, and a fortnight afterwards, 12 inches in 36 hours; nearly half the supply of an average year thus coming within a fortnight. It is on this account that Tanjore, which alone has been properly attended to, has so remarkably advanced; while the other districts, in which the irrigation has not even been kept up, have retrograded. It may be asked, how much of this improvement has been owing to the revenue management; the answer is, the whole of it, for undoubtedly the finest system of irrigation possible would avail little if the district was mismanaged; but, on the other hand, the ablest collector can do little without his district is supplied with water. But the superior revenue management of Tanjore has been especially shown in this very point; that the collectors, I believe, without exception, for 40 years have considered the irrigation of the first consequence, and have most diligently and ably watched over it.

The results in Tanjore, compared with Rajahmundry, place in the strongest light the consequences of the two different modes of proceeding. If we take the increase of revenue in Tanjore at 16 lacs, and consider it to have been progressive, as it has been upon the whole, the total additional revenue in 40 years was 320 lacs, and the total irrigation expenditure 32 lacs. I have not the statistics of Rajahmundry yet for so long a period, but I believe the revenue has not improved, and in the last ten years there has been a falling off of 5 lacs a year, or a loss of 25 lacs in all. I have not the smallest doubt that had one quarter of this been spent on the irrigation, the whole 25 lacs would have been saved; and I am equally certain that had that whole amount been expended from the time the country came under one control, the revenue would have been double what it now is. I do not mean to say that it was possible many years ago to have introduced a complete system of irrigation into the district; the zemindary system

system would have opposed immense obstacles to it, though much might doubtless have been done. But now the time appears to have come when the Government may take the matter in hand without any doubt of being able to go through with it. Many of the zemindars are much more sensible than we are of the importance of such an undertaking, and if there are any still remaining who would be inclined to throw any obstacles in the way of it, they are quite powerless. Arrangements must of course be made with them either to pay a share of the cost of the main works, proportionate to the extent of land watered, or to pay an increase of peshcash; but I have no doubt that under judicious management these points could easily be arranged.

I would next proceed to consider the nature of the works now in existence, and those which would be required. There are a few large irrigating channels from the river, but they are radically defective. Their beds are so much higher than that of the river, that they may admit water in the high freshes, and hitherto they have been without head sluices, so that the crops dependent upon them might be at one time perishing from drought, though there was an immense body of water in the river, and at another drowned by the floods they conveyed to them; and not those lands only, but all the neighbouring country also. The Boopiah Calvah I found to be about 14 feet above the level of the bed of the river, so that nothing but a high fresh could reach it; and last year it was evident from the appearances of the channel, a torrent of water passed down it, overflowing its banks and flooding the whole country. This latter evil is now counteracted by the erection of head sluices, which is a great improvement, but it only removes the smallest evil of the two to which such a channel was subject. These imperfect river channels, which also only lead water to a small part of the district, are the only irrigating works of any consequence in the delta. There are also some low and partial embankments to the river, but so utterly inadequate that several lacs of rupees were lost last year in the destruction of crops by the river floods. There has been some considerable improvement made in these this year, but a very large amount of work is required to put them in an effective state. A good deal of work has been done to the great line of road through the town of Rajahmundry, but this can hardly be said to be in the delta; it is, however, in a very imperfect state, and wants many bridges. About 20 years ago, Mr. Robertson estimated for completing the water communication by the creeks and backwaters near the coast, from the northern end of the district to within a few miles of Masulipatam, a most important work; it was estimated at only 7,000 rupees, but was not completed, though one or two of the cuttings were made.

The works that will probably be required may be thus roughly estimated:—

Annicut across the Godavery above Rajahmundry	-	4	lacs.
Two main irrigation channels	-	5	"
Aqueduct to convey water across the river to the tract lying between the two branches	-	2	"
Detail works, channels, sluices, &c., in the Circar tracts	-	2	"
River banks	-	1	"
Cutting bends, &c., in the river	-	1	"
Roads and bridges in the delta, 200 miles at 1,000 Rs. per mile	-	2	"
TOTAL	-	16½	"

This is, of course, only a rude judgment of the works and their cost; merely intended to show the sort of plan which I would recommend. The principal difficulty to be encountered in this district is the bringing the water from the level of the river to that of the lands. This is owing to two things, the great depth of the channel of the river (about 25 feet at the head of the Boopiah), and the moderate fall of its bed, about 1 foot per mile. These two will make it necessary to have both a high annicut and a considerable length of channel, with deep cuttings to lead the water out to the surface of the lands. I have not, however, examined the river above Rajahmundry. I have no doubt of finding a good site for an annicut as respects materials, for the hills come down to the bank of the river, and I saw an excellent kind of granite at Rajahmundry brought a few miles down the river. I am also inclined to think that when a

few levels have been taken, I shall find the country more favourable for the channels than I have supposed in the above estimate.

The central tract between the two main branches of the Godavery is, I understand, the richest in the delta, but I know of no way in which water can be conveyed to it but by carrying it from one of the main channels over one branch by an aqueduct. This would be an expensive work, but a bridge would be continued with it, which would be an incalculable benefit to the district.

The river banks will not be very expensive; there was destroyed last year by the floods probably three times as much as is wanted to put them into an efficient state.

The channel of the river has been hitherto totally neglected; it has been allowed to wander wherever it would; and what is worse, the inhabitants have been allowed to encourage the formation and growth of islands in it; the consequence of which is that it cuts into the land opposite, which is very like permitting one man to rob another.

The southern channel will not merely provide water for the southern part of Rajahmundry, but also for a very large portion of Masulipatam, sufficient, I suppose, to yield six or eight lacs of rupees when properly irrigated.

In the lower part of the southern Godavery, a bend has been allowed to form, which has cut away the greater part of the town of Maddepollem, and if neglected will destroy both the remainder of it, and the adjoining town of Narsipoor. Two vanganies were constructed this year for the protection of the town; they are well built, and will be of great use, but more are required, and to check the evil effectually the bund ought to be cut away. This is also absolutely necessary on account of another evil arising from it; viz., that it keeps the surface of the river so high in the floods. It is exactly similar to a bend in the Coleroon near the sea, which was cut away about three years ago.

The roads and bridges will have a most powerful effect upon the prosperity of the district; for several months, grain, jaggry and other bulky articles cannot be moved at all, unless produced near the banks of the river; and for several more, the cost of transport is enormous. Supposing that one anna per ton per mile were saved by the construction of good roads, and that 45 tons a day were conveyed by them, there would be a saving to the district of two lacs a year on the 200 miles of road, besides all the advantages to travellers, and the incalculable effect of being able to convey produce to the markets at the proper time. In Tanjore, on one of the raised roads, the traffic was found to be 1,200 male travellers, and near 100 tons of goods per day. It need hardly be urged, that if the people were relieved from a burden of two lacs a year in the transport of goods, the effect of it would be very sensibly felt on the revenue.

I have not supposed that any of the large rivers are to be bridged, though I would undoubtedly continue annually to lay out a large sum on that work, till the communications were completed. From the cheap rate at which excellent timber of various kinds can be obtained in this district, I am in hopes that bridges upon the plan of the American timber bridges would be found very moderately expensive, but I have not yet been able to get one estimated.

This sum of 16½ lacs might be expended in four or five years, and would, I should hope, convey water to all parts of the district; but there would be a demand for additional works of detail for many years, as cultivation extended and population increased; I have not the least doubt that it would very soon yield cent. per cent.; nor that if an effective system of irrigation were fully established and kept up, the revenue of the district would rise to 50 lacs of rupees.

In examining the question of the propriety of such an outlay as this, there is one point which I consider deserving of particular attention: we are apt, generally, to think of a Government expenditure as if it were precisely similar to one made by a private individual. But in countries circumstanced as these are, there is a vast difference, and especially in this particular case of Rajahmundry. A lac of rupees cannot be spent in any district without a large portion of it immediately finding its way back to the treasury; but in this district, which is now suffering such difficulties from the immense diminution of specie, probably the greater part will be paid back in the course of the year. This additional circulation will enable many to pay their kists who would otherwise not have done so; and perhaps there would be little more difference made by its disbursements, in respect of the state of the treasury, than that each portion of the population

population as would otherwise have been either not at all employed or to little effect, would thus be usefully occupied.* During three or four months, the great bulk of the population are employed to very little purpose, where there is almost literally no capital to enable the landowners to make improvements; but an expenditure of three or four lacs a year would put life and activity into the whole district. That part of the population which are just now, from the impoverished state of the district, a dead weight upon the rest, from want of employment, would be provided for, and the supply of specie would give a great stimulus to the remainder. Indeed, I would state it as my opinion, that, independent of the ultimate returns, the Treasury would not be at all the poorer at the end of the year for such a disbursement in the present state of the district; such an outlay seems to me more nearly allied to a loan from a landlord to his tenant, to be expended in improving his farm, than to a simple expenditure.

As for the proper returns from the works executed, they would not certainly be so immediate as in Tanjore (where, I believe, almost without exception, the money was repaid in increased revenue within the year), because it probably will be found impossible to execute the main works within three years; but I have no doubt that if the works are diligently prosecuted, before five years are over, a very large increase of revenue will be obtained.

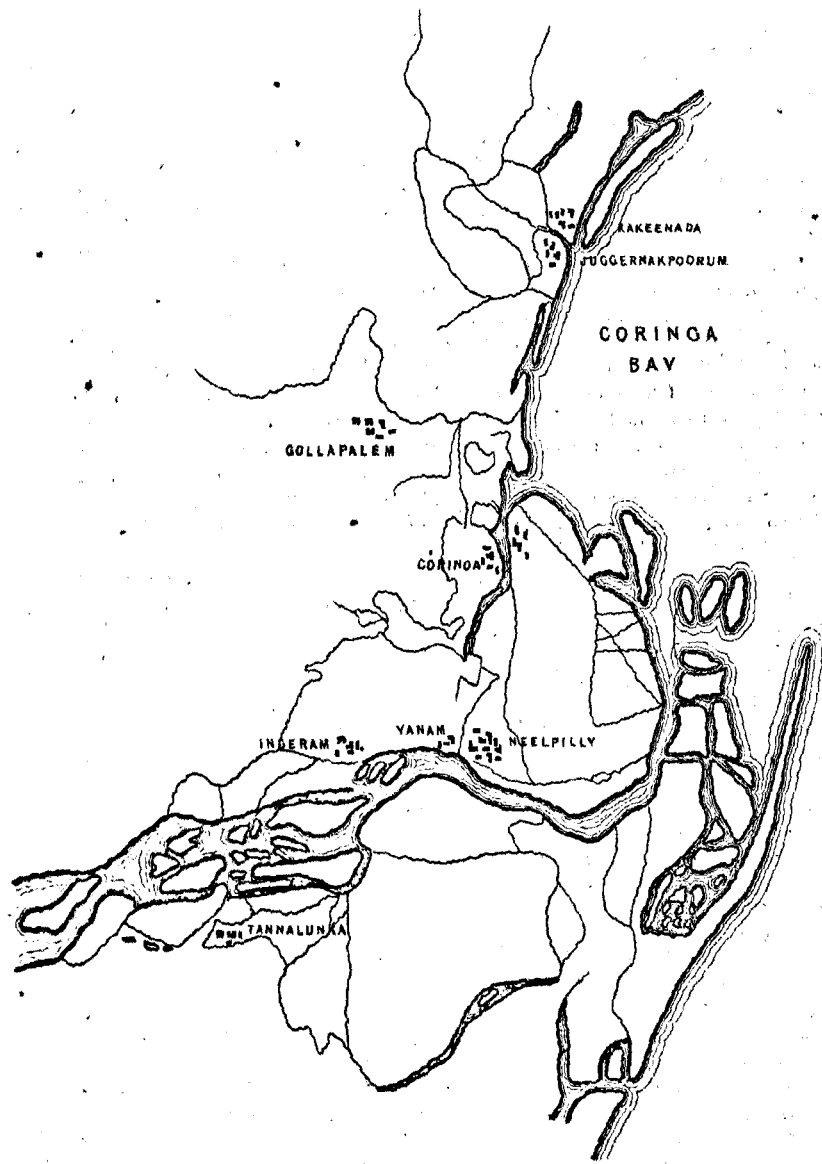
In considering this matter, it will be useful to compare the results obtained in Tanjore, and those that may be expected here, with one of the Government works in Bengal. In the project for the Douab Canal, it was estimated that it might return 7 per cent.; in Tanjore the return is upwards of 100 per cent.; and in comparing the circumstances of this district, there seems abundant reasons to believe that the returns will be at least as great here.

I must not conclude this first rough report of the district without noticing two other points, which may properly be considered as coming within the sphere of a civil engineer's duties: these are the state of the ports, and that of the timber trade.

Till I visited the district, I had no proper idea of the great value and importance of the port of Coringa; first, as being the only shelter for vessels between the Hoogly and Trincomalee; and secondly, in connexion with the teak timber trade of the Godavery; and I was astonished to see about 200 vessels docked there, many of them large ships. The bay is perfectly secure anchorage; very large vessels can be brought into the river, and the teak timber of excellent quality is brought down at a very low price. Such a port ought to be most watchfully cared for, and every plan that could be thought to secure the full advantages of it should be adopted by Government. But so greatly has it been neglected hitherto, that not only has no attempt been made to improve it, but from what I could learn, nothing has ever been done, even to preserve it; every thing has been allowed to take its own course. For instance, the banks of sand have greatly extended off the mouths of the Godavery, of late years, as must necessarily be the case with such a river; but no new survey of the coast and roads has been made, nor instructions for entering the port published for many years. When a survey of the district made 20 years ago was shown to the commander of a vessel, who knew the port, he could hardly recognize it, so greatly had the banks which appear above water extended. Again, I was assured that there is a heap of ballast in the harbour discharged by some ship, and perhaps there are many others; a vessel also discharged her ballast in the small branch of the Godavery, upon which all the docks are situated, the only one having deep water over its bar, and that has never been removed, forming a serious obstacle to vessels passing up and down it.

But not only ought the harbour to have been preserved from injury; it seems certain that it might have been greatly improved. In the first place, the bar at the mouth of the Coringa branch of the Godavery is not a bar of hard sand brought down by the river, but simply a flat of the softest mud, so that there can be no doubt that it might be kept down by dredging. There is, I am informed, about nine feet water over it at present, and if it was deepened a few feet, very large vessels might be loaded in the river, instead of at the anchorage two or three miles off. There is also another small river entering the harbour at Cocanada, the mouth of which is totally neglected. Many ships are loaded from this river, and very great additional facility might be given to this, if this river was attended to. It is the more remarkable that nothing has been done for this most valuable port, inasmuch as it would have itself provided the funds.

(To face page II)



remain permanently as conservator of the trade; he might ascertain whether it might not be advisable to provide a fund for opening up the forests and improving the river by a slight duty on the timber.

I send herewith a small sketch of the port and neighbourhood, to show the peculiar situation of Coringa. The principal mouths of the Godavery are all much exposed, and have bars of hard sand off them; but it will be seen by the sketch that the Coringa branch leads off from the main stream at right angles; it consequently brings down little or no sand; and entering the bay where it is well sheltered, there is little tendency to the formation of a bar. Bars are formed of materials brought down by the rivers, or of sand or shingle swept along the line of the beach by the surf. Where the force of the current of the river is met and counteracted by the swell of the ocean, there the sand or shingle is deposited; and just in proportion as the mouths of the river are sheltered, is the tendency to the formation of a bar diminished. If, however, the river brings down large quantities of sand, and opens into a sheltered bay, it will form extensive flats, where the current is lost by spreading; if, however, this deposit is not brought in very great quantities, a channel may be kept open by dredging, or if there is deep water near it, this may be effected by stone jetties confining the current, and directing it so that instead of its directly meeting the swell, and so forming dead water in which the bar is formed, it may nearly coincide with its direction; and thus the two may unite together in forwarding the materials of which it would be formed in their natural course along the line of the coast. I have no doubt that on examining the Bay of Coringa, both the Coringa and Cocanada rivers might be greatly improved at a moderate cost. My employment on the works at Vizagapatam has led me to consider the subject of bars, and specially of those on this coast, and I feel sure that much might be done generally at very moderate cost to keep the mouths of its rivers open; and I wish to report to the Board the results of what I have here seen, and of my investigation of the subject.

I trust the Board will excuse my forwarding so imperfect a report as this. My reason for doing so without waiting for further data, is to bring the matter as early as possible to their notice, in order to obtain from them that aid which will be required to enable me to prepare a second and more complete report. I have at present no assistant, no surveyor, only two apprentices, and only one levelling instrument; so that if I have it with me, neither of the apprentices would have any instrument to work with. I see by the orders that an assistant has now been appointed, but though he must needs be an important addition to the division, yet being newly arrived in India, he will have every thing to learn connected with the irrigation of this country. I cannot myself now undergo a quarter of the fatigue that I used to do in Tanjore, and this will be a far greater undertaking than the planning of the new works there was, not only on account of the larger extent of works, but also, especially, from the state of the natives, who, in respect of the execution of great works, are far behind those of Tanjore. If the Board should consider it advisable, therefore, to have the district thoroughly examined with reference to the proposed works, I would beg to suggest that an experienced assistant should be appointed, and one experienced surveyor at least, and especially that if possible they should both be men who had been some time in Tanjore, as the experience obtained in other divisions would have comparatively no effect in respect of a project for extensive river irrigation. I shall also strongly recommend the appointment of two non-commissioned officers of sappers and miners; this class of men would occupy a very important place between the European officers and the surveyors, who have never been in England, and are, indeed, in my opinion, precisely what is wanted to complete the series of persons employed in the tank department. Many lines of levels and of survey must be made, and much labour expended in collecting information of various kinds, before a system of irrigation and communications can be effectively planned, and time should not be lost in preparing the plans and estimates; even the loss of a single year will cost several lacs of rupees in revenue, so that it would be poor economy to delay the works by a want of suitable persons to collect materials for determining the details of the project. A falling-off of revenue to the extent of five lacs a year in ten years, is too serious a loss to be endured for want of a vigorous effort to recover it, especially when there ought to have been an increase to that amount in the

same time, had the district been improved as it might have been. The collectors' department also requires as much to be augmented as that of the civil engineer. It is impossible that such a district should be well attended to without a regular native superintendent, even if there were none but ordinary works going on. It is not only necessary that the collector should have a man of superior talents and knowledge in the general charge of the work of irrigation, but also that he should be a person on a footing with the tahsildars; while there is nobody above the rank of a maistry under the collector, it is impossible for him to have sufficient authority to be a proper check upon the tahsildars, who look upon a maistry, of course, as a person under their orders while in their talooks. I have not the least hesitation in saying that upon the person at the head of the irrigation department in the collector's office depends, at least as much as upon any other individual native, the prosperity of the district; for, as I have elsewhere said, unless this essential and fundamental point, the supply of water, is duly cared for, all the energy and talents that can be expended upon the district will be of comparatively little avail. In fact, in this country a collector sheristadar of the greatest energy and talents, if the district is not watered, is only in the situation of a skilful artificer, without any implements. Even in a district like Rajahmundry, with the richest soil and finest river flowing through it, he can do nothing to save it from depopulation and ruin, while the produce of the lands is destroyed by droughts and floods alternately. A native superintendent should immediately be appointed, and as there is no one in the division at all equal to such a charge, he should be sought for in Tanjore. There are there several superior men, who have been brought up under Ramashawmy Naick, the late able superintendent of that district, and who are thoroughly acquainted with the various kinds of irrigation works constructed there. If a Teloo-goo man were selected from them and sent to this division, he would be invaluable. There should also be an able head goomastah in the Cutcherry, at the head of the irrigation department, under the collector, on such a salary as should prevent his situation being looked upon merely as a stepping-stone to something better.

I trust the Board will approve of my thus distinctly bringing before them my opinion of the state and wants of this most valuable and most neglected district. An ample experiment has now been made upon it, and the bad economy of keeping the irrigation in a state of ruin has been fully proved; for every 1,000 rupees saved in expenditure, at least 10,000 has been lost in revenue, and a district which ought to have been now occupied by a million of people, in ease and plenty, while paying a revenue of 40 or 50 lacs, pays about 20 lacs, and has only half a million of inhabitants in a most impoverished state. On the other hand, in Tanjore, the opposite experiment has been made, and the results are as stated above,—a population of 1,200,000 in a very prosperous state, and a revenue of 48 lacs, and still increasing. Undoubtedly the sole fundamental difference between the two districts has been this, that money has been expended in the latter, both in keeping up and improving the supply of water, while in the former not even the old works have been kept in order. The work that has been executed in the last few years has been very valuable, and the following extract from Captain De Butts' diary shows in the strongest manner that the expenditure has not been in vain in one considerable instance; and there is no doubt that the restoration and improvement of the old works would add lacs to the revenue; but it is not the irrigation of this or that village, or even of half of a talook (when there happen to be ample freshes in the river and no flood), that is wanted, but it is the irrigation of the district, and that when the freshes are scanty, and without endangering the crops by floods when they occur. While the district is without an extensive and effective system of irrigation, the civil engineer ought not to be employed about the repair or improvement of individual works, which are radically defective in principle, such as the Bhoopiah Channel for instance, which has no water in it, where there is about 14 feet in the river opposite its mouth, and which may have a stream running down it 45 days, when there ought to be a full supply every day in the year. His proper employment would be in planning and executing such works as would both affect the district generally, and also lead out water to the lands as long as there was any in the river. This improvement of the Bhoopiah Channel, however, is not only a useful work, in having added 27,000 rupees a year to the revenue, but much more so in this, that it shows indisputably that the real evil

under

under which the district is labouring is the want of water, and that directly this is obtained the district will assuredly revive. The extract is as follows:—
 “ Having stated in former diaries the importance of this channel to the Woondy talook, upwards of half of it being irrigated by its means, I shall only observe here that since the restoration of this channel in 1839, and the re-opening of the Apparou Calvah in the following year, the revenue of this talook has gone on steadily increasing. The average annual revenue from 1835 to 1838 was Rs. 59,864. 8.; but from 1839 to the present year (1843) it has been Rs. 87,885. 2. 4., making a total increase of Rs. 27,987. 12. That this increase has been effected by the excellent supply of water this talook now receives, and the improvement that has been made in its works of irrigation, is apparent from its being the only talook in the district that can show such an increase of revenue.” The average revenue of the rest of the district was during the former period here mentioned. * * * and during the latter * * * showing a falling-off of Rs. * * * while the revenue of the district generally fell off to the amount of * * * per annum or * * * per cent., that of one talook increased 28,000 rupees, or 47 per cent., merely from a partial improvement of its channels of irrigation, though they were radically defective, and no water was obtained by them till there was more than 14 feet in the river. Thus we have the same thing proved most distinctly, both by comparing the district generally with another of the same kind, and also by comparing it with one of its own talooks.

* See in orig.

When the improvement of the general system of irrigation in Tanjore was commenced in 1830, we had not the strong grounds for expecting great results that we now have. It was comparatively a bold proceeding to spend three or four lacs on new works, and the most sanguine had no expectation of such prodigious results as have followed from them; the district, also, was already in a high state of improvement, indeed so high that one great objection made to the expenditure was that it was impossible the revenue could be increased, and further the river itself, upon which all depended, was not always fully supplied with water. But in this case we have actual results already obtained on a large scale in another district, and on a small one in the same, we have a district of the greatest possible capabilities, but as yet very little improved, and a river containing water enough to irrigate five such districts. We have now, further, an article for cultivation of far greater value than the grain produce of Tanjore. The total produce of Rajahmundry can scarcely be worth more than 80 lacs of rupees at present, but were it fully irrigated, and all its suitable lands cultivated with sugar, the produce would be worth at least 400 lacs of rupees, allowing only 300,000 acres at $\frac{2}{3}$ ton of sugar per acre, besides the produce of its other lands. A revenue of 50 lacs would then really be scarcely felt.

I feel assured that the Board will consider the state of this district, in respect of its irrigation, at least as worthy of their most attentive consideration, as it has been thought worthy of it in respect of its revenue management; the latter will be of little avail without the former; just as much so as the greatest zeal and skill in the management of a steamboat would be when there was no fuel on board. The Court of Directors, I find from Captain De Butts' report, written in 1842, had, in 1838, written approving of the restoration of the old works of irrigation, and expressing their confidence that this work would make ample returns for its cost. Since that we have had, both in this district and in Tanjore, abundant additional proof of the ample returns that improved irrigation would give; but why should we restore the old works, instead of planning new ones more worthy of our means and advantages? Would it not be unworthy of the Government of a civilized nation, after having had possession of a district for a long series of years, merely to put in repair old, partial and radically defective works, executed by the Native Governments under immense disadvantages, and suffered by us to go to ruin, when we have it in our power to construct a complete and general system of works which will bring the last drop of water in the river to the surface of the lands, and put it all under complete control? One of the most striking facts in the whole of the proceedings of Europeans in India is the proneness which there has been in past times to lower ourselves to the level of the natives, and their modes of proceeding, when they had not the knowledge and science of the Western Natives, instead of diligently applying the means which God has placed in our hands to the benefit of the countries He has given us charge of. In nothing has this been more shown than in the irri-

gation;

gation; with this aggravation, however, that we have been far behind the Native Governments in keeping the works, such as they were, in order. The only instance in this presidency in which such an improved system has been tried, viz. in Tanjore, fully justifies by its results the extension of such a plan of proceeding. But if anything worthy of our Government is undertaken, adequate means must be used, especially in respect of European superintendence. In Tanjore, during the time the works were planning and executing, that is from 1829, almost every officer was completely knocked up by the fatigue and exposure, and they were carried on under the immense disadvantage of a constant change of officers; no less than seven different officers had charge of the division in about 12 years, and five different assistants, there having been never more than one assistant, and often none. Almost every one of these officers was obliged to go either to Europe or Australia for his health, after being one, two or three years in the district. When this is considered, it appears really wonderful that anything like a distinct plan was followed out, or any satisfactory results obtained. I trust that in taking this district in hand, not only will sufficient officers be appointed to do it thoroughly, without necessarily becoming so injured in health as to be obliged to leave it after a short time, but also that if one is obliged to leave, there may be more than one left in it who has had time to get acquainted with the works, and that thus they may not be endangered by falling into the hands of officers entirely new to the project.

As the fundamental work in the system of irrigation here supposed, viz. an annicut across the Godavery, may appear, in consequence of our having as yet attempted scarcely anything worth the name of a work of magnitude, a very serious undertaking, if not an impracticable one, I would say a few words on that point. First, let us observe what has been done; the two Colleroon annicuts, one 650 yards long, and one 750, with locks, sluices, &c., were both built at once, and each finished, notwithstanding the presence of a considerable stream of water, in exactly three months from the time of its commencement; the one costing near a lac, and the other about 85,000 rupees. The completion of one of them within two years was looked upon by most people as a vast work, and what could scarcely be hoped for. The present work would contain probably double the quantity of materials of these two together. But I expect to be able to choose a site for it, where there will be abundance of suitable stone close at hand, which will greatly facilitate the work; and I think it is worth considering whether it might not be constructed of rough stone chiefly. The low rate at which we have been able to do this work at Vizagapatam, even with the comparatively imperfect apparatus we have used (viz. wooden rails and two-ton cranes), encourages me to think that we might construct an annicut in that way cheaper than any other; and it would have many advantages, chiefly that it would be done almost entirely by ordinary labourers; for in a district where so little masonry work is generally going on, it would be very difficult to collect so many artificers as would be desirable if the annicut were formed entirely of brick and squared stone. With waggons, rails and cranes calculated for ten-ton loads, or even five tons, it could be executed with great expedition and very cheaply. By this mode of construction, also, what would probably be the main obstacle, would be overcome without any trouble; that is, the disposal of the large stream of water which flows down the river even in the hot weather; this would find its way through the open stone work, while it was under construction, and a lining-wall along the upper face of the dam could be added afterwards. The body of a dam 2,000 yards long, 50 broad, and 4 high, on the average, could be formed for about two lacs of rupees, and it could be finished by a covering of cut granite afterwards. The channels might be cut to the full depth and of a moderate width the first year, so as to allow the water to flow down them, and they might be gradually widened, by which means early returns would be obtained.

There does not seem to be any use in my attempting to go further into this subject at present, till I have obtained the necessary materials for a more complete report; and I would, therefore, now only request the Board to place at my disposal the means I require to examine the district thoroughly, and without waste of time; and I would take the liberty to remind them, that my own health and strength are such, that I am utterly unable to do more myself than visit the various localities, and prepare plans and estimates from the materials provided for me by others. Surely it is time to take decided steps to restore to prosperity
a district

a district which has so sunk under our management during a long series of years; a district which in itself has such capabilities as can scarcely be equalled, if at all, in any other tract in the world, having all the advantages of Tanjore, with a richer soil, a far nobler and more certain river, and, in addition, what is certainly not to be found in any other country, a perfectly accessible and safe port, directly connected by a large river with forests of teak of the finest quality. That such a district should have greatly retrograded under our management is one of those things which it is impossible to explain.

I cannot conclude this paper without observing, that this is only one instance, though an aggravated one, of the total misapprehension that there has hitherto been of the importance of the irrigation of this presidency. Excepting Tanjore, every district on the eastern side of the peninsula has regularly declined from the time we took the charge of them; and this is solely owing to the inadequate expenditure on the irrigation. The subject has been completely misunderstood. Of late years, indeed, an important change has been made by the division of the country into eight districts, with one or two officers in each, instead of four districts only, and also by the great additional attention it has received from all concerned in it. Still both the departments and the expenditure is utterly disproportionate to the value and extent of the works, even of those now in use. After 20 years' most anxious attention to this subject, I am satisfied that in general one per cent. upon the gross revenues of the districts irrigated by river channels, and two per cent. upon those chiefly watered by tanks, is the very least sum that could possibly keep in order the present irrigation works, if they were once put in a complete state of repair, and that, excepting Tanjore, there is not one district in which an expenditure of two or three lacs is not at this moment required to put them in tolerable order, and that unless the expenditure is greatly increased, nothing can prevent the continued declension of the revenue, and the increased poverty of the people. In this division, I find that when the Board took the average expenditure for five years, from 1832 to 1836, the annual sum was 5,500 in Ganjam, 6,000 in Rajahmundry, and 6,000 in Vizagapatam,—sums so preposterously inadequate, that they might almost as well have been kept in the treasury. It may be easily understood from the mere mention of this amount of expenditure how rapidly the works generally must have been going to ruin, and what sums must now be required to recover the ground that has been lost. In general it may be safely estimated that every lac of rupees retained in the treasury when it was required to repair the works of irrigation, has caused a permanent diminution of revenue of at least a lac a year; but in many instances this is much below the actual result.

The Bhoopiah Channel is an instance in this division, and there are several in the fifth division. The Bhoopiah has cost 5,600 rupees before this year, and the increase in the revenue of the talook was, as before stated, 28,000 rupees a year. If some systematic arrangement had been made to secure the early and regular repair of irrigation works, similar to what is done in the case of Government buildings, the diminution of the revenue of the country would never have taken place, and it seems unaccountable that the one should have been accounted less worthy of attention than the other. Every individual building is kept in order, and nobody ever hears of one tumbling down from want of constant petty repairs; but in the case of irrigation works the superintendence is so utterly inadequate, that thousands of valuable works have perhaps never yet been seen by a European, and there is no check whatever upon the revenue authorities or civil engineers to secure the regular repair of works. A collector may spend 500 rupees a year for any number of years in his district, when 20,000 would not keep the works in order, without any direct evidence appearing that they are in ruins, but merely the effect is seen in the fall of revenue by a certain number of lacs, and then probably any cause but the true one is assigned for it. Till there is a sufficiency of superintendence to have every individual work regularly examined annually, and repaired when necessary, there can be no security for the revenue, or for the welfare of the people. The present civil engineers, surveyors and maistries are lost in the division; they cannot see one-tenth of the works that ought to be inspected annually. But much more is required now than a more regularly organized department, sufficient to see that the works are kept up; the first thing wanted in every district is to have the works restored generally, and for this a large sum is required in every district.

But

But as I, some years ago, had the honour of laying before the Board a report upon the state of the irrigation generally, in which I gave many statements of the actual results of our management of this most important branch of the revenue department, I need not enter further into the matter now. This case of Rajahmundry, however, I was not at that time particularly informed of; it is the strongest case of any of the districts I am acquainted with.

Vizagapatam,
12 August 1844.

(signed) *A. T. Cotton,*
Captain, Civil Engineer, 1st Division.

To the Secretary, Board of Revenue Department of Public Works.

Sir,

Dated 8 August
1844.

I HAVE the honour to acknowledge the receipt of your letter, No. 439, with the Board's orders to report upon the irrigation of the division; and to send in projects for new works, especially with reference to the Godavery. You will have seen that I had so far anticipated the Board's orders as to have sent in a first report on the Godavery.

In that I have pointed out the necessity of sending great additional help to enable me even to prepare proper reports and estimates for Rajahmundry alone; the Board now call for reports and projects for the whole of these districts. I beg respectfully to express my conviction of the utter impossibility of doing anything worth mentioning with my present department, even in conducting the ordinary business of the division, much less in examining the various rivers, to ascertain the best mode of making use of them. The assistant appointed has been ordered to take charge of those works at Vizagapatam; but even if wholly freed from that charge, he could do little at first towards the present objects, being newly arrived, and without any knowledge of irrigation. There is only one instrument belonging to the division, and the senior of the two sub-assistant surveyors has just written from Rajahmundry to say that he cannot adjust it, and can do nothing in consequence, and I have no means of supplying him with another. This is the present state of a department in charge of works, upon which about 20 lacs of rupees of revenue depend, and upon which there ought to be a revenue of double the amount depending, and where every thing is in such a state of ruin that a most decided effort is required to restore the districts to prosperity. The loss of revenue in this division arising from the state of the irrigation cannot be reckoned at less than 12 lacs a year; it is in fact a great deal more. Supposing that we were properly supplied with instruments, as I hope we soon shall be, what an immense loss of time must be incurred, if the required surveys, levels, &c. are to be made with the present department? That may be done with these means in five years very imperfectly, which might be efficiently performed in one; and for every month's delay at least a lac of rupees is to be paid.

I do not hesitate most earnestly to recommend to the Board's consideration the increase of the department as follows:—

Two First Assistants; Two Second Assistants; Two Assistant-surveyors;
Four Non-commissioned Officers of Sappers as Surveyors; Four Writers
for the Assistants; Two Maistries for the Assistants; Twenty-six Lascars
for the Officers, &c.

One of the Assistants to be placed in charge of each of two districts, while the plans and projects are preparing in the third, that the Civil Engineer may for a time give his exclusive attention to the works to be proposed for that district. The cost of this addition would be about 2,000 rupees a month, or 24,000 rupees a year, and that of the whole department about 3,200 rupees a month, or 38,400 rupees a year. Surely this is the very least that could be allowed for the purpose of hastening the restoration of a revenue of 12 lacs a year; how much wiser would it be rather to double this addition than to lose a single month, where such a sum as 12 lacs is annually thrown away, solely for want of a sufficient superintendence? If it is said that the Treasury cannot bear the outlay of these thousands, there is
of

of course no alternative but for it to continue to bear the loss of lacs instead. This is certain, that unless the irrigation is restored, these losses must continue to be sustained; and, moreover, greater ones every succeeding year; and the irrigation cannot be restored without this additional superintendence. Even the current business of the division requires that such a department as this should be permanently appointed to it, to put the present works in good order, but if necessary, the whole of this addition may be considered as extra, and entered in the estimates for the new works. A sum of 10,000 rupees might be at once sanctioned to provide for the preparation of plans and estimates, which might be afterwards included in the estimates themselves. It is very necessary that the assistants and surveyors should be amply provided with instruments, and also with writers, &c. Nothing can be worse economy than to employ a man on 100 or 500 rupees a month, in doing what could be done by one on 15 or 20, excepting the having the surveyors paralysed, because the only instrument there is in the division has got out of order. I would also beg to recommend that the assistants in charge of districts should correspond direct with the Board, merely transmitting all papers through the civil engineer, in order that in any extraordinary case he may give his opinion. He would thus be able to give undivided attention to the very important projects which will be before him.

I trust the Board will allow the necessity there is for thus hastening the preparation of plans and estimates, and also of endeavouring, as far as possible, to secure the thorough investigation of this important subject. If a public work in England, on which 300,000*l.* a year depended, were under construction, it would be thought a small thing to appropriate 10,000*l.* to the preparation of estimates, surveys, superintendence, &c. It must be remembered that in respect of returns these irrigation works stand alone; nothing can be compared to them. In public works and private speculations in general, a return of eight or ten per cent. is considered very encouraging; but in these works the returns are generally 100, 200, and even 300 per cent. in direct revenue, besides indirect revenue to Government, and the profit to the people. In the Bhoopiah, an outlay of 6,000 rupees restored a revenue of 30,000, 500 per cent., and in Tanjore the increase of produce from the construction of the annicuts was, when I last heard, worth about eight lacs a year, from an expenditure of about three lacs. In the two southern talooks of South Arcot, the revenue, which had gradually fallen from two lacs to 1,08,000 in 1831, was raised again to 3,18,000 in 1839 (and probably it has risen since that), solely by attention to the irrigation. I do not know exactly what the expenditure was during this time, but I believe it was about two lacs, including ordinary repairs, and half the cost of the lower annicut, giving a return of upwards of 100 per cent. for the improvements.

If I am asked whether the preparation of these estimates cannot be prepared with a smaller department, I answer that every one that is taken from it will proportionally delay the restoration of the districts, and every one that should be added to it will tend to hasten it. I am in great hopes that if this addition were made, the estimates might be so forwarded that some serious commencement upon the works themselves might be made this ensuing dry season.

I hope that in so serious a case as this, no smaller matter will be allowed to stand in the way of the appointment of two or three engineer officers to the division; but if so many cannot be found, I am sure very efficient men could be obtained from the line.

(signed) *A. Cotton*, Captain,
Civil Engineer, 1st Division.

Vizagapatam, 22 August 1844.

To the Secretary to the Board of Revenue Department, Public Works.

Sir,

I HAVE the honour to request that the Board will be pleased to obtain for me sanction to expend to the extent of 500 rupees in the course of my present undertaking, which would greatly facilitate my operations. The duty I am employed upon necessarily demands various small expenditures, such as boat's hire, the hire of stone-cutters to examine the country for materials, Cooly hire for the carriage of specimens, rewards for the discovery of materials, such as stone, lime, &c., all of which I have at present to pay for myself. In a district where

where there is scarcely a masonry work of any kind, and probably not one modern work of brick or stone, except the Europeans' houses, it may be supposed that scarcely anything is known of the resources of the district of this kind, and everything requires to be searched for. There will also be many lines of levels to be taken, which will require the jungle to be cut, &c. Even in the 5th division, where many great works both of stone and brick had been executed, both formerly and of late years, the existence of so valuable a material as magnesia was unknown till a few years ago, from which it may be readily supposed how little the resources of this part of the country are known.

I would also beg respectfully to press upon the consideration of the Board how slowly this work must proceed, if no additions are made to the department of the division, and what an enormous loss of revenue is certainly involved in the delay of every month in the restoration of the irrigation of the district.

I have examined the upper part of the Godavery, and have ascertained beyond a doubt that the perfect irrigation of the whole district is the simplest thing in the world, and that nothing is wanted but to ascertain the lines of channels, and to plan the various masonry works. The facilities for leading the water of the Godavery from its bed to the surface of the country are far beyond what I had contemplated, and there is no sort of difficulty in constructing an anicut at a site where it would command the whole delta, about 2,000 square miles, in this district alone.

With such an opening for the improvement of this most valuable tract, I trust that the energetic prosecution of the undertaking will not be delayed for want of a comparatively trifling expenditure in officers, surveyors, &c.

I hope to have the honour of forwarding to the Board a further Report upon the Godavery within a week or ten days.

(signed) *A. Cotton*, Captain,
Civil Engineer, 1st Division.

Rajahmundry District, Camp at Narsipore,
25 October 1844.

To Captain *S. Best*, Secretary to the Board of Revenue in the Department of Public Works.

Sir,

I HAVE the honour to forward, for the information of the Board, copy of letter lately received from the civil engineer of the 6th division, on the subject of the construction of the road over the Hassavoor Ghaut.

2. I have lost no time in making the requisite arrangements for the collection of the Coolies. The working party will probably amount in number to some hundreds, and it is therefore necessary that provision should be made to give profitable and efficient effect to their operations, which can only be looked for in adequate superintendence. With this view, I request that the early sanction of Government may be obtained for the employment of a party of sappers, and a first class instead of a second class dresser, as previously sanctioned, and two goomastahs and a shroff.

3. The Board are aware of the great importance of the Sattimungalum talook in a revenue point of view, and of the impossibility of sparing any of my responsible revenue officials for this duty without detriment to the interests of Government.

4. I would further venture to draw the attention of the Board to the magnitude of this undertaking, and to the local difficulties with which it is invested. I am utterly ignorant of the surveyor's qualifications for the superintendence of such works; in practical experience he may be all that can be desired, but I feel satisfied that official rank, and the prestige and confidence which invariably attends it, is particularly required on occasions where deprivation, difficulty and sickness may be anticipated. I would therefore beg to submit for consideration whether the appointment of a commissioned officer is not also necessary. Mr. Collyer, formerly employed on the Ghaut, was so obliging as to see the workmen paid in his presence, which not only extended his influence, but also had the effect of greatly conciliating, and thereby keeping the people together.

5. These suggestions have occurred to me as necessary, but if viewed to be of a more precautionary character than real, I have only to add that, I will do my utmost to carry out such orders as the Board may finally determine upon.

6. I would take this opportunity of calling attention to the fact that, in last year, not only Lieutenant Collyer, but all his assistants, were attacked with fever at Hassanoor, rendering their absence from the place necessary at different periods; and as there is every reason to suppose that the present surveyor will be equally liable to the same febrile influences, such a contingency should be guarded against; and this, I submit, is also an additional reason for the appointment of augmented European agency.

(signed) *J. C. Wroughton,*
Principal Collector.
Coimbatore, Principal Collector's Office,
31 October 1844.

To *J. C. Wroughton, Esq.,* Principal Collector of Coimbatore.

Sir,

As I expect the early arrival at the station of Revenue Surveyor Meighan, who has been deputed by order of the Board of Revenue from the 7th division to superintend the construction of the Hassanoor Ghaut, I have the honour to request that you will be so good as to issue orders for all necessary preparations to be made for commencing the works by the collecting of work-people, by authorizing advances to be made, and by proper people being sent to the spot for keeping the accounts and paying the labourers, as the duties of Mr. Meighan must necessarily be confined chiefly to directing the work according to the plans and estimates, and seeing that the materials employed in bridges, &c., are of the best quality procurable.

On the arrival of the surveyor, it is my intention to proceed to Hassanoor, and to go over the whole line with him, so as to point out the manner in which the road ought to be made. I should wish also that the Murramut superintendent be present at the same time, should you not otherwise require him, as he possesses considerable local experience, and I was deprived of his services when I last visited the place. I think it possible that the present line in some places is capable of improvement, and as this is certainly desirable, I am anxious to have the assistance of the superintendent, who has already examined a part of the road with this object in view.

(signed) *R. Henderson, Captain,*
Civil Engineer, 6th Division.

Civil Engineer's Office, 6th Division,
Coimbatore, 22 October 1844.

(True copy.)
(signed) *J. C. Wroughton,*
Principal Collector.

To the Secretary to the Board of Revenue in the Department of Public Works.

Sir,

I HAVE the honour to enclose copy of a letter* from the collector of Vizagapatam, calling upon me to examine the irrigation of the newly-purchased estates in that district, together with a copy of my answer. * Dated 1 Nov. 1844.

I beg to bring to the notice of the Board the great importance of my being allowed, if possible, to give my undivided attention to this very important subject which I am now investigating; such a matter as the restoration of the irrigation of this district certainly deserves all the time and strength of several officers; and it is of the greatest importance that, if possible, their attention should not be distracted by other and minor matters at a distance, while planning works on which so much will depend; every month, too, that the works are delayed will be an enormous loss in revenue.

There cannot be a doubt that the district now referred to by the collector of Vizagapatam will require the whole attention of an officer for a considerable time, and amply repay the cost, to say nothing of all the rest of the division.

I would, therefore, earnestly recommend the appointment of an officer of sufficient experience to the charge of the two northern districts, as a temporary arrangement. But as I have before had the honour of communicating with the Board on this subject, I need not say more now than that it will take me two or three years, as I am now circumstanced, to examine this district properly; and that in the meantime I am certain 10 times the amount that additional officers and surveyors would cost will be lost in revenue. The additional information I have obtained since my report on this district has, in the strongest manner, confirmed my opinion of the facilities and advantages of a thorough and systematic reformation of it, in respect of its irrigation and communications, and my conviction that it is most ruinous policy to leave it in its present state longer than can be helped.

I have, &c.

(signed) *A. Cotton,*
Civil Engineer, 1st Division.
Rajahmundry District,
Camp at Narsipoor, 8 November 1844.

To Captain *A. T. Cotton*, Civil Engineer, First Division, Rajahmundry.

Sir,

I HAVE the honour to inform you, that the most Noble the Governor in Council has been pleased to authorize me to purchase the Royaveram proprietary estate, with a view to put an end to the disputes on the subject of irrigation that have so long existed between the ryots of that estate and those of the Survasiddy talook.

I have also purchased four other adjoining proprietary estates, and I have formed the whole into one talook.

It is of much importance that the disputes above referred to should be at once set at rest; and that any works which it may be necessary to construct for that purpose should be commenced upon without loss of time. It is also very desirable that works of irrigation generally throughout the talook should be inspected, and estimates for any repairs or improvements prepared.

I am well assured that I may calculate on your co-operation in this work; and I should be extremely glad if you could visit the talook, at any time that you have leisure.

My principal assistant would meet you on the spot, and afford you all the assistance and information in his power.

I have, &c.

(signed) *W. N. Arbuthnot,*
Collector.
Vizagapatam, Collector's Cutcherry,
1 November 1844.

To the Collector of Vizagapatam.

Sir,

*Dated 1 Nov. 1844.

I HAVE the honour to acknowledge the receipt of your letter,* on the subject of the irrigation of the newly-purchased estates in your district; and, in reply, I regret to state that the work I am at present employed on, the examination of the district, with a view to the improvement of the Godavery irrigation, calls for my undivided attention, and will do so for a long time to come, so that I could not take up the subject you have brought before me without postponing this most important work, to which my attention has been especially directed by the Board. I might give up a few days to inquire into the disputes you mention, if they could be settled in a moderate time; but the proper examination of the new talook would require, probably, much more time than it appears desirable to give up to it, when the importance of my present object is considered.

I have before requested further assistance in my department, but have yet received no communication on the subject. I will now forward a copy of your letter to the Board, and request that, if possible, additional officers may be appointed to the division.

I expect

I expect to be at Vizagapatam in about a month, and I could then meet your assistant, and inquire on the spot into the disputes in question, so far, at least, as to ascertain whether their adjustment would occupy much time.

I have, &c.

(signed) A. T. Cotton, Captain,
Rajahmundry, Camp at Narsipoor, Civil Engineer, 1st Division.
8 November 1844.

(True copies.)

(signed) A. Cotton, Captain,
Civil Engineer, 1st Division.

(A true copy.)

(signed) R. G. Clarke,
D^r Sec^y to Gov^t.

SECOND REPORT on the Delta of the GODAVERY.

1. THE First Report on the irrigation, &c. of this tract pointed out the neglected state of the district, its destitution in respect to those artificial works which are absolutely necessary to develop the vast capabilities of these rich, alluvial lands, and the consequences of such neglect in comparison with the results of a liberal system of improvement, as shown in the delta of the Cauvery. It required neither time nor attention to discover so far what was required for this important district. What it wanted was only what every delta requires, and without which such tracts, with all their prodigious natural advantages, are subject to more dreadful evils than many less fertile districts. If such countries are left to the mercy of the great river that flows through them, the water at one time many feet above the surface of the land, and at another, 20 or 30 feet below them, in one month during a certain crop deluged with rain and river floods combined, and before that crop is cut (if any of it escapes) exposed to a perfect drought, an impoverished people and empty treasury are the inevitable consequences. The question, therefore, is merely how the necessary works may be most economically and effectually carried out. It is rather the question how a man may be best clothed and fed, than whether he needs clothing and food. On my return to the district, therefore, after the monsoon, I proceeded to the examination of the river and the lands, in respect to their levels, the rise and fall of the water, &c., the first and fundamental point to be ascertained being the proper site and cost of an annicut. It must be acknowledged that, before looking closely into the subject, this appeared to be a formidable undertaking, in consequence of the great depth and breadth of the river, both so much exceeding those of the Cauvery and the Colleroon, the rivers which I had been accustomed to; and the idea of building a dam across a river where it is more than seven times the greatest width of the Mississippi might very naturally seem a doubtful project. This case is, however, a remarkable instance of the vast difference there may be between the distant superficial view of an object, and that which we may obtain by an actual examination of it. Upon a careful survey of the river, I find that not only is such a work as an annicut practicable, simple and easy, but that such are the extraordinary natural facilities for its construction at the site where it could be most beneficially constructed, that its cost, in comparison both of its great extent and the vast effects which it is calculated to produce, would be really very moderate. I here propose only so far to touch upon the subject of the levels of the river as may be necessary for the explanation of the subject in a general way.

2. The Godavery, rising near Bombay, passes for several hundred miles through an open country, watered chiefly by the south-west monsoon. About 200 miles from the sea it enters the hill tract that runs at the back of the Northern Circars, and at 60 miles from the sea it enters the alluvial country which it has itself formed. It seems very remarkable that in passing through the great barrier of hills (I find from information which seems to me conclusive) it has so effectually made its way that there are no falls throughout the whole length of its channels, nor indeed any obstructions of consequence. Such is the statement

of the boatmen who navigate the river, and it seems to be completely confirmed by the fact that the timber rafts never come down from the Hyderabad country, except when the river is almost at its lowest, and has not more than two or three feet of water at the fords in the low country. The alluvial land does not immediately expand to a great width from the point at which the river leaves the main range, there being still rising grounds and detached patches of hills at a distance of from half to five miles from the river for the distance of 23 miles further, at the end of which distance two or three detached hills come close to it. The river divides into two streams; the alluvial country spreads out on both sides, and the delta may properly be said to commence, extending on the west side till it meets that of the Kistnah at the Colair Lake, about 40 miles, and on the east side about 32 miles to the shore of Coringa Bay, where the coast runs for some distance nearly north and south.

3. With the line of the hills the river has, I conclude from the above-mentioned fact, a very moderate fall, and I saw that such was the case for some distance within. From the hills, where the alluvial land immediately adjoining the river is 80 feet above the level of the sea at high water spring tides, it has a most regular slope, commencing with a foot and a half per mile, and gradually diminishing to one foot as it approaches the sea. The rise and fall of the river there is 38 feet, and as the rise of the river is reduced to nothing at the sea, it follows that the summer surface of the river must have a less fall than that of its banks to that extent, viz., 38 feet; so that at Palaveram, where it leaves the hills, the summer level is only 42 feet above high water, and the bed at the ford there only 38 feet; but the fall of the bed, or even of the summer surface of the river, is by no means regular like that of the surface of the floods and that of the land. Between the fords there are deep hollows; one I measured was 30 feet deep in summer, another 28 feet; and in one place I found a slope of nine feet in three miles in the summer surface of the water; in another only one and a half foot in four miles. The average from the hills to the sea is seven and a half inches per mile at the head of the delta; the bed at the ford is 22 feet above the sea; and the distance being 38 miles in a direct line, the average fall measured in that way is seven inches a mile, but if the actual length of the river, viz., 60 miles is taken, it is only five and a quarter inches.

4. Besides the slope of the land towards the sea in a delta, it has another slope, viz., a fall from the river in a direction perpendicular in its course, and this fall is much more rapid than that towards the sea. In the present case it has been ascertained to be in one place, viz., soon after the river leaves the hills, 18 feet in one and a half mile to where it meets the adjacent hills on the east side. In another on the west side, about four miles from the hills, eight feet in three-quarters of a mile. Near the head of the delta, 18 feet in two miles on the west, and seven feet in two and a half miles on the east side; 13 miles further down, that is, 25 miles from the sea, the fall is nine feet in two and a half miles on the west side of the west Godavery. Thus the river banks form a ridge from 18 to seven feet above the level of the land at the distance of from three-quarters to two and a half miles distant on either side, providing most remarkably for the leading out of the water upon the lands. The slope of the country towards the sea at the foot of this ridge is uniformly one foot one inch per mile on the west side all the way from near the hills. On the last side, the distance being shorter to the Bay of Corinja, the fall is one and a quarter foot per mile from near the head of the delta, where the Dowlaisweram Hill closes on the bank of the river.

5. The upper part of the great mass of the delta land is under 30 feet above high water; hence there is comparatively little to be gained by having the top of the annicut more than two or three feet above that level. Further, the slope of the bed being quite irregular, while the slope of the banks is perfectly regular, it follows that the rise and fall of the river, or its depth in the high freshes, varies considerably at different places, besides that, on an average it diminishes all the way to the sea. Thus, at Palaveram, its rise and fall is 38 feet; at Rajahmundry, 20 miles lower, it is about 31 feet; at the head of the delta, four miles lower, only 27 feet; at the head of the Bhoopiah Channel, 11 miles further down, 27 feet. The level of the land on the banks generally is about two feet below that of the highest floods that have occurred in this country.

6. Thus the apparently formidable operation of bringing the water from the bed of a river more than 40 feet deep (as it is at Palaveram) to the surface of the lands

lands is, upon an examination of the levels, reduced to this, that the highest part of the delta is only eight or ten feet above the bed of the river in its immediate neighbourhood, that is, within two miles of it; and that if an annicut be built 11 feet high above the deep channel of the river, the deepest excavation for the irrigating channels will be only 18 feet, and within two miles the country on the west side would be below the level of the top of the annicut. On the east side the lands would be the same level within about four miles. The apparent objection arising from the great depth of the river is thus completely disposed of. The breadth of the river varies from about 2,000 yards, or one mile and one furlong, to 6,000 yards, or nearly three and a half miles, which latter breadth, however, includes islands to the extent of about 1,000 or 1,500 yards. This great breadth cannot be avoided, but there are everywhere great facilities for constructing an annicut, from the nearness of the hills containing good stone and lime; and especially, at the head of the delta, there is a hill of a most suitable kind of stone, and hydraulic limestone of excellent quality in abundance in the immediate neighbourhood. From these advantages, and the low price of labour in the district, a vast mass of masonry may be executed for a moderate sum. The difficulties to be encountered in building an annicut in an alluvial country are no more than what we have always met with in Tanjore; while, on the other hand, we have a great advantage here in a much lower velocity of water, the fall at the head of the delta of the Cauvery being three and a half feet per mile, and in the Godavery only one and a quarter foot, which will make a very important difference in the power of the water to injure such a work.

7. Having thus taken a general view of the water of the river, and the facilities it offers for works to lead off its waters to the lands, we may consider the extent, quality and present state of the lands to be watered. The delta of the Godavery extends from Samulcottah on the east, to the Colair Lake on the west, where it meets that of the Kistnah. This whole tract, with the exception of a steep of sandy land bordering on the sea, is one noble expanse of rich alluvial land, fit for almost any cultivation, if supplied with water, and decidedly richer, on an average, than Tanjore. It contains as follows:

East of the Godavery	- - - - -	450 square miles.
Between the two main branches	- - - - -	550 "
West of Godavery and within Rajahmundry district	- - - - -	700 "
Ditto in the Masulipatam district, as far as the Colair Lake	- - - - -	300 "
TOTAL		- - 2,000 " or,
		Acres 1,300,000

and deducting one-fourth of this for sandy tracts near the sea, sites of villages, channels of rivers, &c., there remain 1,000,000 acres of land fit for cultivation with paddy or sugar. For this there is an ample supply of water in the Godavery, on an average of the last three years for 120 days in the year, when it stands not less than $5\frac{1}{2}$ feet on the Rajahmundry standard, that is, during the months of July, August, September and October, without a day's intermission, which is sufficient time fully to secure the rice crop. I have not been able to ascertain correctly the supply of water during the summer, but from what information I can obtain, I think there must be considerably more than enough to supply 100,000 acres of sugar. Besides the extent of land above mentioned, the waters will be conveyed to the Colair Lake, the bed of which, and all the land bordering on it, about 500 square miles, would thus be watered. Indeed, there is no reason why the water should not be led all the way to the Kistna, the channel terminating on that river at 15 feet above the high water, which would allow a fall of three inches per mile from the Godavery, and include a breadth of about 20 miles between it and the sea at Masulipatam. A further extent of about 500 square miles would thus be brought under the annicut, making a total of at least 3,000 square miles. The quantity of water in the highest freshes of the Godavery, I calculate to be 90 times as much as would be required for the whole of this tract, and there would be abundantly sufficient for a rice crop every year for such a length of time as would secure it completely.

8. We thus easily establish these three fundamental points : 1st. That there is an ample supply of water for a rice crop in all the land forming the delta of the Godavery, and as far as the Kistna also, and there is certainly water enough in the river for a very large extent of cultivation, probably not less than 100,000 acres, all through the dry season. 2d. That there is a vast extent of rich alluvial land, not less than 820,000 acres, within the district of Rajahmundry, and nearly as much at Masulipatam, taking in the whole tract, as far as the Kistna, to which the water may be applied. 3d. That by means of an annicut of a very moderate height, and main channels only, two or four miles in length, the last drop of water in the river may be brought to the surface of the country at a level which will command the whole of the above-mentioned tract. 4th. We may consider, also, the practicability of the construction of an annicut (omitting for the present the question of its cost), fully established by the same thing having been already effected in similar instances in the two Colleroon annicuts, the difference of such a work standing being decidedly in favour of the Godavery, viz., the velocity of the river being only about three-fourths of that of the Colleroon at its head, which more than compensates for the greater height that is above proposed for this work, the Colleroon annicuts having been only six and a half and eight feet high.

9. There seems no possible room for doubt on these fundamental points, and we may therefore proceed at once to consider the remaining questions, which appear to me, first, whether any evil can arise out of such a work as a dam across the Godavery; and secondly, what the cost and returns would be.

10. The annicut will be situated similarly to the lower Colleroon annicut, extending quite across the river. Its only effect, therefore, must be to raise the water in the river above it; but it will not raise it to the same extent, owing to the very low velocity of the river. If it be built at the site I propose, and 11 feet high above the deep channel of the river, it will close up about two-sevenths of the whole water-way of the river in high floods, which in so low a velocity as three and a half miles per hour would scarcely cause a perceptible elevation of the surface of the water above it.

11. When the water in the channel of the river is low, the annicut is just level with the top of that work; I calculate that the upper water will be raised to about one and a half foot above the crown, and this difference of level between the water above and that below the work must of course diminish as the river rises; and in severe floods, the difference of level will be reduced to two inches. With respect to its effect on the bed of the river, the ordinary effect of such works is of course to raise the lands on the upper side, and to produce deep excavations on the lower. The former is a very serious evil, and unless counteracted, the tendency will be to fill the irrigation channels with sand. The principal means proposed to prevent this is the construction of six ranges of under-sluiques, of 40 vents each; their floods level with the apron of the annicut, and eight feet below its crown. Four of these to be placed near the heads of the irrigating channels, and the whole of them left open whenever there is water in the river to spare. The influx of sand into the channels will be further checked by leading them off at right angles with the river, and as much out of the set of its current as possible, and also by making the heads of the channels capacious, so that the water may enter them with too low a velocity to carry much sand with it. The other effect of the excavation of deep pools below the works affects only the stability of the work itself. The operation is greatly checked by the section given to the work, similar to those in the Colleroon, by making the body of the work nearly perpendicular on the lower side, and laying an apron sufficiently strong to bear the over-fall of the water; its force is so greatly broken that but little effect is produced in the bed of the river below, and the remainder is counteracted by an ample apron of loose stones of large size beyond the solid apron, which must always be the grand protection of such works as sluices and annicuts, in a delta where there is nothing more solid than sand around and beneath the works.

12. The annicut will certainly have an important effect in one respect, viz., in obstructing the navigation of the river in the low freshes, and the extent of the navigation is very considerable.

13. This difficulty is provided for in two ways; first, the irrigating channels will all be also navigable, and will form an internal water-communication of the most

most complete kind, intersecting the whole country, and entirely free from the serious drawbacks to the present communication by the river, viz., the sand-banks, want of towing-paths, heavy ripples, and in the dry season shallowness of water, besides many others. The main channels will have water in them the whole year round, and there will, indeed, be nothing wanting to make them effective lines of navigation. But, at the same time, for boats and timber that may be required to pass down or up the river, when there is neither so much water as to allow of their passing over the annicut, nor so little as to prevent their navigating the river, locks are proposed to be constructed at the heads of the irrigating channels, to pass vessels round the annicut.

14. The main question now remains to be considered, viz., whether the cost of the works will be repaid in their effect upon the district? The estimate for the works now proposed, viz., an annicut, the head sluices for two main irrigating channels, viz., one on the west side of the river, and one at the head of the central tract (the upper part of which is called the Rallee Estate), locks at each end for passing boats round the annicut, and those for carrying them past the head sluices into the irrigating channels (which is all that is included in the present estimate), amounts to rupees—

	Rs.	a.	p.
Annicut, with six set of 40 under sluice	3,88,004	2	-
Five locks - - - - -	18,419	8	-
Two head sluices - - - - -	13,148	8	-
Excavations - - - - -	14,000	-	-
Superintendence - - - - -	12,000	-	-
Contingencies, &c. - - - - -	30,000	-	-
TOTAL - -	4,75,572	-	-

This sum is very small, whether the magnitude of the work or that of the expected results is considered. The length of the annicut will be 4,200 yards; and it will be seen by the plans, that I propose to build it on a substantial and permanent plan, so as to be nearly independent of periodical repairs. The extraordinary advantages of the site will enable us to execute the work at a moderate cost. There is a hill of coarse strong sand-stone close to the spot. This stone is of a degree of hardness exactly suited to the case; neither too hard to be expensive in working, nor yet soft enough to be unfit for the purpose. There are also several hundred thousand tons of broken stone, the accumulation of ages from former quarryings, which will exactly suit for rubble work; all this latter material, therefore, will cost nothing but the carriage, and it is within 800 yards of the end of the annicut. As if everything should concur to facilitate the work, we have further, in the immediate neighbourhood, abundance of first-rate hydraulic limestone. There is also teak to be had in any quantity, and of excellent quality, at about ten annas per cubic foot, including carpentering for the lock and sluice-gates. The cost of the masonry work, omitting the carriage, I have estimated at the rate at which it can be executed at present; but there is every reason to believe, that on a large scale, and under European superintendence, the cost of every part of the operations may be considerably reduced. This part of the country is nearly without masonry works of any description, so that the natives are far behind those of the southern districts in all their modes of executing them; for instance, they burn their lime in heaps on the open ground, not even rising a kiln of any kind. In such a state of things it is not to be supposed that under European superintendence the cost cannot be diminished. For the carriage of materials I propose to use rails, as I have done with such good results in the execution of the bulwark at Vizagapatam, even though nothing but wood was used with wooden wheels to the waggons.

15. Taking the cost at 4 ½ lacs of rupees, we ought to consider that if there be a fair prospect of a return of 30 per cent., or 1,42,500 rupees in direct revenue, besides the benefits to be derived by the inhabitants, there is more than ample ground to justify the construction of the works. One-third of this would be considered most abundant in England; and if it yielded only 5 per cent., or 23,750 rupees, it would pay the Indian interest of the cost, and the benefits obtained by the ryots would be a clear advantage.

16. The results of the annicut may be properly divided into two heads; viz., 1st. The ultimate results, when by means of additional channels of irrigation, drainage, &c. &c., the water is led to the whole of the lands commanded by the annicut; and, 2d. The immediate results of the works now estimated for throwing water into the present channels, which will probably be realized to a great extent in the first year.

1st. We are to examine into the probable ultimate effects of the annicut. It is evident that, as the crown of that work will command the whole delta, there can be no possible reason why every acre of it should not be perfectly irrigated for one crop, that is, during the four months the freshes continue; and that all the best lands, to the extent that the Godavery can supply water, may be irrigated all the year round. We have therefore to consider the extent and present produce of these lands. The water from the annicut may of course be conveyed all the way to the Kistna; and it must necessarily affect all the country below the Colair Lake; but it does not seem necessary here for me to go beyond the part of the delta lying in Rajahmundry.

The following is a statement of the extent of revenue, &c. of these lands:

DELTA.		Square Miles.	Acres.
Total extent of land in Rajahmundry	- - - - -	1,700, or	1,088,000
Deduct, on account of sundry tracts, channels, roads, sites of villages, &c. 1-4th	- - - - -	-	272,000
Remaining cultivable land	- - - - -	Acres - -	816,000
or pooties, at 8 acres to the pooty	- - - - -	-	102,000
Ditto - 10 - ditto	- - - - -	-	81,600

The real measurement of the pooty is 8 acres; but from the inquiries I have made, it seems certain that, on an average, the pooty, as entered in the village accounts, really contains about $1\frac{1}{4}$ pooty, or 10 acres. I gather that the quantity of uncultivable land cannot exceed one-fourth of the whole, from the following returns of the contents of a large portion of the delta, taken from the village accounts.

Gross extent of land	- - - - -	12,583
Cultivable land in the same village	- - - - -	9,878
Uncultivable land, being about 1-5th of the whole	- - - - -	2,705

As no portion of the bed of the Godavery is included in these returns, the average of the whole of the delta to be deducted for waste must rather exceed the proportion of 1-5th, but can scarcely be so much as 1-4th.

The total permanent assessment on these lands is as follows:

Peshcush of the villages now in the hands of zemindars and proprietors	- - - - -	Rs. 1,30,000
Ditto, of villages under Government management	- 4,37,000	-
Permanent assessment of Government villages	- - 7,23,000	-
		11,60,000
TOTAL	- - -	12,90,000

In order to ascertain what is the actual average assessment per pooty throughout the delta, we must calculate what would be the total revenue of the whole, if all the lands were assessed on the same principle, for the zemindaries are reckoned to pay as peshcush only two-thirds of the permanent assessment, and there is a vast extent of manniems, or rent-free lands. I have not obtained returns

returns of the whole of the latter; but the proportion they bear to the other lands may be taken from the following statement:

	Pooties.
Total cultivable lands in Nagaram, Woody and parts of Amlapoor Talook	17,248
Manniems in some villages, being about 3-5ths of the taxed land, or 3-7ths of the whole	6,457
Remaining	10,791

2d. We may from these data thus estimate the revenue of the whole delta, if all the lands were assessed:

	Ru.
Peshcush of zemindaries	1,30,000
Add for proprietor's share, one-half	65,000
Lands in the hands of Government	1,95,000
Add of manniems 3-5ths	11,60,000
	13,55,000
	8,13,000
	21,68,000

Taking the whole cultivable lands at 81,600 pooties (reckoning 10 acres to the pooty), we have an average of 26½ rupees a pooty; this is in some degree supported by the returns of a portion of the delta which I have obtained; viz., 6 Lands paying tax in Nagaram Talook, 14,116 pooties; permanent assessment on the same, 4,59,000 rupees, being at the rate of 32½ rupees per pooty.

These lands being situated in one of the richest talooks of the delta is probably the reason why the average assessment per pooty is higher than that calculated above for the whole delta; but it is very possible that I have rather underrated the average extent of the pooty, as entered in the village accounts, at 10 acres.

I find from the revenue returns, that the collections of late years may be taken at about 30 per cent. below the permanent assessment; allowing for which, the collection per pooty will be—

Rate per pooty above calculated	- - - 26½ rupees.
Deduct 30 per cent.	- - - 8
Average collection per pooty	- - - 18½ rupees.

From this average rate of collection, we may obtain an approximation to the present value of the gross produce of the delta. From what I have seen of the state of the people, and the inquiries that I have made, I do not think it can much exceed double the collections; and probably, including the years of extensive failures, will scarcely amounts to that. Taking this rate, however, the calculation will be—

81,600 pooties, at 18½ rupees	- - 15,10,000 rupees.
Gross value of produce	- - - 30,20,000 "

To enable us to see distinctly how paltry this revenue and produce are for such a tract of country, we may compare it, first, with the known produce of fair land, when nothing particular occurs to injure the crop; secondly, we may compare it with the actual revenue and produce of the delta of the Cauvery; and thirdly, we may consider what capabilities this district has beyond that tract. The above value of produce, 37 rupees per pooty, is the price of about 3½ candies of paddy at present, a candy of grain being about 1,200 lbs. Now a pooty of fair land, if well watered, will produce on an average not less than 10 candies of paddy, which, at 10 rupees, gives 100 rupees as the value of the rice crop; to this may be added about 20 rupees for second crop of grain, oil, seeds, &c., making together 120 rupees, or 12 rupees per acre.

If grain only were grown, the produce of the delta would thus be—

	Rs.
81,800 pooties, at 120 rupees - - - - -	97,92,000
Present produce - - - - -	30,20,000
	<hr/>
Deficiency of present produce - - - - -	67,72,000

That this calculation is not mere speculation is manifestly shown by the actual produce and revenue of Tanjore. The rice produce of a pooty of 10 acres is, by the return of the whole of that district on an average of 60,000 pooties, 12 candies of grain, or one-fifth more than I have estimated above, being, at 10 rupees per pooty of land, 120 rupees. The total net land of Tanjore is now, I understand, about 112,000 vaylies, or 747,000 acres, equal to 74,700 pooties, and the value of rice produce is about 85,00,000 rupees, to which, if the other produce (viz. that of gardens, &c.) is added about 10 lacs, it makes a total of 95,00,000; and as the returns are made in such a manner as to be rather under the true produce, there can be no doubt that a crore of rupees is annually produced in that part of the delta of the Cauvery which lies within Tanjore (besides the produce of rent-free lands); including both rice and garden cultivation, there are about 123,000 vaylies, or 820,000 acres, or 82,000 pooties, just equal to the extent of cultivable land in the delta within the limits of Rajahmundry.

	Rs.
Estimated gross produce of 82,000 pooties in Tanjore -	1,00,00,000
Ditto of 81,800 ditto in Rajahmundry - - - - -	30,00,000
	<hr/>
Difference - - - - -	70,60,000
	<hr/>
Collection of land revenue of 82,000 ditto in Tanjore -	36,00,000
Ditto, ditto, 81,800 ditto in Rajahmundry, supposing the whole were assessed according to permanent settlement	15,00,000
	<hr/>
Difference - - - - -	20,90,000
	<hr/>
Land revenue of delta of Tanjore - - - - -	36,00,000
Ditto at present collected in delta of Rajahmundry -	9,40,000
	<hr/>
Difference - - - - -	26,60,000
	<hr/>
Deduct on account of zemindaries' share, being one-half of 1,30,000 - - - - -	65,000
Ditto on account of maniams, three-fifths of amount of present collections; - - - - -	5,60,000
	<hr/>
	6,25,000
	<hr/>
Difference of collections in same extent of land in Tanjore and Rajahmundry - - - - -	20,35,000

17. In the last calculation I deduct the proportion of tax that would be paid by zemindars and maniams if they paid equally with the Government lands, because in the statement for Tanjore, only lands actually paying tax are included.

18. The last sum, viz., 20,35,000 rupees, shows the real difference in the collections on the same extent of delta land in the two districts, from which it appears that if Rajahmundry were as well managed as Tanjore, it ought now to be yielding in land revenue, 29,75,000 rupees (the delta alone), instead of 9,40,000, or about three times as much as it does now. This, however, supposes that Rajahmundry has no advantages over Tanjore, whereas it is superior to it in two most important points; viz., 1st. The land is on an average decidedly superior in quality, there being a very large extent of very inferior land in the heart of Tanjore; and 2d. There is both a much more certain supply of water for the rice crop, and also a large quantity throughout the dry season, which makes the important difference of Rajahmundry being most completely suited for sugar cultivation.

19. Further,

19. Further, not only is the land revenue 20 lacs below what it might be, supposing it could produce nothing but grain, but it appears also from the above calculations that the surplus of produce above the revenues is, in Tanjore, 67 lacs, while in Rajahmundry, it is only 20½ lacs, showing the prodigious difference in the circumstances of the people. This is also clearly shown by the amount of extra revenue in the two districts, that of Tanjore being 10½ lacs of which about seven-eighths probably is paid by the delta, or nine lacs, and that for Rajahmundry, five lacs, of which probably two-thirds is paid by the delta, or 3,30,000 rupees. This difference of extra revenue, 5½ lacs, should be added to the difference of land revenue before given; viz., 20,35,000, showing a total difference of near 26 lacs in the whole collections of an equal extent of country in the two deltas, notwithstanding the prodigious natural advantages that Rajahmundry possesses.

20. It is impossible that any case could be more simple or more clearly proved than this is, by this comparison with another district similarly circumstanced. Why does one tract of equal extent, superior soil, far better supplied with water (having also a most invaluable port and teak timber trade, which the other has not), pay 22 lacs less than the other? The real cause of the difference is, that in the one, the peculiar natural advantages have been secured by a wise and liberal system of management in respect of its irrigation and communications, and in the other, even what has been done by the native government has been allowed to go to ruin.

21. But the most important feature by far in the matter has yet to be considered, viz., the advantages of the district for sugar cultivation. Though I have before, in a separate paper, brought this subject to the notice of the Board, I have thought it necessary, on account of its great importance, to add a memorandum in the Appendix to this Report, which is in substance the same as that before sent in, but containing some additional information which I have since obtained. I will here add only the leading points in the question, that I may not extend this Report to too great a length. Under the following advantages it seems that these districts must be superior to every other tract in the world for this cultivation.

- 1st. The cane thrives remarkably.
- 2d. There is a constant and certain supply of water wholly independent of local rains.
- 3d. Labour costs about one anna, or 1½ d. per day, and there is abundance of it.
- 4th. All kinds of materials are proportionably cheap.
- 5th. The district lies on the coast, so that there is very little inland carriage to be paid for, and that chiefly water carriage, and there is an open port protected from all winds.

22. Let these circumstances be compared with that of other countries from which sugar is at present obtained, especially the West Indies and Mauritius, and there appears no room for doubt that it can be grown here for a trifling price compared with what it costs elsewhere; and the actual results of the manufacture, upon the European plan, which has now been fairly tried for more than a year, fully confirms the expectations that may be formed from the peculiarly favourable circumstances of the district.

The following is the calculation made from what has been effected up to this time:

	Rs.
Cost of 10 candies (5,000 lbs.) of jaghery, at the present price, 10 rupees per candy	100
Carriage to sugar works, &c.	20
Manufacture	10
	130
Deduct value of rum manufactured from the same	80
	50

28 REPORTS ON THE IRRIGATION OF RAJAHMUNDRY

If grain only were grown, the produce of the delta would thus be—

	Rs.
81,600 pooties, at 120 rupees - - - -	97,92,000
Present produce - - - -	30,20,000
Deficiency of present produce - - - -	67,72,000

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Estimated gross produce of 82,000 pooties in Tanjore	1,00,00,000
Ditto of 81,600 ditto in Rajahmundry	30,00,000
Difference	70,00,000
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Ditto at present collected in delta of Rajahmundry	9,40,000
Difference	26,60,000
Deduct on account of zemindaries' share, being one-half of 1,30,000	65,000
Ditto on account of maniemis, three-fifths of amount of present collections]	5,60,000
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- 1st. The cane thrives remarkably.
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- 3d. Labour costs about one anna, or 1½ d. per day, and there is abundance of it.
- 4th. All kinds of materials are proportionably cheap.
- 5th. The district lies on the coast, so that there is very little inland carriage to be paid for, and that chiefly water carriage, and there is an open port protected from all winds.

22. Let these circumstances be compared with that of other countries from which sugar is at present obtained, especially the West Indies and Mauritius, and there appears no room for doubt that it can be grown here for a trifling price compared with what it costs elsewhere; and the actual results of the manufacture, upon the European plan, which has now been fairly tried for more than a year, fully confirms the expectations that may be formed from the peculiarly favourable circumstances of the district.

The following is the calculation made from what has been effected up to this time:

	Ru.
Cost of 10 candies (5,000 lbs.) of jaghery, at the present price, 10 rupees per candy	100
Carriage to sugar works, &c.	20
Manufacture	10
	130
Deduct value of rum manufactured from the same	80
	50

	Rs.
Cost per ton when shipped	50 or 5 <i>l.</i> per ton.
Freight and merchant's charges	80
Duty	250
	<hr/>
Cost per ton in London	380 or 38 <i>l.</i> per ton.
Present value of such sugar in London.	60 <i>l.</i> per ton.
	<hr/>
Profit	22 <i>l.</i> per ton.

23. From what I can learn of the culture of the cane here, I conclude that the present price of ten rupees per candy affords a good profit to the grower, and that at this rate there will be a rapid extension of the cultivation, now that there is a certain demand for it in consequence of the establishment of sugar works by the European mercantile houses. It seems impossible but that under such immense advantages the whole of the lands that can be supplied with water throughout the year should within a very few years be cultivated for sugar. I have not been long enough in the district to ascertain with certainty what supply of water from the Godavery can be depended upon in the dry season, but from the present state of the river, and such information as I have obtained, I have hopes that at least 100,000 acres may be supplied, and probably much more. This at the present rate of produce would afford 10,00,000 candies; the export cost of which, converted into sugar, would be (including the spirits obtained) 1,30,00,000 rupees, and as this does not allow for the effect of the substitution of the Mauritius cane (which is thoroughly approved of by the natives) for a more ample supply of water and the aid of European example and advice in the culture, we may be confident that in a few years the produce per acre will much exceed what it now is.

24. When the sugar cultivation is thus extended, the produce of the delta may be estimated as follows :

10,000 pooties (or 100,000 acres) of sugar, at 1,000 rupees	100 lacs.
71,000 pooties (or 710,000 acres) of paddy, at 120 rupees	85 "
	<hr/>
TOTAL	185 "
Present produce	30 "
	<hr/>
Increased value of gross produce	155 "

25. There is also this peculiar advantage of the sugar cultivation, that it affords the simplest means of obtaining an ample return to Government for the outlay incurred in irrigating the delta. The lands at present under sugar in the delta are watered by the pecottah at an expense of from 20 to 30 rupees per acre, or 2 or 3 rupees per candy of jaghery, 200 to 300 rupees per pooty of land, an expense which is incurred in addition to about 80 rupees a pooty for land-tax, making a total for these two items of from 280 to 380 rupees, or of from 2½ to 3½ rupees per candy of jaghery, ¼ or ⅓ of its total cost to the purchaser.

26. If Government, therefore, were to assess land supplied with water throughout the year at 120 rupees per pooty, it would be an immediate relief to the cultivator of from 140 to 240 rupees per pooty, equal to a reduction of tax on sugar to the extent of from 1*s.* 6*d.* to 2*s.* 3*d.* per cwt., while the revenue would be increased on those lands from about 60 to 120 rupees per pooty, for almost the whole of the lands that would be under sugar are at present cultivated for grain, and do not pay more than 60 rupees. It is certain that such a reduction in the cost of jaghery to the grower would be a vast stimulus to the extension of the cultivation. There might also be a great reduction in the capital required for

for the cultivation ; at present the ryot has to provide about 250 rupees a pooty, equal to $2\frac{1}{2}$ rupees a candy of jaghery for watering this land ; from this he might be relieved entirely, as he might not have to make his payments till after he had cut his crop ; this would greatly hasten the extension of the cultivation, because it would bring it within the means of many without borrowing, who have not sufficient means as things now are. The revenue of the delta might be calculated as follows :

10,000 pooties of sugar, at 120 rupees	- - - -	12 lacs.
71,000 pooties of grain, at 40 rupees	- - - -	28 $\frac{1}{2}$ "
		<u>40$\frac{1}{2}$ "</u>
Add for extra revenue in proportion, viz., $\frac{1}{3}$ of land revenue, as in Tanjore	- - - -	8 "
		<u>TOTAL - - - 48$\frac{1}{2}$ "</u>

27. This, however, is the revenue of the lands supposing the whole to pay equally ; from it must be deducted one-third of the revenue of lands in the hands of the proprietors, about one-seventh of the whole extent, and also the amount of taxes remitted at present on the manniems, the extent of which is about one-third of the whole ; viz. :—

Zemindaries one-third of the revenue on 11th of the whole ditto	1 $\frac{1}{2}$ lacs.
Present revenue remitted on manniems	8 "
	<u>9$\frac{1}{2}$ "</u>
Amount above calculated	- 43 $\frac{1}{2}$ "
	<u>Increase of revenue - 34 "</u>

28. This supposes that the zemindars, instead of receiving one-third of the present collections, would receive one-third of the increased revenue, so that their condition would be greatly improved. The manniendars are supposed to pay the difference between the present rate of cultivation in Government lands, and what they could pay when properly watered, and they would then have a share in the general advantages, as the water would be rented to them at less than its value ; but as both these cases are in some measure doubtful, because it cannot be known how long it may take to persuade these parties to benefit themselves by taking a share of the water, it may be better for our present purpose to estimate only the increase of revenue on the lands now in the hands of Government :

		Pooties.
Total extent of land	- - - -	81,000
Deduct one-eleventh in the hands of proprietors	7,400	
And three-eighths for manniems	30,000	
	<u>- - - -</u>	<u>37,400</u>
Land in the hands of Government	- - - -	<u>43,600</u>
Revenue of one-fourth of this cultivated for sugar,		Rs.
10,000 pooties, at 120 rupees	- 12,00,000	
Ditto on remaining 33,600 pooties of grain, at 40 rupees	- 13,50,000	
	<u>- - - -</u>	<u>25,50,000</u>
Present peishcush	- - - -	1,25,000
		<u>26,75,000</u>
Add for extra revenue in proportion, one-fifth of land revenue	- - - -	5,25,000
		<u>Carried forward - - - 32,00,000</u>

	Rs.
Brought forward - - -	32,00,000
Present revenue land - - - - -	9,40,000
Extra - - - - -	3,30,000
	12,75,000
Estimated increase on lands in the hands of Government -	19,25,000

29. In reckoning the extra revenue in this way, a low estimate is taken, because the net income of the people, after the revenue is paid, would be much more than in Tanjore, as will be shown by the following calculations:

	Rs.
Present estimate value of produce in Tanjore - - -	1,00,00,000
Total collections, lands and extras - - - - -	46,00,000
Net value of produce to the people - - - - -	54,00,000
Gross produce of sugar on 100,000 pooties, 10,00,000 candies, at 10 rupees - - - - -	1,00,00,000
Ditto of 33,600 pooties of grain, at 120 rupees - -	40,00,000
Ditto zemindars, at present one-eleventh of 30,20,000 rupees - - - - -	3,00,000
Ditto manniems, three-eighths of 30,20,000 rupees -	11,00,000
	1,54,00,000
Total gross produce - - - - -	1,54,00,000
Deduct estimate revenue - - - - -	36,00,000
	1,18,00,000
Net value of produce to the people - - - - -	1,18,00,000

being nearly seven times the present value, even supposing that no improvement takes place in the zemindaries or manniems; but on the other hand, a considerable part of the extra revenue being raised on salt exported, the internal state of the district will have no effect upon that part. Let us compare this result with the actual present revenue and produce of Tanjore; the revenue of the delta in that district is about forty-six lacs, and the estimated revenue in the same extent of land in this, thirty-six lacs; the gross produce of the former, one hundred lacs, and that of this district, one hundred and forty-six lacs; the surplus produce of Tanjore, after the land revenue is paid, is estimated at above sixty-seven lacs, and the extra revenue about nine lacs, or not quite one-seventh of the surplus produce.

30. The surplus produce of Rajahmundry is estimated at 118 lacs, the extra revenue at four lacs, or rather less than one twenty-eighth.

31. We have thus, in a most palpable shape, a fair opening for an increase of revenue to the extent of 20 lacs, and of produce to the extent of 124 lacs in the lands only that are in the hands of Government. If it is asked how is this great sum of money to be obtained, the answer is simply by converting the water of the Godavery into money, instead of letting it run into the sea. At this moment water is paid for by the sugar-growers at about one rupee for 800 cubic yards, the cost of raising it, by pecottahs. There are now about 42,000 cubic yards of water per hour flowing into the sea, worth, at the rate at which it is now actually and profitably purchased, 500 rupees per hour, or 12,000 per day, which for 240 days (the portion of the year in which the district is not supplied at all) gives 28,80,000 rupees. This water, if applied to the land, would be worth to the cultivators full 50 lacs; the whole of this is at present lost. Through the remainder of the year, that is, during the cultivation of the great crop, about four times this quantity, or 1½ million cubic yards per hour, are

are allowed to flow into the sea that might be profitably applied to the land, and in this way it may be understood by anybody how easily 100 lacs a year may be lost. That some such amount is actually lost just for want of proper care of the district, is shown in such a way that the conclusion is inevitable by the actual state of Tanjore. The only question is, what expenditure is required to give us the full benefit of our natural advantages? I have before estimated it roughly at 16½ lacs, and the further examination of the district that I have since made has given me a more favourable view of the case than I before had. It has several facilities that I had not calculated upon, especially in respect to the site of the annicut, which I thought would be 20 miles further up the river. The site now proposed, being at the head of the delta, will save the conveyance of the water 20 miles, and the construction of an aqueduct to carry the water to the central tract.

32. My rough estimate for the whole of the works required to put the delta in good order is now as follows:—

	<i>Lacs.</i>
Present estimate for the annicut, with its locks, sluices, &c.	5
Embankments to the river - - - - -	1
Irrigation channels - - - - -	2
Drainage works - - - - -	1
Sluices, locks, and other small works of masonry - -	1
Roads and bridges - - - - -	2
TOTAL - - -	<u>Lacs 12</u>

33. This expenditure may appear as absurdly small as the estimate of the capabilities of the district appear large; but it is also very well supported by the case of Tanjore, if the circumstances of the two districts are considered. In my former report I calculated the total expenditure on improvements in Tanjore at 18 lacs in 40 years, during which time the revenue had risen 16 lacs; but here we have, in the first place, the prodigious advantages of the experience gained from all that has been done in Tanjore; and secondly, what has been done there has been done piecemeal, while here we can make the improvements on one complete plan, which will make a very great difference. The cost of labour is also lower here, and materials are much cheaper.

34. In my former report I endeavoured to show, by a comparison of the results in Tanjore and Rajahmundry, the difference between an energetic, intelligent and liberal system of management in the former district, and the opposite in the other. As I have since obtained some further statistical statements, I propose now to make a more particular comparison, as eminently calculated to put the matter in a striking light.

REPORTS ON THE IRRIGATION OF RAJAHMUNDRY

GROSS REVENUE of Tanjore and Rajahmundry since 1800.

YEAR.	RAJAHMUNDRY.		TANJORE.		RAJAHMUNDRY.		TANJORE.		Miscellaneous Expenditure.	
	Collections.	Averages.	Collections.	Averages.	Increase.	Decrease.	Increase.	Decrease.	Tanjore.	Rajahmundry.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1801			88,40,000							
1802			88,80,000							
1803	20,60,000	18,10,000	25,20,000	21,40,000						
1804	18,80,000		35,10,000							
1805	20,80,000		38,70,000							
1806	20,80,000		29,80,000						1,17,000	
1807	21,60,000		37,70,000						75,000	
1808	20,40,000	21,94,000	39,80,000	26,80,000	3,24,000		5,40,000		38,000	
1809	21,40,000		40,80,000						32,000	
1810	25,80,000		37,70,000						98,000	
1811	21,10,000		36,00,000						58,000	
1812	22,30,000		39,10,000						90,000	
1813	25,80,000	22,80,000	42,00,000	39,60,000	24,000		3,30,000		1,03,000	
1814	22,70,000		41,80,000						74,000	
1815	18,70,000		5,98,000						94,000	
1816	23,70,000		40,40,000						77,000	
1817	23,40,000		39,80,000						46,000	
1818	23,40,000	22,90,000	40,00,000	40,40,000	40,000		80,000		78,000	
1819	22,80,000		41,10,000						1,31,000	
1820	21,30,000		40,80,000						51,000	8,044
1821	22,80,000		39,30,000						53,000	7,500
1822	22,80,000		41,30,000						24,000	6,900
1823	21,90,000	23,00,000	53,40,000	47,70,000	10,000		7,30,000		66,000	5,400
1824	26,80,000		60,00,000						36,000	17,500
1825	23,40,000		44,80,000						60,000	136,000
1826	25,10,000		38,90,000						33,000	700
1827	22,80,000		37,80,000						25,000	2,100
1828	24,00,000	23,50,000	47,90,000	42,40,000	20,000			5,30,000	29,000	3,400
1829	22,40,000		44,90,000						33,000	4,300
1830	23,60,000		43,70,000						83,000	8,900
1831	20,80,000		44,40,000						1,01,000	17,000
1832	19,10,000		46,90,000						1,03,000	23,900
1833	26,70,000	22,60,000	48,80,000	46,20,000		1,00,000	8,80,000		1,03,000	8,500
1834	26,40,000		46,10,000						1,14,000	5,800
1835	19,80,000		44,77,000						59,000	2,900
1836	21,50,000		48,50,000						1,54,000	4,000
1837	24,40,000		46,70,000						86,000	6,300
1838	17,30,000	10,00,000	48,30,000			3,50,000			91,000	4,500
1839	18,20,000		48,40,000						99,000	10,500
1840	17,40,000								76,000	15,800
1841	21,10,000									32,600
1842	19,60,000	19,40,000								14,400
1843	17,60,000									11,100

Gross

Gross Product of the Delta of Tanjore.

YEAR.	Collections of Paddy.	Average.	Increase.	Decrease.	Greatest Difference between any Two Years of each Period.	Amount of Fluctuation in each Period.
	Rs.	Rs.	Rs.	Rs.	Rs.	
1801	1,14,20,000	94,20,000	-	-	48,00,000	63 per cent.
1802	68,80,000					
1803	77,30,000					
1804	1,01,40,000					
1805	1,12,50,000					
1806	86,80,000	1,05,18,000	11,00,000	-	25,80,000	24½ per cent.
1807	1,11,20,000					
1808	1,13,15,000					
1809	1,12,40,000					
1810	1,02,80,000					
1811	1,02,40,000	1,14,37,000	9,40,000	-	17,50,000	15½ per cent.
1812	1,15,90,000					
1813	1,19,00,000					
1814	1,20,00,000					
1815	1,15,40,000					
1816	1,11,40,000	1,15,00,000	50,000	-	32,50,000	6½ per cent.
1817	1,15,60,000					
1818	1,14,10,000					
1819	1,18,45,000					
1820	1,17,85,000					
1821	1,11,30,000	1,23,18,000	3,10,000	-	17,10,000	14 per cent.
1822	1,23,00,000					
1823	1,26,10,000					
1824	1,28,40,000					
1825	1,27,00,000					
1826	1,23,40,000	1,23,93,000	38,03,000	-	11,40,000	9 per cent.
1827	1,27,20,000					
1828	1,22,00,000					
1829*	1,24,00,000					
1830	1,28,00,000					
1831	1,32,50,000	1,31,70,000	4,80,000	-	6,45,000	4½ per cent.
1832	1,32,80,000					
1833	1,38,45,000					
1834	1,34,93,000					
1835	1,30,00,000					
1836†	1,18,50,000	1,41,10,000	9,40,000	-	regular increase.	
1837	1,33,50,000					
1838	1,40,20,000					
1839	1,41,90,000					
1840	1,43,80,000					
1841	1,45,80,000	1,45,20,000	12,60,000	-	1,20,000	1 per cent.
1842	1,44,50,000					

* Year of commencement of new works.

† Year in which annicuts were built.

35. These statements suggest the following remarks :

1. The revenue of Rajahmundry is not just what it was 40 years ago : viz., 19 lacs. That of Tanjore has almost regularly increased from 31½ lacs to 47½, being an increase of 16 lacs per annum, or 336 lacs in 42 years, showing the difference between a district of inferior advantages, but wisely managed, and one of greater capabilities, but allowed to go to ruin for want of a liberal expenditure in its irrigation.

2. The revenue of Rajahmundry shows a regular but very slow improvement, to the extent of 4½ lacs in 28 years, or about 16,000 rupees a year, in the former part of this period, owing doubtless, chiefly to a more strict system of collection, not to any real improvement in the produce of the district, of which there are no evidences whatever. During the latter part of the term the revenue has again rapidly fallen to what it was 42 years ago.

3. In Tanjore, the revenue has been more fluctuating than it would otherwise have appeared, owing to the excellent system there adopted of allowing the money payments to vary, in some measure, with the state of the prices; but upon the whole the revenue and the circumstances of the people have steadily improved, excepting one of the above periods of five years, in which two years of enormous prices raised the revenue so greatly above the average, each period shows an increase upon the preceding.

4. But this improvement in Tanjore has been an advance upon a state in which the resources of the district had already been developed to a very considerable extent. The grand annicut, upon which the irrigation of the district mainly depends, had been constructed ages before, and multitudes of channels and works of masonry were in use at the commencement of this century.

5. In Rajahmundry, nothing at all had ever been done to lead the water from the bed of the Godavery upon the country, and, excepting two or three small channels to lead off the water in the high freshes, the district was wholly unimproved; yet upon the state of things, 42 years of peace under our Government have done nothing for the district, and with the same extent of delta land nearly, and a much greater extent of good high lands, the district now produces 19½ lacs, while Tanjore, with much inferior capabilities, yields, with much less hardship to the people, 47½ lacs.

6. The statement of produce in Tanjore shows much more distinctly the progress of things and the cause of its improvement, because the revenue, as before observed, fluctuates with prices. The last column, showing the amount per cent. which the fluctuations in each five years bear to the average produce, is the most striking proof of what may be effected by due attention to the irrigation. The seasons are now just as variable as they were 40 years ago, yet the fluctuations have been gradually reduced from 52 per cent. to almost nothing. What can have caused such a change as this, but the due application of the water of the Cauvery? and can it be imagined that, if the same wise and liberal system had been adopted with respect to the Godavery, something like the same effect would not have been produced? It cannot be denied, indeed, that the zemindary system would have been a hindrance, which nothing in the world could have entirely counteracted; but still an irrigated zemindary must be incalculably better than a dry one; and latterly there has been only a partial obstruction of this kind to improvement in the delta, so that, for the last years at least, it ought to have been advancing, instead of rapidly declining.

7. As the actual results of the late works in Tanjore are of the greatest importance to us in considering the expediency of the present project, and there has been now time enough, since their execution, to show distinctly how far they have answered expectations, I will here show, from these statements, the returns which have been obtained. It was in 1829 that, in consequence of the alarming state of the Cauvery, which threatened the most extensive injury to Tanjore, the subject of the non-complete and systematic regulation of the irrigation was taken up. The first of the works determined on was executed in 1830, and various others were executed from that year to 1835. The effect of these is abundantly shown in the return of gross produce. Instead of an enormous falling off, which had been so fully apprehended, there was an immediate increase on an average of 490,000 cullums of paddy, worth 2,30,000 rupees per annum. The prices being good, the increase

for the revenue for the same period was no less than 3,80,000 rupees per annum. The expenditure on "occasional" works in the five years was 1,40,000, of which, at most, one lac was expended on the new works of irrigation. In 1836, the two Culleroon annicuts were built; in that year there was the greatest failure of the river ever known, so that, though the whole of the water in the Augunda Cauvery was secured for irrigation, instead of about two-fifths, as had been previously, there was a great deficiency of produce. This year, being altogether unprecedented, has been omitted from the average. In the average of the following four years there was an increase of less than 9,40,000 cullums, with $4\frac{1}{2}$ lacs, per annum, upon the last period, or if 14 lacs of cullums, with seven lacs of rupees, per annum, upon the former period.

36. In this period there was a great falling-off of price, which was general in the south of the Peninsula; yet the revenue increased, on an average, one lac, and exceeded that of the period previous to the first commencement of the works, by 4,80,000 rupees per annum; the total expenditure chargeable to Tanjore, up to this time, having been about three lacs. In the following year, the last that I have received accounts of, the increase is, on an average, four lacs of cullums, worth two lacs per annum.

37. I have not the statement of collections since 1839. The whole increase, therefore—that is, the difference between the average of the years 1841 and 1842—is 18 lacs of cullums, worth nearly nine lacs per annum. In Rajahmundry, the average collections were, previous to 1830, $23\frac{1}{2}$ lacs, and for the two years ending 1842, 19 lacs, being a falling-off of $3\frac{1}{2}$ lacs per annum, or 20 per cent.; the same period in which they had increased in Tanjore nearly five lacs. Thus, not only had the new works averted the evils which were apprehended, but had caused an actual increase of revenue of 166 per cent. upon the outlay, while this district, with superior advantages, had fallen off to the extent of one-fifth its revenue. What would have been said of works producing such results, if they had been executed in England or Bengal, when it is considered that this vast improvement was made in a district already so highly irrigated, that one of the great objections made to the annicuts was, that no increase of produce could be obtained? And also, considering that there was no summer water to make the district into a sugar plantation, there is the strongest reason for expecting that the results here will far exceed those, the district having been hitherto so entirely unimproved, and having so superior a supply of water.

38. Thus, we have, on the one hand, the estimate of the produce that the land of the district is capable of when properly irrigated, taken from a portion of the district itself, and on the other, most extraordinary results actually realized from works similar to those now proposed here, already executed in another delta: How we could possibly have stronger grounds for proceeding boldly with the projects now under consideration, I cannot imagine, and it must be remembered that all the above calculations include only 17,000 square miles in the Rajahmundry district, and omit entirely 1,300 square miles in the Masulipatam Zillah, which would be commanded by the annicut, and of which 300 square miles on the east side of the Colair Lake, and as much round that lake, must be immediately benefited prodigiously by this work, the present channels terminating in that reservoir. The bed of the Colair, which is now lost to cultivation from its being used as a reservoir, and which contains about 160 square miles capable of bearing a population of 70,000, and of yielding a revenue of three lacs of rupees, would be made available as arable land, if a regular and constant supply of water were thus procurable from the Godavery, unless I have been misinformed as to the quality of the soil.

39. But to show more directly what may be the progress of things in an alluvial tract, where the irrigation has been previously neglected, and when improvements are made, we must take the instance of the two southern talooks of South Arcot.

These talooks, lying on the northern side of the Culleroon, near the sea, had about 16 centuries before been provided with two or three channels, and a magnificent tank, 25 miles in circumference, filled from that river. Under grievous neglect of the irrigation, which had been so general that every district on this side of the Peninsula had suffered from it, the talooks had declined from 2,09,000 rupees, the highest revenue they had yielded since 1820, to 1,05,000

rupees in 1831. In that year the irrigation began to be attended to, and in consequence of the clearing out of the channels, it had risen to 2,37,000 in 1836, when the Culleroon annicuts were built, and a thorough system of irrigation and drainage commenced upon, in consequence of which, notwithstanding some adverse circumstances arising from the discontent of the people at the revenue arrangements, it increased till in 1839 the revenue was 3,18,000, or an increase of 2,10,000 upon the revenue of 1831, making it nearly threefold in eight years, and of 81,000 upon that of 1836, in addition of 33 per cent. in three years upon the previously greatly improved revenue; and this though the people were in so unsettled a state, and did not in consequence cultivate anything like the extent of land that would otherwise have been occupied. It might be supposed that this alone would be a sufficient proof of what irrigation is to be on this side of the Peninsula: In two talooks alone, a difference of 2,10,000 rupees a year is made in the revenue, to say nothing of the change in the condition of the people in eight years, by nothing but attention to their irrigation, not much less than double the whole cost of all the officers, surveyors and their establishments in the Tank department. The total sum chargeable to these talooks is the cost of the works, which I believe did not during this time much exceed a lac of rupees; but I have not the exact amount. These talooks, when at their lowest, were certainly better provided with water than this delta now is; but the condition of the latter is nearer that of the former than Tanjore is, and therefore it is a much better test of the rapidity with which its revenue may improve. Since 1839 the revenue of these talooks has again declined, but this has been owing, I believe, to the discontented state of the people, which in 1841 and 1842 had become a serious matter. It is now reviving. I cannot help here remarking how perfectly insignificant the cost of the charges of the irrigation is with the sums at stake upon its due management. It is the greatest thing which on this coast makes the difference between famine and abundance, between abject misery and the greatest prosperity of the people, and between an empty treasury and a full one; and in the alluvial tract from one to two per cent. on the collections makes the difference between the works already in existence being kept in good order or left to go entirely to ruin; and further similar sums will make the difference of a district remaining stationery or making rapid improvement; which leads me to point out the contrast between the expenditure in Rajahmundry and Tanjore, compared with the receipts. In Tanjore the total sum expended from 1820 to 1840 was 15½ lacs, averaging 72,000 per annum. In Rajahmundry it was in the same 21 years 17,000, or averaging 3,400 rupees per annum, or not one-eighth of the former. The average collections of Tanjore (land and extras) were about 48 lacs per annum, upon which the expenditure was about one-half per cent., which was sufficient not only to keep up the works, but greatly to improve them, and it includes the formation of raised roads and bridges, with tunnels throughout the district. The revenue of Rajahmundry was on an average 22 lacs for that period, and the Maraumut expenditure was consequently two-thirds per cent., or, in proportion to the actual revenue, was not half of what it ought to have been, and would probably have been, if it had been properly irrigated. We may consider, judging from the results, which sufficiently justify the amount expended there, that it was not more than one-eighth of what the strictest economy required it to be; and this is, in fact, greatly underrating the deficiency of expenditure, because in 1820 Tanjore was in comparatively a high state of improvement, and Rajahmundry required a much more than proportional expenditure. What would be said if the public buildings of a cantonment had only one-fourth of the necessary expenditure laid out upon them for 21 years, and what state would they be in at the end of it; and why should that care be withheld from the public works upon which both the revenue and the welfare of the people depends, which is invariably given under our system in the public buildings?

40. It seems clear from this comparison, that no principle of any kind has been adopted in former years in determining the Maraumut expenditure. How else can we account for these facts, that one district, already in pretty good order, has, on an average of 21 years, 78,000 rupees per annum expended on its irrigation, and that another in the most ruinous condition has had for the same period an expenditure of only 3,400 rupees per annum?

The gain and loss under the two systems may thus be stated :

Maharaut expenditure in Rajahmundry for 21 years	- - - -	Rs.	1,76,000
Ditto for Tanjore	- - - -		15,24,000
Gained in Rajahmundry by economical expenditure in 21 years	- - - -	Rs.	13,48,000
Average revenue of previous 5 years in Rajahmundry	- - - -	Rs. 22,90,000	
Ditto of 21 years	- - - -	22,00,000	
Average diminution of revenue	- - - -		90,000
Average revenue of previous 5 years in Tanjore	- - - -	40,40,000	
Ditto of 21 years	- - - -	46,00,000	
Average increase in Tanjore	- - - -		5,60,000
Difference in favour of Tanjore	- - - -		6,50,000
Ditto for 21 years	- - - -		1,36,50,000
Net Loss in Rajahmundry by an economical expenditure	- - - -	Rs.	1,23,00,000

41. With these actual results, and other items of information that I have obtained respecting the district, I think we may, without presumption, form something like an estimate of the probable results of the two modes of proceeding that may be adopted in the district for the next ten years.

FIRST ESTIMATE.

As in the above period of 21 years an expenditure of half what is necessary to keep the present work in order, or 3-5ths per cent. upon the collections (19,40,000)	- - - -	Rs.	7,700
Diminution of revenue at the same rate as in the former period of 21 years	- - - -		90,000
TOTAL expended and lost in revenue	- - - -		97,700
Ditto in 10 years	- - - -	Rs.	9,77,000

SECOND ESTIMATE.

Expenditure in next 5 years to put the Delta in order	- - - -	Rs.	12,00,000
Ditto per annum from that time for 5 years, at 1 per cent. per annum on 24 lacs	- - - -		1,20,000
TOTAL Expenditure	- - - -		13,20,000
Increase of revenue on an average of 10 years, at 4 lacs per annum	- - - -		40,00,000
Net gain in next 10 years by a liberal expenditure	- - - -		26,80,000
Estimate net loss by an economical expenditure in the next 10 years	- - - -		9,77,000
Estimate net gain on the same period by putting the irrigation in order	- - - -		26,80,000
Net Advantage by a proper expenditure over an economical in the next 10 years	- - - -	Rs.	36,57,000

42. In the first of these estimates, I suppose that the same proportional expenditure of two-fifths per cent. on the revenue is continued for the next 10 years, as was allowed for the period of 21 years, and that it produces the same results, viz. a diminution of revenue of 90,000 rupees per annum, bringing it down to 18,50,000 rupees. In the second, that after the sums now required are expended, the rate of one per cent. is continued, which, it appears from the results in Tanjore, is sufficient to keep the works in good order, and that the result of this plan is, to raise the revenue eight lacs per annum in the 10 years, or 80,000 rupees a year, which will be 66 per cent. on the first outlay of 12 lacs, a very low estimate when compared with return of 166 per cent. in Tanjore, and of

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256 per cent. realized already in that district in the improvement of the Woody talook; and at the end of this period of 10 years,

	<i>Rs.</i>
The revenue by the first estimate would be	- 18,50,000
And by the second	- 27,40,000

Making a difference per annum - - *Rs.* 8,90,000

43. In the second place, we may consider what would be the effect of the works now estimated in throwing water throughout the year into the present channels.

44. The following is a statement of the permanent assessment of the villages watered at present by the channels that would be immediately filled by the annicut in Rajahmundry :—

	<i>Rs.</i>
West side of Godavery	- - - - 2,10,000
East side of ditto	- - - - 47,000
TOTAL	- - - - <u><i>Rs.</i> 2,57,000</u>

45. The difference between the permanent assessment and the collections being on an average about 30 per cent., it appears that if the collections of these villages were only brought up to the assessment, there would be an increase of 77,400 rupees, or about 18 per cent. upon the estimated outlay for an annicut. But the permanent assessment having been itself laid upon lands only a little assisted by the channels, and not by any means fully irrigated (the water passing down the channels, even in their present improved state, only 50 days in the year), the revenue on the same lands, when constantly supplied for a rice crop, ought far to exceed the permanent settlement. I have before estimated that the revenue of the land, if properly irrigated, ought to average at least 40 rupees a pooty for a rice crop; whereas it is now only assessed at about 30 rupees per pooty for those parts of the district. The revenue, therefore, ought to exceed the permanent settlement by 33 per cent. when all the lands of the villages were fully irrigated, making an increase on the permanent settlement of 86,000, or nearly 1,83,000 above the actual collections; this would be 33 per cent. upon the present estimate. How much of this could be actually obtained, and in what time? is the grand question. We have a great help in judging of this by the progress of the revenue in the Woody talook since the Godavery Channels were opened.

46. The following is a Statement of the Collections for 11 years :—

		<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>
1833	- -	70,000	} 74,600	65,100
1834	- -	88,000		
1835	- -	64,800		
1836	- -	71,800		
1837	- -	77,700		
1838	- -	18,100		
1839	- -	84,300	} 87,300	83,000
1840	- -	81,500		
1841	- -	90,300		
1842	- -	93,300		
1843	- -	84,000		
		12,700		17,900

47. From this it appears that an increase of 12,700 rupees a year, or excluding the two extraordinary years 1838 and 1843, of 17,900 rupees has been obtained in this talook, solely through the trifling improvement of clearing out this channel, upon which only about 7,000 rupees had been expended, showing an

an increase of 180 per cent., or by the latter calculation, 256 per cent. upon the outlay, besides the advantages to the landholders; and this is only the smaller part of the effects of these improvements, as the greater proportion was produced within the Masulipatam district. I have been charged half the expenditure to this district.

48. The clearing out of the channels by which this improvement of the revenue was effected, was only begun in 1839; so that the revenue was immediate, and in each year must have far exceeded the money expended in the same year.

The expenditure was as follows:—		Rs.
	1839 - - -	795
Bhoopiah Channel - - -	{ 1840 - - -	1,303
	{ 1841 - - -	2,678
	1842 - - -	500
	1843 - - -	373
		<hr/>
Woosoodoom Channel - - -	{ from 1839 - - -	5,649
	{ to 1843 - - -	3,000
Apparow Channel - - -	{ from 1840 - - -	} 6,000
	{ to 1842 - - -	
		<hr/>
		14,649

49. The two last sums I am obliged to state roughly, as part of them was expended in the second division, and I have not an actual statement of the amount. The very deficient collections of the last year were caused by the excessively severe floods of that year, and point out distinctly the necessity for river embankments. Here is a loss of about 40,000 rupees in a single talook, in a single year, in land revenue, implying a destruction of crop to the extent of about 80,000 rupees; much more than sufficient to embank the whole of that side of the river from the hills to the sea effectually. We have in the case of this talook an excellent example, from which we may safely conclude that the district will immediately improve if the proposed works are executed, and that not one year will pass after the construction of the annicut without a large return, just as was the case in Tanjore. In my former report, I supposed that it might be some years before a considerable return was obtained, but I am now quite satisfied that the return will be immediate.

50. The above calculations, however, do not show all the effects of the annicut in nearly filling the present channels. I have there mentioned only the villages now watered by them; whereas they pass through and near much land which at present is not affected by them, in consequence of the water in the channels being, excepting in severe freshes, below their level. The best instance of this is the Tanookoo talook, situated near the head of the Bhoopiah Channel, and certainly, almost without exception, land of the first quality. The Bhoopiah Channel passes through the talook, but does not water an acre of it; yet the whole of it, with the exception of a very small corner on the bank of the river, is below the level of the proposed annicut, and would therefore be watered all the year round.

The following is a statement of its lands and revenues:—

Total land - - - - -	5,031 pooties.
Deduct rivers, roads, &c. - - - - -	800
<hr/>	
Remaining cultivable land - - - - -	4,231
Deduct free mauniens - - - - -	1,166
Cuttoopody ditto, land paying a diminished assessment - - - - -	626
<hr/>	
	1,792
<hr/>	
Remaining assessed land - - - - -	2,439 pooties.

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Permanent assessment in land	1,11,000 pooties.
Deduct Cuttoopody mauniens, 626 pooties at 8 rupees, estimated	5,000
Assessment upon 2,439 pooties, or per pooty 43½ rupees	1,06,000 pooties.

This average shows the richness of the land of this talook; the average of the whole delta being under 30 rupees a pooty.

The collections for the last eleven years are—

	Rs.	Rs.
1833	1,02,000	1,00,000
1834	98,000	
1835	97,000	
1836	1,04,000	
1837	1,03,000	91,000
1838	75,000	
1839	96,000	
1840	89,000	
1841	91,000	86,000
1842	91,000	
1843	77,000	
Average of the last three years	86,000 rupees.	
Deduct for mauniens	5,000	
Collections on 2,439 pooties, or 33 rupees per pooty	81,000 rupees.	

51. The present collections are thus only 86,000, or 25,000 under the permanent assessment which was made upon the lands while unprovided with water by Government. The highest point of this talook is 37 feet above high water, or four feet above the proposed level of the annicut, but only a few pooties are in this level, excepting this corner on the bank of the river; the highest land is only 26 feet above the sea, or seven feet below the annicut, and being only eight miles from it, there can be no question about its being perfectly irrigated. From the excellence of the soil, I have no doubt that a large portion of it may be cultivated with sugar, probably almost the whole of it. Allowing that it is supplied with water for a rice crop only, I think that a very moderate estimate of the increased rate which it would pay would be ten rupees a pooty above the permanent assessment; and this would give, not allowing anything to be obtained for the mauniens—

	Rs.
Revenue of 2,440 pooties, or 53½ rupees	1,31,000
Add for mauniens as at present	5,000
	1,36,000
	86,000
Increase estimated upon present collections	50,000

This supposes that no arrangement is made with mauniens. If the mauniens were assessed at the rate of increased assessment, paid by the taxed lands, the revenue would be on 2,440 pooties, as above

On 1,166 pooties free mauniens, at 22½ rupees, being the difference between the present rate of collection and the estimated rate	26,000
On 626 pooties Cuttoopody mauniens, 30½ rupees, adding 8 rupees a pooty to the last mentioned	19,000
Total estimated collections	1,76,000
Increase	90,000

52. Lastly,

52. Lastly, we may conclude the revenue, if the whole of the taxed lands were watered throughout the year, or as some of the lands will not, for some years at least, be cultivated for sugar or garden produce, we may take three-fourths of the land as assessed for water supplied during the dry seasons, as the land cultivated for sugar, even when the water is not supplied by Government, pays ordinarily from 80 to 110 rupees a pooty. We cannot be above the mark in estimating the revenue at 120 rupees a pooty; for, as it costs the cultivators from 200 to 300 rupees a pooty for raising water, this rate would give them a great advantage over the present cultivators.

The calculation would thus be:—

	Rs.
Revenue of 610 pooties cultivated with rice, at 53½ rupees	32,000
Ditto, 1830, ditto, sugar, at 120 rupees	2,19,600
Add for mauniens	5,000
	2,56,000
Present collections	86,000
	1,70,000

And if a small assessment were laid upon the mauniens, as before estimated, the revenue would be increased to 3,01,000 rupees. From these calculations it would appear that if the permanent assessment only is realized, the increase will be 25,000 rupees, and allowing for a light assessment of 22½ rupees, on mauniens 90,000; supposing that three-fourths of the taxed lands are watered throughout the year, and that the mauniens pay, as above, 23½ rupees, 2,15,000.

53. I have given more details respecting this talook, because it shows so distinctly what may be expected from the annicut. There is a talook composed almost entirely of the richest lands, only 28 feet above the sea, with a large channel running through it, and left unirrigated. From the above calculations, and from what have taken place in the Woondy talook, we may surely reckon upon an increase of 50,000 rupees within two years, and of a lac within a few years more in this talook alone; and hence, that if the annicut were built for its sake only, it would yield 22 per cent., besides the vast benefit to the people; and this is not reckoning one-half of what the talook is capable of.

54. There is much other land circumstanced like this talook, which would be immediately benefited by the annicut, besides that above mentioned, which is now imperfectly irrigated by the channels. But adding this talook only to the latter, and allowing for rice cultivation only, we have—

Increase on present cultivations, on partially irrigated lands, reckoning the revenue to be 40 rupees per pooty, as above shown	1,63,000
Ditto, in the Tanookoo talook	80,000
	2,53,000

And as the present collections on the sand lands are 2,67,000, this would be an increase of 108 per cent. upon the present revenue. In Woondy talook the average increase of four years, reckoning from the commencement of the clearing of the channels, was 27 per cent. by the lowest calculation, while the rest of the district had declined. It is not possible but that the improvement caused by the abundant supply of water thrown into those tracts every day during the crop would far exceed what has been thus obtained. If we take it only at 50 per cent., or one-third of what these lands ought to yield ultimately for grain only, we have a sum of 1,32,000 for the average increase for the first four years, counting that in which the annicut is finished; making a total within the four years of more than the annicut is estimated at; but long before the end of four years there cannot be a doubt that much would be brought under sugar and other garden cultivation, and also the additional channels for the whole delta might be easily completed. The extent of land thus immediately affected by the annicut would be 11,000 pooties, and the revenue, per pooty, when increased according to this estimate, would be only 36 rupees, while the present central collection, on the average of the whole delta of Tanjore, is 50 rupees for inferior land.

land. If 50 rupees were collected here, it would add 1,54,000 rupees more. Upon the due consideration of these calculations and statements, surely there cannot be a doubt as to the results of the construction of an annicut, considered separately from the other works which the Delta requires. Estimating it to cost 4,80,000 rupees, it seems certain that within a very few years it would yield at least 2½ lacs or 50 per cent., and that when the sugar cultivations have extended considerably, 100 per cent. would be by no means an improbable return; and when to this we add the immense change it would make in the circumstances of the people, there seems to be no possible room for doubt as to the advantages derived from such a work being such as to counterbalance the outlay several times over. Take the case of one single year of famine, and consider the dreadful amount of suffering which it involves, to say nothing of the lasting injury to the revenue which is the certain consequence of it, and the incalculable blessing that an annicut would be to the district may be well imagined. That such a thing as a famine in any of the districts near the Godavery should ever take place, is indeed the deepest reproach to us. The consideration that such a time has been, and that it will inevitably occur again within a few years, if an annicut is not built, ought alone to be sufficient to induce us to build one; even if there were no returns in ordinary years. This work would not only secure this district from famine, but would necessarily much mitigate it in the neighbouring districts. Indeed it would effectually secure the whole of these circars from the fearful extremities of starvation, to which some of them have been exposed so lately. Had this work been in existence during the last 20 years, undoubtedly much more than 100,000 lives would have been saved by it. In 1836 and 1837 there was so great a failure of the north-east monsoon, and consequently of the crop, throughout the whole of the southern districts around Tanjore, that there was a scarcity approaching to a famine; and if it had not been for the Colleroon annicut, which had been built the same year, and without which a large portion of the main crop in Tanjore also would have been lost, that district, instead of having a large surplus with which it supplied the surrounding country, would itself have had to import grain, and have thus incalculably increased the distress.

55. It is impossible to calculate what the benefit thus arising from the construction of the annicut was in the very year in which it was built. I may here also mention how fully the estimated effects upon the revenue from the Colleroon annicuts have been realized, as it would tend greatly to encourage us to hope that the estimate made from the present state of things in this district will prove equally correct. In the first report recommending these works, dated 29th January 1834, is the following paragraph:

"I estimated the returns in money to Government as follows:

In Tanjore, from lands at present entered as Nungey	-	-	2 lacs.
Ditto, new cultivation	-	-	1½
South Arcot, restoring its cultivation under the Veranum tanks	-	-	1
Total			- - - 3½ lacs.

Besides some addition in Trichinopoly. I feel very confident that this would be much below the real results."

The following statement will show what the results have actually been:—

	In Tanjore.	Gross Produce.
1826	- - 1,33,40,000	
1827	- - 1,37,20,000	
1828	- - 1,22,00,000	
1829	- - 1,24,00,000	
1830	- - 1,21,00,000	
1831	- - 1,32,50,000	
1832	- - 1,32,50,000	
1833	- - 1,28,45,000	
1834	- - 1,34,90,000	
1835	- - 1,30,00,000	
		- - Average of 10 years preceding annicuts, 1,29,80,000.

	In Tanjore.	Increase of Land a Year on the Average of 10 Years.	Value of Increase.	Value of Government Share of Increase to 40 %.
1836	1,18,50,000			
1837	1,38,50,000	8,70,000	4,35,000	1,78,000
1838	1,40,20,000	10,40,000	5,20,000	2,08,000
1839	1,41,90,000	12,10,000	6,05,000	2,42,000
1840	1,43,80,000	14,40,000	7,00,000	2,80,000
1841	1,45,80,000	16,00,000	8,00,000	3,20,000
1842	1,44,50,000	14,70,000	7,35,000	2,94,000

The revenue fluctuating in some measure according to prices, renders it necessary, as before mentioned, to give this statement of gross produce, in order distinctly to show the results realized, compared with these estimates.

The year 1836 was a failure in the river wholly unprecedented, and therefore cannot be compared with other years.

1826	38,90,000			5 11	} 8 annas.
1827	37,30,000			5 10	
1828	47,90,000			9 8	
1829	44,20,000			8 -	
1830	43,70,000			6 3	
1831	44,40,000	Rs. 44,30,000		7 3	
1832	46,90,000			10 1	
1833	48,80,000			12 -	
1834	46,10,000			8 7	
1835	44,70,000			7 4	
		Increase above Average for 10 Years.			
1836	48,50,000	2,20,000		11 9	} 9 3
1837	46,70,000	2,40,000		8 6	
1838	48,30,000	4,00,000	Rs. 3,20,000	8 10	
1839	48,40,000	4,10,000		8 6	
1840				8 3	
1841				4 6	
1842				6 1	
1843					

The results from the revenue exceed those calculated from the gross produce, because the former include the extra revenue, which is also increased, and which shows the improved condition of the people.

1826	1,78,000			
1827	1,48,000			
1828	1,42,000			
1829	1,55,000			
1830	1,28,000			
1831	1,08,000			
1832	1,43,000			
1833	1,71,000			
1834	2,31,000			
1835	2,39,000			
		Increase of Land a Year above preceding 10 Years.		
1836	2,37,000	37,000		
1837	2,76,000	1,12,000		
1838	3,09,000	1,45,000		
1839	3,18,000	1,54,000		
1840	3,08,000	1,44,000		
1841	2,34,000	70,000		
1842	1,98,000	34,000		
1843	2,28,000	64,000		

56. The average increase of 1,00,000 has been obtained, notwithstanding the discontent before mentioned, which had come to a great height in these talooks. In 1840 the increase had risen to 1,44,000 rupees, and there was still abundance of land and ample supply of water for it. There has thus been, on an average of years from the very first construction of the work, an average increase of revenue exceeding by 70,000 rupees the above estimated results; and had it not been for the disturbance in South Arcot, there is not a doubt that it would have been much greater; yet the whole effects of the works are by no means fully developed as yet, and these have been produced under the superintendence of continually changed officers; almost every one that has taken charge of the district having previously had no experience in Delta irrigation, which makes it wonderful that such serious mistakes have not been made as completely to spoil the whole undertaking. There has also been some considerable improvements, as expected, in Trichinopoly, but I have no return of them, further than that under one channel there was an increase of 7,000 rupees per annum.

57. In the present case we may confidently estimate that the annicut now estimated, with some trifling sums for small channels, will, within a year after its completion, produce an increase of one lac; and that by the tenth year there will be an increase of five lacs, or cent. per cent. on the outlay.

58. Upon the whole, therefore, we may consider the annicut as—

1st. Laying the foundation for the complete irrigation for a rice crop of the whole Delta of the Godavery, and part of that of the Kistna, in all 3,000 square miles, or nearly 20,00,000 of acres.

2d. Providing for leading out on the land of every drop of water of the Godavery, in the low freshes, and thus making use of what is now totally lost.

3d. Opening the way for the conversion of the Delta from a mere grain district to a sugar plantation.

4th. Thus the produce of this tract, which at present probably does not exceed 30,00,000, would, when full advantage is taken of the water thus distributed over it, be increased to at least 200 lacs.

5th. This tract, which now pays with great difficulty about 22 lacs, would then with great ease pay 50 or 60 lacs.

6th. A complete system of internal navigation, intersecting the whole Delta, would be established throughout the year.

7th. Every village would be furnished with a stream of pure water for the people and cattle at all seasons.

8th. The present estimate provides for the full irrigation of all the tracts at present partially irrigated by the principal channels of the Godavery.

9th. It will give us at once the use of a large portion (about one-third) of the water of the low freshes during the whole summer, thus providing for sugar cultivation to the extent of about 30,000 acres.

10th. It will give a constant supply of water to these tracts, which, like Tanookoo talook, are situated near the present channel, but which receive no benefit from them at all.

11th. It will put a famine in this or the neighbouring districts out of the range of probability.

12th. It will provide immediately two or three most important lines of water communications from Rajahmundry, through the heart of the Delta, to the sea, available at all seasons.

13th. It will have the important effect of showing to the people what can be done for them; at present they have no idea of the water being thrown into the channels during the summer; and from the first moment that water is seen passing through any villages in the low freshes, the whole people of the Delta will be awakened to its great capabilities, and will be prepared to welcome the opening of the channels throughout the whole tract, and to extend the cultivation of sugar and other things, which are at present limited by the want of water.

14th. It may be estimated to yield one lac of rupees, or 20 per cent. on the outlay in the first year, and at least five lacs, or cent. per cent., within 10 years. This is much less than the new works in Tanjore yielded under circumstances which did not offer anything like the advantages that the state and capabilities of this district hold out.

15th. But

15th. But it seems to me that the most important point of all in the present state of this district is its capabilities as a sugar plantation, and the annicut will immediately provide for the most unlimited extension of that culture. When this work is executed there will not remain a single obstacle to this most valuable plant becoming the main produce of this district. Water would be provided for at least 3,000 pooties, producing, with the Indian cane, sugar of the value of 1,300 rupees per pooty; and with Mauritius cane, if I am rightly informed, double that sum; while grain produce is worth only 120 rupees per pooty.

59. Upon the whole, we have in this case almost every thing that the most timid could desire to encourage us to prosecute the undertaking. On the one hand, the most perfect success, and almost unprecedented results from precisely similar works in Tanjore, and on the other immediate returns for what has already been done in this district, more than ten times as great as would have been an ample return for the expenditure. Added to this, we have a product which can be raised here, probably at one-fourth the cost that it can be produced in the countries from which it is at present chiefly obtained. Both the culture and manufacture have been fully tried, and nothing is wanting but that the water which flows perpetually through the district should be applied to the lands; and this can be done at a cost which, compared with the object in view, is most insignificant. What this district may become, if this matter be taken in hand with only a small part of the energy it deserves, it is not easy to conceive. The unfailing river, an immense expanse of the richest soil, a safe and accessible port, a complete internal water communication, with teak forests, a climate and soil perfectly suited for sugar, and abundance of labour at only 1½ d. a day, form such a combination of advantages as I suppose cannot be found in the world, and certainly not under such a government as ours. The climate being quite healthy and free from excessive heat all along the sea-board, also opens it so fully to the establishment of sugar works under European superintendence. Its situation, too, between the two great ports of Madras and Calcutta, makes it very convenient for commercial undertakings.

60. I conclude this report without entering upon many points which might be considered, because it does not seem desirable to make it too long. I believe all the important points have been examined, and that much more than enough is stated to establish the importance of the proposed works. I do not attempt to answer the objections that will of course be started in this case, as there were when the Tanjore works were proposed; but I have fully satisfied myself that no objection can be preferred that has not been fully answered already by the results in that district, or which cannot be easily answered on sound grounds. So far as the objections to these works were made known to me, and I was allowed an opportunity to answer them, there was no difficulty in showing their futility. Those which were withheld from me, so that I could not refute them at the time, have since been answered by the works themselves.

61. It will be evident that the future progress of the district depends above every thing upon the means which may be provided for the sugar culture, and that it is hardly possible for the Government to take too decided measures for promoting this most valuable cultivation. The providing water is of course the first thing, but it is very possible that many minor means might be employed which would have an important influence in the matter. An ample supply of the Mauritius cane, which the ryots are anxious to substitute for the common kind, and which thrives well; the collection of the whole of the rent of the land after the crop is secured, or the institution of custom duties at the place of exportation for the greater part of the rent, so as to diminish, as far as possible, the capital required for the culture, and free the ryots from the interference of the Government servants and of the money lenders; a lower assessment for the first year upon the lands cultivated with Mauritius cane;—these are some of the means which would tend to forward the culture: if, upon consideration, they appeared to be admissible on other grounds, the subject deserves the most careful examination; and upon the means that may be used will depend in a great degree the rapidity with which the works now recommended will produce the results which they are calculated to yield.

62. I will only add the following remarks:

1st. With respect to the estimated cost of the works now proposed, viz. 4½ lacs, that it provides for a solid and permanent work, and that the prices allowed are those at which such work can now be executed without allowing for many

reductions that may confidently be expected, if subordinate European superintendence is made use of, a sum of 30,000 rupees, or $6\frac{1}{2}$ per cent., is allowed for sundries and contingencies. If it should be considered that in dealing with so large a river this is not sufficient, any additional sum might be sanctioned, though I think we have no right to calculate upon contingencies which would require a larger per-centage than this. Both the Colleroon annicuts, and, I believe, every one of the subordinate works of any consequence, were executed under the estimated amount.

2d. With respect to the estimated returns, I have given a statement of the lands, their present collected revenue, the permanent assessment, &c., from which any person may form their own judgment of the probable effects of these works. I think they must fully support my expectation, that they will yield 100 per cent. on the outlay; and this also is abundantly supported by the actual returns in Tanjore, which have already much exceeded that per-centage, though under circumstances much less favourable than those of Rajahmundry.

3d. The sum for which sanction is now requested, being the cost of the annicut, and subordinate works for keeping the present channels supplied, is 4 $\frac{1}{2}$ lacs. The remaining works necessary for the completion of the irrigation, navigation, embanking, and roads of the Delta within Rajahmundry, is roughly estimated at 7 lacs. This does not include the detailed works that would be required in the Masulipatam district, if it should be determined to extend the channels as far as the Kistna. If this further tract of country should be in the same manner provided with such works, I have no doubt that returns little short of 100 per cent. would be obtained there also.

4th. I need hardly observe that if this work is undertaken, it will be necessary to have it executed in the manner in which large military buildings are constructed, that is, under the entire control of the engineer officer. This is especially necessary in the northern districts, as the native Revenue authorities have no experience in such works, and it is almost impossible to get even a common sluice built, in a whole season, under the ordinary system, from the utter inefficiency of the people in respect of works of civil engineering.

5th. I think there can be no objection made to my earnestly requesting, in the conclusion of this report, that the objections that will be made to every part of the project may be openly discussed, and that not one will be allowed to be said or insinuated but what shall be put on paper, and the fullest opportunity allowed to me of answering it. It seems to me that in justice the least that can be granted to any one who takes upon himself the great responsibility of proposing and urging extensive improvements of this sort, is that he should be allowed to defend his project against the objections of others, when it is considered how many difficulties will appear even to the embarrassed who are not conversant with such subjects, but for which any professional person will know that there is not the slightest foundation.

(signed) *A. Cotton,*
Major, Civ. Eng. 1st Dⁿ.

Madras, 17 April 1845.

THE SUGAR CULTIVATION.

THE circumstances of these districts are at present peculiarly difficult in respect of their commercial prosperity; they have within the last few years lost their former important cloth trade, which formerly brought it an annual income of 10 lacs from England and other countries, and nothing has been substituted for it. A small tract of country, without any considerable product, which is suited for exportation to other parts of the world, must necessarily continue in an inactive and impoverished state; and if the revenue is received in bullion, the value of money must necessarily rise, and the taxes consequently press more and more heavily upon the people. It seems evident, that a district which pays annually 25 lacs in bullion as revenue, if deprived of an income of 10 lacs a year from foreign countries, which it had been accustomed to receive, must feel the effects of it most severely, and annually become less and less capable of paying its taxes; not only must the value of money rise (or, what is the same thing, the price of its remaining products diminish), so that the amount of assessment (if

continued

Commercial state
of this division;
loss of the cloth
trade.

Scarcity of bullion.

Total of prices
attributable to it.

continued the same), must annually bear a larger proportion to the produce of the district, but also, from the diminution of capital and the want of stimulus, the energies of the people must be greatly depressed. An export trade to other and richer countries has the most powerful tendency in every way to keep a population in a state of activity and industry. The effects of the failure of the export trade is already severely felt in these districts; and it must inevitably continue to decline, if some substitute for the cloth trade is not discovered. Happily the sugar cultivation is calculated not only to fill this void, but it offers the fairest prospect of much more than compensating for the former trade. I have lately obtained what information I could on this subject, especially from Mr. Mackenzie, who has both cultivated the cane, and has also had a vacuum pan for manufacturing the sugar in very successful operation for some time. I have not had time yet to obtain the materials for anything approaching to a complete report; yet the main points are so plain, they appear to be so intimately connected with the whole subject of the irrigation of the district, that I think it but sufficient to send to the Board the information I have obtained without delay. When it is considered that the price of food, and consequently the price of labour, building, &c., is here only about 1-30th of what it is in the West Indies, it appears surprising that when it was known that the sugar-cane would grow here, the extensive cultivation and manufacture of sugar did not immediately follow; for if it answered to supply the English market from the West Indies, there would seem to be no possible room for doubt that it would answer here, even in the face of a much heavier duty; and so far as I can now learn, there seems to be no doubt that it would have been a sufficiently profitable produce, even before the duties were equalized; but now there is everything in favour of sugar produced here. Mr. Mackenzie's late superintendent, who had been long in the West Indies, in his account of the expenses incurred in labour, building, &c. there, quite agreed with the common information obtained respecting them; so that the capital required for establishing works here, would not exceed 1-10th of that required there. So far as the local expenditure is concerned, the machinery must of course be obtained from England in both cases. The small cost of cultivation and manufacture by the natives is shown in the prices at which it is now sold; viz. 2½ rupees a maund of 25 lbs., or about 2d. per lb. of loaf sugar, not much inferior in colour to the finest made in England. This is made from the unproductive country cane, and grown and manufactured in the slovenly and wasteful manner, and on the small scale, in which all such operations are carried on in India. There cannot be a doubt that with the superior skill, knowledge and capital of Europeans, the sugar could be produced at much lower prices than the natives can make it. For instance, one vacuum pan of a small size, at Bunlipatam, can produce five tons of sugar a day; so that all the jaggery at present produced in the district cannot keep it employed, and the result of the manufacture up to this time has been highly satisfactory; so that there is now a prospect of an extensive sale of it. I take the liberty of forwarding a specimen of native manufactured sugar sold at two rupees a maund; though the Board will probably have had specimens already before them.

The sugar trade promises to supply the place of that of cloth.

Comparative cost of labour, &c. here with that of the West Indies.

Cost of sugar at present.

Successful manufacture of sugar on the European plan.

As to the extent of country capable of bearing this valuable product, I have reason to believe that it may be considered almost unlimited. Mr. Mackenzie informed me that he had grown excellent canes round his works, where, from its being so close to the coast, the land was comparatively very bad, and that he did not think there was an acre of ground in the whole neighbourhood where it would not grow luxuriantly. In the neighbourhood of Aukapilly, where it had been introduced by the late intelligent zemindar, Suria Precassce Row I saw the Mauritius cane growing in the greatest luxuriance; and, so far as I can hear, it has thriven wherever it has been tried.

Country generally capable of producing sugar.

The extension of the sugar cultivation affects the subject of the irrigation of the district essentially in two respects: 1st. If the culture of an article of foreign consumption is extensively introduced, a portion of the land and population will be taken off from the cultivation of rice, and the improvement of the irrigation of the remaining lands may of course be more freely undertaken, as there will be the same population to be supplied from a smaller extent of land, while, at the same time, from the improved circumstances of the people, there will be a larger consumption of rice than at present. It will also tend to encourage the improvement of irrigation by raising the price of rice. It has been openly argued by

Connexion of the sugar cultivation with the irrigation.

Supposed cause of the low price of rice,

Low price attributable to the scarcity of specie.

Proof that the depressed state of districts is not owing to over-produce.

Effects of increased productiveness.

No drain of specie while under the Native Governments.

Less water required for sugar than for rice.

Comparative value of produce of sugar and rice.

Quantity manufactured at Buntipatam.

Great encouragement to improved irrigation.

Specimen of sugar.

some, that the superabundance of the produce of rice, by lowering its price, has been the main cause of the depressed state of many districts, and this opinion is, I believe, still held by many. This is so fatal a mistake, that so far as it prevails, it must be a complete barrier to improvement in the state of the eastern parts of this Presidency. There are two ways in which diminution of price may be produced, viz., either by an increased produce of the article purchased, or by a diminished supply of the bullion with which it is purchased; now which of those two causes it has arisen from makes the whole difference. It is quite evident that while the revenue is collected in bullion, if a country is without the means of obtaining a constant supply from abroad, the quantity must rapidly diminish, and its value increase, or, in other words, price must fall; and the diminution of the produce would be a poor remedy for this state of things; it would only deprive the people of a part of their food, but in no degree improve the revenue, though it would certainly raise the price of grain. The only effectual remedy is to find an article of produce which can be exported to foreign countries from whence bullion can be obtained. That the depressed state of the districts is not owing to an over-production of rice, is indisputably shown by the fact that the only district on this side of the Peninsula which has regularly improved in revenue, and in every thing which can be taken as a criterion of prosperity, viz. Tanjore, is the only one that has invariably produced more food than it could consume. I have been led to make these remarks because I have so often, in speaking of the extension of irrigation, been met by this objection, that there was already too much food grown, as shown by the fall of prices. In my opinion it is absolutely impossible to improve the productive powers of the soil too much; for the only consequence of raising the necessary food by the fewer people, will be to leave a larger proportion of the population disposable for the production of comforts and luxuries. That the cause of the depressed state of these districts, arising from the large quantity of rice that must be sold in order to obtain the amount of money required to pay the taxes, is owing, not to over-production of grain, but to the failure of the supply of bullion, is most obvious. It is to be observed, that while the districts were under their zemindars they were in a manner independent of foreign trade; the bullion that was received in taxes was all spent within the countries, and there was therefore no necessary diminution of it; now, after paying the civil and military charges, the remainder of the bullion collected is constantly sent away from the district, and, unless produce is sent out to exchange for it, it cannot possibly find its way back again.

2d. The cultivation of sugar affects the irrigation essentially, inasmuch as the same extent of land will not require certainly one-fourth of the quantity of water that paddy does; so that every acre of paddy land converted into land for the cultivation of sugar, will tend to relieve the other murjah lands, and also the water flowing down the rivers in the months of April and May, which is at present made no use of whatever, will be most valuable when applied to the sugar cane.

The value of this cultivation may be shown in another way besides those mentioned, viz., the produce of an acre is estimated to be worth about 150 rupees, while that of an acre of paddy is only 12 rupees; so small an extent of cultivation as 10,000 acres would produce an export trade of 15 lacs a year taken at its cost of production; and as the small pan at Buntipatam is capable of manufacturing 1,600 tons a year, or about 3 lacs of rupees in value, a single sugar work, containing four large pans, would be sufficient for the manufacture of the above quantity. The general introduction of this new source of wealth is therefore calculated to make these districts the richest, as they are now the poorest in the Presidency; the revenue at present paid would then be scarcely felt by the people.

I trust the Board will excuse my thus attempting to bring this subject before them distinctly, with reference to the irrigation in question. I have been, as it were, compelled to it, from finding that the whole plan of my proceeding in the management of it must be fundamentally affected by the prospects of the foreign trade of the district. With a rapidly increasing produce of an article of foreign consumption, a much more bold system of improvement should be followed than would be advisable if the district was likely to remain in its present state.

The specimen of sugar I now send is of native manufacture, and cost two

two rupees a maund, or 18*l.* a ton. Mr. Mackenzie judges that it would sell for from 80*l.* to 85*l.* a ton in the English market. This, however, would not be admitted, as it would be considered as refined sugar, upon which a very heavy duty would be levied; but if such sugar as this can be produced for 18*l.* a ton, it is evident that an inferior kind can be manufactured at this rate. The finest sugar that would be admitted as unrefined would be worth, in England, about 70*l.* a ton; and supposing it cost here as much as the present sample, the cost of bringing it into the English market would be as follows:—

Profit upon sugar exported.

Cost in the district - - - - -	£. 18
Freight and charges - - - - -	9
Duty - - - - -	24

TOTAL - - - - -	£. 51

Value in England - - - - -	£. 70
Difference - - - - -	£. 19

The charge for freight, &c., was given me by Mr. Mackenzie; thus it appears that at the present actual cost, by the wasteful and expensive process used by the natives, there would be a profit of 19*l.* a ton; but there seems every reason to believe that with a proper cane mill and the vacuum pan, it could be manufactured at a much lower price than this, certainly as low as 12*l.* a ton, which would leave a profit of 27*l.* a ton.

It is evident that sugar could not keep up to its present price if it could be grown at anything like this rate in the West Indies; from the state of those islands at present, the price now obtained cannot afford more than a moderate profit, so that we may confidently conclude, that, including interest of capital and everything, such sugar as is sold in England at 70*l.* cannot on an average cost less than 35*l.* a ton for its manufacture in the West Indies. Hence we arrive at this result, that while the West Indies are the richest of the colonies, solely because they can grow sugar at 35*l.* a ton, these districts, which are probably the poorest at present, do actually produce it at less than 18*l.* a ton, and in all probability could produce it at 12*l.*; which is a most singular state of things, and can only be accounted for in this way, that the former protecting difference of duty of 8*l.* a ton prevented mercantile men from properly investigating the matter; and thus the advantageous circumstances of these districts were never rightly understood till the equalization of the duty caused the subject to be attended to. I should further observe, that not only have these districts the advantage over the West Indies, but we may safely conclude that no country in the world could contend with them, when labour costs little more than a penny a day; so that even if the Brazilian sugar, for instance, were admitted upon an equal duty, it could not injure them.

Cost of sugar in the West Indies.

Extraordinary neglect of the sugar culture in this division.

Advantages of these districts superior to all other countries.

Another point should be mentioned as of great importance: in Bengal, generally, the cane will not grow a second year, but it must be planted anew annually. Mr. Mackenzie has now a fourth year's growth from the same plant, and it is the strongest of the four. The West India superintendent considered the cane equal to the average of Guiana, and it is growing on the poorest land in the neighbourhood, being very near the sea, a small patch planted round the sugar works.

Superiority of these districts to Bengal.

I have not yet been able to obtain the statements of revenue, &c., which I wished to have added to this report, to show the extent of the demand for bullion which has been made upon them of late years, compared with that of the period while the cloth trade was flourishing, but I do not like to detain this diary any longer, especially as the Board have the means at hand of ascertaining the state of the trade, &c., from their records, if they should consider it necessary. I give, however, a statement of the revenue, &c., of Rajahmundry for 10 years, which, so far as it goes, will show how enormously the supply of bullion in the division must have diminished.

Statement of bullion withdrawn from this division lately.

REPORTS ON THE IRRIGATION OF RAJAHMUNDRY

Amount of collections paid into the Treasury in specie in 10 years, from 1832 to 1842	208 lacs.
Value of Exports, exclusive of salt, during the same period by land and sea	54
Deduct ditto of Imports	19
	—
	35 — 35
Paid out of the Treasury on account of Civil and Military Charges	53
	—
	120
Value of Salt exported, by estimation	10
	—
	110 lacs of rupees.

110 lacs withdrawn in 10 years.

Effect of the loss of the cloth trade.

Results of this examination of the foreign trade.

The value of the salt is not entered in the statements I have, but I am informed it is about a lac of rupees a year. It appears from this, that supposing the whole of the difference between the value of exports and imports had found its way back to the district in bullion, there would remain a diminution of the amount of specie in the district to the extent of 110 lacs in the last 10 years. It is quite certain that no more can return than is brought back by means of produce exported. There is no occasion whatever to look further than this for a cause for the fall of prices (or rather for the increase in the value of bullion), for in such a state of the case as respects the supply of bullion, even if the produce of rice in the district had greatly diminished (which it probably has), its price must fall; and this effect is not felt only in the district in which the cloth trade existed, but in other districts also that have been in any way connected with them; for instance, while, in consequence of the influx of specie and the employment of a large population in the cloth manufacture, the price of rice was comparatively high, the district could afford to buy from Tanjore; but that district has of late years been deprived of this outlet for its produce.

I trust that this statement will be sufficient to show,—1st. That a fall in price is not in the slightest degree a proof of over-production of rice; 2d. That while the revenue is received in specie, it is absolutely impossible to prevent its falling off annually, unless some article of export can be found equal to the amount of specie withdrawn from the district by Government; 3d. That while the cloth trade seems irretrievably lost, the sugar manufacture holds out the fairest prospect of being more than an equivalent for it; and 4th. That with such a prospect the irrigation both for paddy and for sugar may be improved to any extent, without the least fear of any evil consequences.

(signed) A. Cotton,
Captain, Civil Engineer, 1st Dⁿ.

Zilla Vizagapatam, Camp at Vizagapatam,
1 June 1844.

From Major A. Cotton, Civil Engineer, to the Secretary to the Board of Revenue in the Department of Public Works.

Sir,

On the 22d August 1844, I had the honour of writing to the Board on the subject of the state of the Irrigation department in the division. Since that Lieutenant Rundall and Captain Shaw were appointed, and an experienced surveyor

veyor, instead of one of the young hands that I had. Lieutenant Rundall was sent for the Vizagapatam works, but as I could entrust them to Serjeant O'Hara, I took him into the division, which was approved; he has now become a very efficient assistant, so far as he can be, considering his small degree of experience. Captain Shaw did not come till near the end of the cold season, and was removed again in a few weeks. Mr. Ottman is quite efficient for levelling and surveying, but he did not come till the cold season was nearly over; and nearly three months of the time he has been in the division has been occupied in completing the papers he brought with him from the 2d division, though he had also the aid of the other young surveyor, Mr. Blacker, and my maistry for several weeks; so that as yet he has been scarcely any help to me. Mr. Blacker is very well conducted and attentive, and I can pretty well depend upon his levels. I have therefore one effective young assistant, one experienced and one young surveyor, both efficient; but such a department in this division is so totally inadequate to the work that it is quite lost in it. I have before said, and after further insight into the state of the division I must declare, that the Government lose a lac of rupees a month, and in truth much more, by leaving the irrigation in the state it now is throughout the three districts. It must be remembered that no expenditure worth mentioning has been allowed for the irrigation here, even in comparison of other districts of the presidency, for a long series of years; the returns of expenditure in my second report on the Godavery shows what it has been in this district, averaging 800 rupees a year for 21 years, while in Tanjore it was 80,000. A zemindar lately called upon me who told me that his talooks, yielding three or four lacs a year, had been 17 years under management, and not a thousand rupees has been expended on his channels, &c. the whole time; so that on its being given up to him, he found all the works, upon which a principal portion of his revenue depended, in complete ruin; and this is the state of things generally. Independently, therefore, of any new projects, we have to bring up the arrears of 30 or 40 years' neglect; the main channel on the north-east side of the Eastern Godavery, the Tooliah Bagah, which used to convey water to 30 miles length of country, is now obliterated in some places, and receives no water till it stands 20 feet on the Rajahmundry standard; that is, only on 24 days in the year; and so on throughout the 400 miles length of this division. This, even in comparison with other divisions, both as respects its neglected state, and its great length, requires, at least double the superintendence that they do. But a third and most important point in which it is far below the other divisions, is in the state of the people; there is not at this moment a single individual in this district competent to superintend the construction of a large sluice, except perhaps the senior Cutcherry Maistry; and the ignorance of the Revenue servants generally of such works, their want of experience, and their slowness and apathy, is such as to make the business of the department quite a different thing from that of the other divisions. Here every thing is to be done; the Revenue people are to be taught both to look upon the work as a matter of importance, and also how to do it; and in a district where there are perhaps not altogether fifty masonry works of all kinds, including houses, there are hardly any artificers, and these so bad as to require double superintendence. Further, the very appointment of native Maramut superintendents does not exist, nor any suitable establishment in the collector's Cutcherry; and this, besides its direct effect, makes every one suppose that the irrigation works are only a most insignificant part of their duties, which must give way to every thing. The collecting of the revenue is looked upon as the only thing of any consequence; the care of these works, upon which the power of the people to pay the revenue depends, is considered as quite by the way, and only to be attended to when there is nothing else to do; and the consequence of this is plainly seen both in the falling-off of the revenue to the extent of lacs a year, and also in its instantaneous increase where, by the exertions of the late civil engineer, something has been accomplished, as in the Woondy talook in this district (statements of which are already before the Board), and in the estates of Bahurzully and Bitterzully in Masulipatam, also watered from the Godavery, of which a statement is here given.

STATEMENT, showing the Extent of Land cultivated and the Settlement made on the Bahurzully and Bitterzully Purganahs, bordering on the Colair Lake, which receives Supply of Water from Apparou Calwah, in the Zillah of Masulipatam, during the last 10 Years, from Fusly 1245 to 1254.

Fuslies.	Extent of Land cultivated.		Settlement.	
	Rs.	a. p.	Rs.	a. p.
1245 - - -	1,151	6 15	57,311	3 9
1246 - - -	855	14 14	39,945	1 9
1247 - - -	667	8 7	37,363	14 10
1248 - - -	797	13 11	39,867	10 10
1249 - - -	16	6 7	2,439	6 6
1250 - - -	302	11 13	13,406	9 9
1251 - - -	351	12 9	15,616	8 6
1252 - - -	663	7 13	26,542	3 1
1253 - - -	2,001	1 13	86,610	4 2
1254 - - -	1,709	1 0	64,945	15 2

How could such vast immediate returns be realized, unless every thing had been ready and waiting for the water, and the people in the greatest distress from being deprived of it?

That the Board may understand the state of things in the division in respect of the execution of works, I may mention the circumstances of the Bhoopiah head sluice. Last year when I visited the spot just as the freshes began, I found it had been built some weeks, and left unplastered, unprovided with shutters, and without any protection by fascine work or anything else, from having the earth washed away from the wing walls by the heavy rush of the water in the highest freshes to which it would be exposed, as it could not be shut. In the work itself every brick that came to hand had been used, burnt or not, so that many of them had dissolved under the first rains that had fallen. As the destruction of the sluice in this state appeared inevitable if there was any continuance of freshes, I gave orders for the immediate transport of rough stones to place round the wing walls and below the apron, gave particular instructions where they were to be put, and left orders with a surveyor to see that the stones were sent. I also directed the shutters to be made, which could easily be done in a few days. When I returned, after the monsoon, I found the shutters had not been made, and the stones that had been sent down had been left on the bank near the sluice, but not one applied to the work; and thus this large new work had been in imminent danger, and has escaped only from the river having remained only one or two days at its full height; this was not at all a case of the persons who should have attended to it being particularly inefficient; on the contrary, I believe they were rather better than ordinary. I append also a copy of a letter from Mr. Assistant-Surveyor Ottman, whom I have left in charge of the new cut of Sakenatepully. This letter points out distinctly one of the main, if not the principal obstacle to the execution of works in these districts; and it is the true explanation of the common remark inserted in bills, "not completed for want of workmen." I have every reason to believe that the present prices are ample, if the people received them, if the work was honestly measured, and if there was no delay in making the payments; and I have not the smallest doubt that we could spend five lacs with the greatest ease in the year at the rates now paid. There are now, I believe, about 2,000 men at work at Sakenatepully, and they would go on increasing as the news spread that the work was fairly paid for. It is to be observed that the man who had come to take charge of the work and relieve

relieve Mr. Ottman was sent expressly by the collector for the purpose, and was undoubtedly the best that he could find for the purpose. I had thus the alternative of allowing the work to stop, and thus lose the opportunity of passing the great fresh of this year through it, with the probability of the cut being thereby at once completed for us, and also of delaying it another year, or I must leave a surveyor, on 176 rupees a month, to superintend it; had I not left him there, probably not 200 men, instead of 2,000, would have been now at work on it.

It will not do, therefore, to let matters go on as they have done, nor will it be sufficient to order things to be done better. To put things into order, the whole subject must be taken up *de novo*, and in such a manner as to secure, as soon as possible, an efficient supervision, both as respects the executive and inspecting departments.

The things which I would therefore respectfully and earnestly recommend for the consideration of the Board are these:

- 1st. The partial or entire separation of the two northern districts of the division from the southern.
- 2d. The appointment of an efficient Maramut department in the Collector's Cutcherry.
- 3d. The appointment of additional officers.
- 4th. The appointment of European subordinate assistants in the Civil Engineer's department.
- 5th. The appointment of additional writers and maistries to the Civil Engineer's department.
- 6th. The giving additional powers to the civil engineers.

Respecting the first, the superintendence of the civil engineers over a long division of this kind, 400 miles in length, with such means of locomotion as he has, not being allowed to travel in a palanqueen at the Government expense, and if he were, being, whenever he made a run, separated from his office establishment, is in reality only nominal; it would take him about two months to march from one end of it to the other; and if he attempted to keep the whole of it equally under his eye, the only effect would be that he would lose half his time in moving; and further, the works in Rajahmundry are so much more important than those in the north, that it is most undesirable that he should be absent from that district for four months together at any time. The only remedy for this is either to make two divisions, or to place one or both of the northern districts under an experienced first assistant, who should have a separate charge, merely transmitting his papers through the civil engineer, if the Board should think it necessary. If the two northern districts were given to a separate officer, the northern part of Masulipatam, which is watered from the Godavery, might be placed under the Rajahmundry engineer, as the two southern talooks of South Arcot are connected with Tanjore, which, indeed, is desirable on many accounts, the villages of the two districts are so completely intermixed to the eastward of the Colair Lake. A year or two ago the tract south of the Godavery was, in consequence of the way in which the two districts of Rajahmundry and Masulipatam are intermixed, ordered to be placed under the civil engineer of the Second Division; but it would appear to be a better remedy to put them under the First Division, because the whole irrigation from the Godavery would then be under one officer. I am of opinion that the officer in charge of the northern districts had better be quite independent of the civil engineer, and communicate direct with the Board. His range would extend about 280 miles, and without any very large river or work.

On the second proposition I have before mentioned the necessity of a Maramut superintendent. There can be no possible reason why there should not be such an appointment here as in the southern districts; it is necessary, on every account, that a man of superior qualifications may be at the head of the executive division of the department, that he may have sufficient weight in the district, and also that persons entering this branch may have something to look forward to. It cannot be expected that any men at all of superior qualifications will enter or at least remain long in a department in which there is no one

appointment of any consequence. None but inferior men will remain in a department where the highest situation is inferior to all the higher appointments in the Revenue department. Such a man as Ramasawmy Naik, the late superintendent in Tanjore, could never have remained in the department, if the highest pay in it had been 30 or 40 rupees a month, and thus his peculiar talents would have been thrown away. The appointment, therefore, of a native superintendent on 80 rupees a month, with a promise that 100 rupees should be given to a person who was pretty well qualified for the duties, I consider one thing that is absolutely necessary to an efficient establishment. The appointment, also, of a head goomasta or deputy sheristadar in the Maramut department, to reside always at the Huzzoor, and have the charge of the office work connected with the department, is equally necessary.*

* Additional talook
maistries are also
absolutely necessary.

The third proposition is necessarily implied in the first. An officer of some standing will be required for the northern districts, with at least an assistant, if anything is to be done towards their restoration; and if an engineer cannot be found, an artillery officer or an infantry officer who has either been at Addiscombe or who has a turn for engineering work, I have no doubt, could be found. But two additional officers are also urgently required for this district, and especially, if possible, an officer who has been employed in the southern districts, where they will have learnt that something can be done.

The fourth proposition is as important as any of these. The value of European subordinate superintendence has been remarkably overlooked in the Tank department hitherto, and I have no doubt that wherever it is employed, it will repay its cost fourfold; but here, where we have to teach the natives everything in the way of civil engineering, it will be invaluable. The saving in every way by the employment of a non-commissioned officer of sappers on the works at Vizagapatam, who could at once secure the regular payment of the workmen, check the accounts, see that the work was well executed, and carry out new modes of performing the operations, such as the natives have been unaccustomed to, has given me a very strong impression of the incalculable advantage of adding such men to the department. In this district especially, where so many obstacles are thrown in the way of the execution of the works in delayed payments, fraudulent measurements, ignorance of all the details and consequent dislike of the charge of them, resident European superintendents are required much more than in the southern districts. In all important estimates a sum is allowed for superintendence, and this may as well be given to Europeans as to natives. It would, however, be certainly better that they should have a constant salary, independent of the particular employment at any time. We have also, as I have elsewhere stated, particular need for such men here, in order to search the district for materials; so few masonry works existing in the district, hardly anything is known of its resources in this respect. At a bridge on the Godavery Bank, in the second division, they had brought shell chunam (not fit for the purposes) up the river from the coast 50 miles, while there was hydraulic lime within three miles of the spot, that would not have cost more than one-third of the price of the former. A great deal of my time has already been expended on searching for and trying different materials (which might have been employed on my own proper duties), especially with reference to the construction of the anicut, for which we must be prepared with a stock of acquaintance with the means we have around us, and the most economical way of applying them, before the sanction arrives. I have no doubt that, upon the whole, with European subordinate superintendence, the cost of works in this district will be reduced to two-thirds or half of what it now is, besides being incomparably better executed, both as respects their durability and effect; and the officers will thus be left almost entirely at liberty to plan and inspect, which will have the effect of doubling their number. Every non-commissioned officer should be allowed an interpreter till he has qualified himself in the language, when he might have an increase of salary. On the 5th proposition, I remark that the civil engineer of this division has only one writer, and the assistants none; it would seem to be easy to convince any person that this must be a mistake. To employ an officer on 300 or 400 rupees a month, and perhaps of 15 years' standing, in the duties of a native English writer, who would be paid 30 rupees, is very far from being an economical arrangement. It does not, however, appear quite clear, from the Board's letter to Government, whether it really

really was intended that an assistant in this division should not have a writer; and it is to be supposed that his time would be as valuable as that of an assistant employed in one of the other divisions. The civil engineer was stated in the same letter to require only one writer, as there was less writing than in the other divisions. This seems to have been said with reference to the old state of things, when only 12,000 rupees a year was spent; but that state of things is in fact now the strongest argument on the other side; the long neglect of the irrigation makes it now necessary to write and spend double what is done in other divisions. I also consider the appointment of young maistries of great importance. At present we have no means whatever of providing for a supply of instructed maistries; and the most effectual means of remedying this is, in my opinion, the appointment of one assistant maistry to each officer, on a moderate salary, perhaps 20 rupees a month, and of one or two on a trifling pay, a bare subsistence, to enable the engineers, whenever they meet with intelligent young men, to keep them in their camp, and give them an opportunity of learning the duties of the department. This was the constant practice of the late Ramasawmy Naik, superintendent of Tanjore, who thus generally had some person ready, of whose qualifications he could judge, for any appointment that fell vacant. At present this must be done, if at all, at the expense of the person who selects them.

Respecting the 6th proposition, I do not touch upon the question generally of the degree of authority given to civil engineers; but I must say, that I think that the knowledge by the native agents, that he has some direct power over them, is necessary to give him the requisite influence in these districts. Even as long as there is a collector who will determinately support him, yet, while the revenue officers know that he can do nothing beyond making a complaint of them, he has not that authority in their view which seems to me to be necessary, at least under present circumstances, when the importance of the irrigation works has been so long lost sight of; and I would therefore propose, though with deference, that the civil engineer should have the power of fining, to a certain extent, all to whom he has to give directions, or upon whom he has to call for information. If it was known that he had such power, it would be very seldom necessary for him to use it, but it would remove many difficulties which at present stand in his way. I must say that I think this worthy of the serious consideration of the Board, though of course there may be objections to it that I cannot judge of; yet something which will give the department increased weight with the native authorities, I consider very necessary.

Almost all that I have now written has reference to the present state of this division, in respect of its old works, and independent of any grand and new project. The division has been almost totally neglected for 40 years; the works are almost without exception in ruins. They were originally very imperfectly executed; and whether the whole is re-organized, or only the old works are restored and improved, in either case an effort is demanded. It may be thought that too much importance is here given to the subject altogether; but nothing but some theory misapplied can lead to such a conclusion; the facts are so plain, that if any line of argument leads to it, it is certain that there is a fallacy somewhere. If we take the instance given above of the two estates in Masulipatam (and any number more could be given if required, such as all Tanjore, the two Southern Talooks of South Arcot, Woondy Talook in this district, &c.), we find that the revenue actually varied from 2,400 to 84,000 rupees within three years, solely, without any doubt, owing to the different quantities of water it received in these years. The first of these two years the local rains failed, and the irrigation channel from the Godavery had been neglected for 40 years. In the interval, 7,000 rupees was expended in clearing the channel; and though the estates do not comprehend half of the lands affected by the channel within three years, the revenue is increased by 84,000 rupees. It is no answer to this that the second was a more favourable season. In what was it more favourable? Only in there being more water, which is the point to be established; that is, that more or less water made a difference of 84,000 rupees out of 86,000; and can it be said that any probable difference in revenue management, or anything else whatever, except actual war or rebellion, would make a quarter of this difference? And this difference is not the effect of a long-continued but gradual improvement, but the immediate effect of trifling repairs.

The works were executed in 1841 and 1842, and the revenue of 86,000 rupees obtained in 1843. Yet this by no means shows the whole effect of a supply of water. The channel is a most imperfect work, only providing water in good years for about 40 or 50 days, and providing a supply by the Colair Lake for perhaps 60 or 70 days more to some of the lands; while the river contained, in the worst of these two years, 50 times as much as could be used in the whole Delta during the rice crop. Had these estates had a share of the summer water of the river, and at the same time as much as they could use during the freshes, they could have more easily paid 3 lacs than they did 86,000, supplied as they were. I cannot see how, if we will but thoroughly consider such facts as this, we can possibly escape the conclusion, that after providing for the peace and order of the community, the first of all things is to secure a supply of water to the utmost extent that our natural sources will afford it.

In what is here said, I have not considered at all the state of the people; the misery implied in the fact of a year's revenue amounting to one-thirtieth part of what the same estate can pay when better supplied with water, is what no European can form any proper judgment of. There is no necessity for me to urge the importance of this part of the subject.

I am sure the nature of this question, involving so immediately the welfare of the people and the amount of revenue, to the extent of at least 12 lacs a year, will be a sufficient apology for my again addressing the Board at length on the subject, and also giving my views of what is required. The year which has passed since I was appointed to the division has been almost entirely lost; scarcely anything has been done except the preparation of the plans and estimates for an annicut; but if officers and surveyors could have been sent at this time last year, many subordinate works of importance, and required whether the annicut is executed or not, might have been already finished, probably to the extent of two lacs of rupees; and the returns from them, to the extent at least of their cost, would be received into the treasury before many more months have passed. This is not a question of a matter of speculation; it is simply that of the recovery of ground which has been lost during 40 years of neglect of those works, the importance, the absolute necessity of which, even the Native Government could see. Works are at least as necessary as the repair of a barrack, which, if neglected for 40 years, might fall some day upon the regiment occupying it, and in fact incalculably more important, inasmuch as that the lives of tens of thousands are involved in it. This district is at this moment, though the monsoon season is far advanced, almost entirely without rain; and rice has risen 40 per cent. already; if only the monsoon were entirely to fail, as it did in 1832 (and as it certainly will within a few years, if it does not in this) very probably 60,000 people will perish, while there is now water enough in the river to supply 20 such districts. In the present state of the irrigation of this district, this would be the inevitable consequence of a failure of the monsoon, not to speak of a permanent diminution of revenue to the extent of several lacs. Such is the precarious state of a district possessing a most healthy climate, a soil of the very first quality, fitted for the most valuable products, and an unfailling supply of water from one of the noblest rivers in the British dominions.

As the two following objections were mentioned to me when in Madras, in discussion about the annicut, I might here, perhaps, be allowed to answer them; they are, Where is the money, and where are the officers to come from? To the first, the only answer is, how is the loss of revenue borne? 15 or 20 lacs in this district within a few years; 50 or 60 lacs in Guntoor since the famine, and so on, through the neighbouring districts. If these losses can be borne, it would seem that an expenditure of a few lacs, which would be recovered within 12 months from their expenditure, could be borne. The answer to the second is, that this is an urgent case; if experienced engineer officers are not in existence, others might be found, who, from natural talents or education, would soon be able to make themselves useful in the department.

Under the pressing circumstances of this division, I have the honour to request that the Board will be pleased to give these propositions, which I have ventured to make, early consideration, if possible, and either to recommend them or others more effectual, so that we may be prepared to set about the restoration of the division

division as soon as the monsoon is over. If the matter is deferred for two or three months, the whole year will be lost.

Upon the whole, I can most confidently assure the Board, that, in the present state of disorganization of the department and ruin of the works in this division, any addition, made judiciously, either to the Collector's department, in the way of native superintendent Gomashtahs, Maistries, &c., or to the Engineer's department, in the way of officers, European, N. C. officers or natives, three times their cost at least will be saved; and whatever is expended with tolerable skill in the construction of works, will yield, on an average, at least 100 per cent. in direct revenue, besides improving the state of the people, and increasing the extra revenue.

I have, &c.

(signed) *A. Cotton,*
Major, C. E., 1st Division.

Rajahmundry District,
Camp at Dhowlaisweram,
27 August 1845.

(True copies.)

(signed) *T. L. Peacock,*
Examiner of India Correspondence.

East India House, }
23 March 1848. }