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Revenue DEPARTMENT

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Proceedings of the Madras Government, Public Works Department,
31st March 1875.

No. 642. Read the following :—

No. 155-A.

MEMORANDUM.

THE following notes on works inspected in the Tinnevelly District in October and November 1874 are submitted for the information of Government.

Tambrapoorny Irrigation.

2. The Tambrapoorny would be a river of importance in any district. In Tinnevelly its importance is enhanced by the contrast which the lands irrigated by it present to those which are in its neighbourhood but beyond its influence. It has a very small catchment basin, the whole area drained* by it being about 1,750 square miles, while by far the greater part of its supply is obtained from the small area of 200 square miles above the junction of the Manimuthinuddy. There are eight anicuts across it, and the following is an abstract of the irrigation :—

* Above the last anicut at Strivigumtum.

	Anicuts.	Channels.	Bank.	Acres.	Revenue.	Totals.
1	Kodamelalaghiyen	East	Left			*
		West. ...	Right			*
2	Nachiyany	Nachiyany	L.	1,119	12,968	12,968†
3	Cannadien	Cannadien	R.	9,574	1,79,812	1,79,812†
4	Ariyanaikapuram	Kodagan	L.	4,419	66,173	66,173
5	Pallavur	Pallem ...	R.	7,689	1,01,945	1,01,945
6	Suttamullay	Tinnevelly	L.	5,345	65,502	65,502
7	Maradur	East. ...	L.			*
		West. ...	R.	9,161	1,19,323	
8	Strivigumtum.	North ...	L.			*
		South ...	R.			*

* Not known by the District Engineer.
† Approximate.

Kodamelalaghiyen dam.

3. This work is a dam rather than an anicut. The river, after descending the Papanassum falls, has a short and comparatively level reach; then passes through a narrow gorge which is much blocked up by huge boulders which have fallen from the hill on the right bank into a deep pool, and a reef of rock at the lower end of this pool has been made use of for the dam. In the rock holes have been cut, in which posts, for the most part of palm trees, are inserted; against these cross bars and brushwood and other stuffing are placed, and so the water is held up for the supply of the channels leading off from either bank. The greater part of the dam is swept away by each considerable fresh. Some inams were granted in former times for the construction of this dam from time to time as required. It has been proposed to construct a permanent anicut in place of the dam, and there can be no objection to the subject being investigated and an estimate prepared. With rock foundations the weir would not be very costly, and probably the advantages would compensate for the expense. Proper regulating works at the heads of the east and west channels would form part of the scheme, and, indeed, it would be desirable in any case to provide head sluices. Parts of the east channel, which at first runs to the north of, and then crosses to the south of, the Ambasamudrum

road, were seen, but inspection of this a-

Facilities for channel inspections required.

of most of the anicut channels is impracticable on horseback, and tedious and difficult on foot, owing to there being no continuous pathway, to enclosures being carried on to the banks, and to obstructions of all sorts. Frequent inspection is essential to efficient maintenance, and, in carrying out clearances and improvements, it should be steadily kept in view that bridle paths are necessary, and should be provided as soon as possible, all obstructions being entirely removed. Soil taken from fields when lowering* them should not be placed on channel banks without permission, and then only in a regular manner, so that the proper level* of the bank may be preserved.

* Whatever that may be determined by the District Engineer to be.

4. This anicut is not at all in efficient order. It is difficult to inspect it at all, and that part of it, forming the head of the channel of the same name supplied by it, is altogether inaccessible from being covered with long grass and scrub jungle. Two or three channels in rear of this part were discharging a good deal of water, but whether this came from sand sluices, or from the dam being out of repair, could not be ascertained. The anicut is composed of rough stone uncemented. The crest is of large stones, some of them measuring 10 × 2 × 1½, or rather more. Many of these stones have been carried away and are lying about in rear, and much of the sloping apron also has been washed away. Either the old section should be restored, and this can be done without emptying the pool above the dam, or a regular body wall should be built with a vertical fall on to a masonry apron, or with a sloping apron carried down at about 1 in 12 to the bed of the river.

Nathiyany anicut.

The channel should be provided with a head sluice as soon as possible.

5. This weir is just below the junction of the Manimuthinuddy with the Tambrapoorny. The body wall is a substantial work faced and coped with cut stone, and is in good order, except that there are a few considerable leaks. The apron had a slope of perhaps 1 in 7 or 8, and then probably a drop, but there is hardly a bit of it left in position, and all the stone of which it was composed is lying about in confusion in rear. The weir has been, it is said, in this state for several years, and Mr. Rundell says that he has seen no alteration in it for the last three years. There may be rock every where, but all that can be said from an inspection is that 8 or 9 feet of the body wall are exposed, and that in the absence of rock a breach might easily take place. It will be best to form an apron 15 feet wide, at 6 feet below crest level, of the largest stone available which should be placed on end; then outside and in support of this there should be a mass of the boulders which at the junction with the horizontal apron should be about 18 inches higher than the latter, and be carried thence by a slope not steeper than 1 in 12 down to deep bed level, the rest of the stone being disposed of nearly horizontally beyond the foot of the slope.

Carnadien anicut.

For the Carnadien channel, which takes off on the right bank, a head sluice is under construction, and will be finished in 1875.

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6. This weir is on the Manimutihnuddy, a short distance above its junction with the Tambrapoorny. It supplies the Kothikal on the right bank. The embankment behind the right wing should be put to rights. This end of the dam for a length of 90 feet is composed of large stones laid transversely in a brick-in-chunam wall; it is out of repair, and needs immediate attention. The first sand sluice requires repair and shutters. Another sand sluice of two vents is in pretty good order. There is a great deal of leakage which should be stopped, and the state of the interior of the dam should be ascertained. Some of the rear face of the body wall has been slightly displaced. The rough stone apron is all in disorder, and it should be repacked 3 or 4 feet below crest level. The left wing, which is of brick-work, wants immediate repair, or the undermining, which has gone on already to a considerable extent, will bring it down.

Manimuthinuddy anicut.

7. This is situated on the Tambrapoorny, and is the fourth weir. It supplies the Kodagan channel on the left bank, and for this a head sluice has been recently sanctioned. The anicut proper is a body wall of, as far as is known from the partial removal of the covering, indifferent brick-work with a stone facing and crest of stone not well fitted. The rough stone apron in rear was originally nearly flush with the crest at its junction with the body wall, and then sloped away for a distance of 9 or 10 feet, beyond which point there was a drop. Nearly all this apron has been displaced, and it must be restored, though not on the old section which was a weak one, as without a retaining wall at the end of the slope its failure at this point was almost inevitable. Probably the best plan will be to pack picked stone at the foot of the body wall on a bed of concrete and to fill the interstices with similar material, but weep holes must be left under the apron, or through it, to pass the leakage which is very considerable. Nearly half the dam is a leading wall to the head of the channel, and is of about the same height as the anicut proper. The crest of this portion is of carefully fitted stone; the rough stone apron in rear is in great disorder, and either an apron is not required at all, or it should be put and kept in proper order. The ground in rear of this part of the anicut has a great many trees and much grass upon it, and the former are out of place in what is the river bed in considerable freshes. There is a sand sluice near the head of the channel, and a more powerful work would be an advantage; it might be placed where the apparently useless calingulah just below now stands. The wing wall at this end is too low.

Ariyanaikapuram anicut.

8. This anicut supplies the Paliem channel on the right bank; for this a head sluice has been sanctioned, and the site selected is suitable: the alignment of the head of the channel can be improved without difficulty, and a more regular section should be given to it by degrees when making clearances. The weir is an oblique dam; the half of it towards the left side of the river has a cut-stone surface and slightly curved rear slope; it is in good order. The other half has a body wall with rough stone packed and forming an apron; some trifling repairs are required, but the bed of the river in rear is remarkably high. At a sand sluice a short distance above the head of the channel the leakage through the right side wall should be stopped. A little rough stone is required above the body wall here and

Pahlavar anicut.

there, and grass must not be allowed to grow above the level of the crest of the anicut. The bricks of the face wall built to reduce leakage are for the most part indifferent. Small repairs are required in many places to the body wall and apron.

At a little more than 6 miles from Palamcottah the Palicm channel crosses the Pachiyaur. This river has a shallow sandy bed, and interferes much with the efficiency of the channel. It was observed that the wings of the two large surplus weirs by which this drainage is passed across the channel were too low, the embankments not sufficiently regular, and that revetments were necessary in continuation of the wings. At the end of November a heavy fall of rain occasioned much damage here, a result which need not cause surprise. A powerful set of under-sluices* should be provided: the crests of the weirs should be brought to channel full supply level, and their length should be such as, with the sluices, to pass the maximum flood discharge with a depth of 2 feet going over; the wings should then be 5 feet above the crests, and the embankments should be levelled, and, where necessary, properly protected by revetments: then the Pachiyaur may cease to be the nuisance it has hitherto been. The channel passes close to Palamcottah. It is an old work with the defects which such generally exhibit, the width, fall and banks being irregular, trees and bushes being much in the way, and inspection difficult. There is a great number of distribution sluices. The channel is crossed by several cart and a great many foot bridges, the latter being built with beam stones resting on vertical stones fixed in the bed of the channel. There is much weed in the bed.

* *Vide* endorsement No. 1,071, dated 19th December 1874, to District Engineer's report of damage.

9. This is the sixth anicut, and it supplies the Tinnevelly channel, for which a head sluice must be built as soon as possible, the floods of last November having shown once more the urgent necessity for the exclusion of excessive quantities of water from this and other similarly circumstanced channels. This anicut was the only one which was not inspected.

Sathamullay anicut.

10. This weir has to the north-east of the Palamcottah, and channels take off from both flanks. The anicut is not in good order, and it has clearly not been inspected in detail after the freshes of each year to ascertain what repairs may be required. Such inspections are essential, and the District Engineer should take care that every Range Office has a register of all important irrigation works, masonry and other, and that dates of inspection by the Range Officer himself, with references to the papers in which particulars of the action taken thereupon are detailed, are duly entered therein. Inspection should, of course, be made from time to time by subordinates, and the results communicated to the Range Officer, but the latter must be held individually responsible that all the wants of these important works are attended to year by year, or oftener if needful.

Maruney anicut.

There are a great many sand or under sluices in this anicut, and several of them are out of repair. Several of the lining stones of No. 4 sluice have disappeared. Near this apparently the anicut breached many years ago, as the remains of an old body wall are to be seen below the dam, and there is an inscription stone which states that the anicut was repaired in 1792. No. 7 sluice is greatly out of repair;

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the head must be rebuilt and the sluice closed until this has been done. It is dangerous in its present state.

The cross section of the dam varies considerably and changes several times. It has, however, for the most part, a curved or rounded crest with a concave slope in rear and a drop at the end of this cut-stone covering, the rear face wall being of large-sized and fairly regular-shaped rubble. Near No. 4 sluice there is a length constructed with transverse stones 11 or 12 feet long set in brick and chunam, and this part has a crest of brick-work. Parts of the rear face wall are undermined, or otherwise in need of repair. The rough stone apron below the dam is every where in disorder, and would seem to have been so for some years.

At the two vent sand sluice near the west channel the ground below is 8 or 9 feet below the sluice floor. It would appear that there was a rough stone apron formerly which has been washed away. Apparently there is rock, but it should be ascertained exactly what the circumstances are, and whether any lower apron or other work is needed for the security of the anicut.

Sluices Nos. 9 and 10 have the appearance of requiring rough stone aprons in rear.

Head sluice right bank or west channel (Melakal.)

11. This sluice was under construction, but the ryots were very anxious that the channel should be opened; this had to be allowed a few days afterwards, and the work was not sufficiently advanced to allow of constructive work being gone on with while the channel was carrying a supply. At the end of November the flood water entering this channel did a good deal of damage. The bricks and the soorkhee obtained from them are much too sandy, otherwise the masonry work is good. It may be mentioned that the very rough surface of the stone in the vents of the sluice is not an advantage, and, though effective as regards appearance in bridge-work, it is hardly suitable to regulating works, information regarding the discharge of which is required. With good burnt clay the lime used would do very well.

Head sluice, left bank channel (Keelakal.)

12. An old work not requiring much repair, but the little needed should be done. It is said that the fresh of 1869 topped this sluice, and it ought to have been raised, and the embankments connected with it brought to a proper level immediately afterwards. In November last the fresh either topped, or very nearly submerged it, and a breach occurred in the flood bank just above it. It is not satisfactory that the warning of 1869 should have been disregarded. The sluice road-way should be raised about 4 feet.

Tambrapoorny old anicuts require greater care and attention.

13. The remarks on the state of the Tambrapoorny old anicuts above given will show that they have not received that attention which their importance demands, and that it is requisite that they should have much more care taken of them in the future. It would be extremely discreditable were accidents from neglect to occur, and it is hoped that next time they may be inspected a much more favorable report of their condition will be possible. It is by no means necessary to spend money on work which, though formerly deemed needful, may not be required, but the exact circumstances of walls

and works, which have lost the protection of aprons, must be ascertained, and the lessons, which the instability of the aprons on the old sections teaches, should be turned to account. Sloping and horizontal aprons are both good in their way, and both can be made quite efficient if the materials be suitably arranged. There will but seldom, if in any case, be any need of new material, and what is available should be made the best use of according to the circumstances of not only the individual anicuts, but of particular parts of these works. The first thing to be done, therefore, is to ascertain where there is rock, of what kind it is, and where this firm substratum is wanting.

The use of sand sluices.

14. Sand sluices, as a rule, are of no use when situated at a distance from the heads of the channels. Such works in connection with the head sluices which are now being, or will shortly be, built will be of considerable utility, and where a site on rock can be obtained near a head sluice, it will be well to provide a sand sluice, and, if a platform can be conveniently arranged for on the level of that of the head sluice, this, from which to work the shutters at all suitable times, should be allowed.

Strivigantum anicut.

15. The only work remaining to be done at the anicut is the completion of the coping which was in progress and for which all the stone was ready. This coping is being very substantially done, and it is excellent work, but it is not an advantage that it should be left with a very irregular surface, though no alteration need now be made. The joints were being raked out 1½ inches deep and then pointed with portland cement which should be kept quite moist by putting 3 or 4 inches of wet sand over it. The masonry apron was in very good order; the first rough stone apron was in good order; some of the surface stones are very small, but none have been disturbed; at the outer rough stone apron only a few of the outside stones have been displaced. Beyond this apron the river bed has been lowered about 3 feet. Sections should be taken from time to time to show changes, and the information thus obtained should be acted upon as may be needful.

Nanel and grass had better be cleared from the aprons entirely, that discharge may be direct and equal. A belt of nanel may be encouraged to grow in the bed of the river along the edge of the apron to induce accumulation of sand and mud as a support to the stone, but otherwise no grass should be allowed within the limits of the bed proper of the river. There is a great deal of nanel to be removed from the river bed above and below the anicut. The under-sluice shutters fit badly, and the Lascars want some thing to stand on to work them. Two cross stones behind and one in front of the shutters should be fixed to form a small platform.

The abutment faces in the wings are of brick-work plastered, and these patches of plaster have a very mean effect, all the rest of the wings being stone faced.

South channel head sluice.

16. The water was at ⅜ above 4' 10' below this sluice, the full supply depth in the channel being 4½ feet. It was evident that the channel was not drawing properly, the water level being * at would be produced by a dam across it. The bed should be levelled, and obstructions due probably to silting should be

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removed. A platform for working the shutters should be provided. The pitching of the channel slopes below the sluice has been somewhat disturbed, owing to no backing to the stone having been allowed.

North channel head sluice.

17. Here the difference of water level above and below the sluice was smaller than it should have been, but a less head is required, the sluice being larger in proportion to the discharge required. The head of the channel was not well laid out originally, but no erosion was visible; the revetment or pitching on the left side has yet to be extended.

Anicut Superintendent required.

18. An Anicut Superintendent and six Lascars are required to manage the head works. At Strivigantum this establishment is particularly needed, because the freshes are of very short duration, and it is necessary to make the most of them, and at the same time requisite to confine the discharge of the main channels to the full supply they can safely carry. The District Engineer should make the usual application for the sanction of this conservancy establishment.

Irrigation south or right bank of river.

1869.

19. The south main channel, with the exception of clearances which are indicated by the water levels at the head sluice to be needed, is in good working order from its commencement at the head sluice to its end at the Kadamba tank head sluice. The banks, as noticed on the occasion of a previous inspection having been originally thrown up in a very rough and irregular manner, are still far from what they should be, but they have been very much improved, and from Alwar Tinnevelly to the lower end there is a good fair weather road along the left bank. At Alwar Tinnevelly two bridges are about to be constructed with the money sanctioned for one supplemented by subscription.

Kodamba tank head sluice and weir.

20. The water reaching the lower end of the south main channel is passed into the Kodamba tank by a head sluice and a weir, by which latter work also the surplus of the Tenkarei tank is passed on. At present the quantity of such surplus is liable to be injuriously great, * but the head sluice for the Maradur anicut right bank channel is under construction and, when the river supply is brought under regulation, much of the danger will be removed. The tanks to the westward must, however, all be put into thorough repair. North-west of, and adjoining, the Tenkarei tank is that of Wullur which has a surplus weir discharging direct into the Tambrapoorny, and flood waters when not wanted in the Kadamba tank can and should be there disposed of. Such improvements to that weir, as may be necessary, should be carried out. At the weir along-side of the Kadamba head sluice a bridge-way on beam stones has been formed, and the under side of these stones is stated to be 2¾ feet above the crest of the weir which is one foot below full tank level, and that is 1 foot below (anicut) head sluice sill. There being no guages at these works, it is not easy to judge exactly what the water levels at the time were, but it certainly looked as though full tank level would be much higher than that above mentioned. A nose or spur

* This has again been the case in November 1874.

between the right upper wing of the head sluice and the left front wing of the weir will be an improvement.

Kadamba tank.

21. The bund of this tank was breached by the floods which occurred shortly after the inspection of 1869, and repairs were apparently confined to making good damage thus occasioned for the condition of the bund would seem to have deteriorated during the last five years and, as far as can be judged, it could not now hold a full supply. This should be seen to at once, and the necessary repairs should be carried out before this time next year: the top of the bund may be placed at 4½ feet above F. T. L.

The tank had a narrow escape at the end of November 1874.

The surplus weirs are at the east end and well situated: their present condition is far from satisfactory, but the District Engineer has postponed their improvement until the exclusion of river flood water from the Tenkarei tank shall have removed the danger of having a very large amount of surplus to dispose of. There is now no need of further delay, but, until the tank bund shall have been put into proper order, it will be well to keep the crest of the surplus weirs at a lower than full tank level. It is very important especially in connection with the supply of the Puriyur channel and of the tanks dependent thereon that this Kadamba tank should be capable of holding a full supply whenever water to fill it may be available.

There is some very fine nanel growing on parts of the interior slope, and the planting of this should be steadily persevered with until a good belt has been established all along. The bund has been cleared so as to allow a free passage along it, but there are a great many old hollow and decaying trees which should be removed, and any others which may interfere with the nanel plantations should be cleared away.

The deep sluice of this tank is about to have a new head given to it at the bund, so that the discharge may be properly and conveniently regulated.

Puriyur head sluice.

22. This work has been well built in accordance with the arrangements detailed in paragraph 12 of the note printed in Proceedings, Madras Government, 18th January 1870, No. 193. Its shutters are fitted with screw gearing which works well. The level of the sill was fixed at 5½ feet below full tank level, and the District Engineer is of opinion that it would be better to alter it to 1 foot lower; and undoubtedly it would be of great advantage to the tanks supplied by the Puriyur channel were such an alteration made. On the other hand those cultivating under the Kadamba tank are much opposed to any change. Recently a channel has been dug from above the tank head sluice to supply the lands which have hitherto been irrigated by the highest sluice (—7), but there are three sluices at — 9 which would certainly be rendered much less efficient were water drawn off at the Puriyur sluice to —7·50 or even —7. It is, I think, too soon at present to come to a decision either way. The anicut is not yet quite completed to its proper level, some 200 feet of the coping stones having yet to be placed, and what the supply in the channels will be is as yet not sufficiently well known to allow of deductions being made therefrom. Then, too, the seasons for several years past have been

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adverse. While, therefore, by no means wishing to negative finally the District Engineer's proposition, it seems to be desirable to wait for two or three years before introducing a change which would be very strongly opposed, and these objections cannot but be allowed considerable weight, seeing that the sluice was built at a level which was fixed after due consideration of the interests to be taken into account.

A little more nanel should be planted immediately below this sluice to stop wash.

Gauges.

23. Gauges are required above and below all regulating works. The District Engineer appears to have been waiting for the enamelled iron gauges for which he indented a long time ago, but these may not be available immediately, and certainly many more than he is likely to get, until they have been tested and another supply procured, will be wanted. For use during the next two or three years therefore, painted wooden gauges should be made up and fixed in such a manner that they can be taken out and cleaned annually and, when necessary, repainted.

Water reports.

24. It will be well at once to introduce forms of water report which should be sent to the Range Officer as frequently as possible, so that he may know what quantity of water is being supplied at the head sluices at the anicut, and how it is being distributed. These reports are essential to efficient management and to enable the Range Officer to issue orders for such modifications of the distribution as circumstances may show to be necessary. The District Engineer is well acquainted with the practice in vogue in the Godavery Delta, and a modification of this can be made to adapt it to the comparatively small establishment available for regulation purposes here.

Puriyur channel.

25. This channel is, for the most part, in very good order. The banks at the upper end for a distance of a few hundred yards want putting to rights, and below the drop in the 3rd mile some planting and regulation of the bed are required. The side slopes have been carefully protected with grass, and for the soil the channel has been very well maintained.

Ammenpuram tank.

26. Some nanel planting all along the interior slope has been commenced, and in a year or two this slope will be effectually protected. The bund does not want much in the way of repairs. Several new sluices with shutters easy of regulation have been built, and others are to be constructed.

Kanam tank.

27. This is now a continuation of the last-mentioned tank. The interior slope is being protected by nanel planting. The bund is too low for what is said to be full tank level.

Kanam channel.

28. Except at the lower end this channel runs through sandy soil. It is quite ready for use, and has several distribution sluices; but up to the time of my visit there had been little or no water available.

29. This tank has been greatly improved in connection with the anicut project. It has a long bund, the soil of which is a whitish loam, and this melts away in the water. Nanel has been planted, but it is doubtful whether it will grow, as there is much salt in the soil, but with fresh water from the river this difficulty may be got over. The surplus weir has unfortunately been built at the south-west end, and its discharge would cross the irrigation channels. The District Engineer proposes, therefore, to move it to the head of the swamp drain, and it will be better to do this at once than to injure the channels and lands when the latter shall be brought under cultivation.

Ellapanaikan tank.

30. A great deal has been done for this part of the country from the special funds at the disposal of the Collector. Among the principal works are the following:—

Special Fund Works.

(1.) The Kadamba tank surplus channel has been embanked so as to prevent inundation of the neighbouring rice fields.

(2.) The swamp parallel to the Trichendore road has had a drain cut through it.

(3.) Several new tanks have been made, and old tanks restored.

(4.) Minor distributaries have been cut.

(5.) A drain through the swamp below the Ellapanaikan tank, has been cut.

(6.) Many roads and village communications have been made or improved.

Some of these works were inspected; they have generally been carefully executed and, where necessary, defects of detail were pointed out to the District Engineer.

31. This channel is supplied by a head sluice in the left bank of the southern main channel near its lower end. This sluice has two vents, 2 feet by 4 feet, and it is said to be too small, but the evidence was not conclusive, and, if the channel be put into good order with its proper fall, it appeared to me that the sluice would pass all the water intended. The channel runs on a comparatively high level, crosses the old Autur channel which has a head sluice in the river bank, follows the line of the embankment, supplies the Shaytavaikal tank, and afterwards discharges over a regulating weir into the old channel by which the supply is carried on into the tank of the same name. It is said that there is much loss of water in the sandy soil through which the channel runs, but the information available was not very definite, and such rough observations, as could be made on the spot in the absence of any gauges at the drop, aqueduct, etc., hardly supported the conclusion which appears to have been based to a great extent on the fact that the Autur tank does not get as much water as the ryots would desire to have. It can easily be ascertained what loss there really is by reducing the discharge at the head sluice to the quantity just sufficient to reach the drop, and this quantity will be the loss. If the absorption be found to be considerable, the trial being made after the channel has been running full for three or four days, it will be well to throw the supply for the Autur tank into the old channel e the aqueduct and to the use the new channel beyond this point only for the su of the land above the old channel. The part

Autur channel.

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of the old channel in use is a good one. Some of the distribution sluices want putting to rights; those which have been repaired have huge head walls which have no connection with anything, and at present consequently a waste of money. Head, face and wing walls should be exactly adapted to the position they are to occupy; this self-evident requirement is one which, strange to say, is very often not thought of until after the works have been built. A bridge of four spans over this channel had a hole in its roadway; the wings were uncovered; and altogether the work was in a discreditable state of unrepair.

32. This is very shallow, and holds much less water than is necessary for the safety of the cultivation under it. Practically the only way of increasing its capacity is to join the bund on to the channel banks and to raise the full tank level. It can be ascertained what this arrangement would cost. A new sluice in the bund has its front and rear face walls 2 or 3 feet too low to support the bund at its proper slope; had the actual section of the bund been plotted on the plan, this mistake would have been avoided.

Autur tank.

33. Above the anicut the necessity for the complete repair and improvement of the flood bank appears to have been overlooked, and the damage sustained at the end of November, as recently reported, was a natural consequence of its inefficiency. Below the anicut the embankment was, wherever inspected, in good order generally to somewhat below Autur, but a breech nevertheless occurred near the Autur old head sluice from, it is supposed, the sandy nature of the soil. At Chundamungalum, about a mile below Autur, the river has been eroding the bank for many years past, and some groynes were constructed in Colonel Horsley's time, but of these but little now remains. The artificial bank has almost disappeared, and the houses of the village stand very close to the scarp. Three or four permanent stone groynes appear to be needed, and much may be done to recover the proper alignment by persistent nanel planting. A survey is required. The flood at the end of November broke in here, and did much damage to the cultivation.

River embankment, right bank.

34. The bed of the river greatly needs attention. Nanel has been establishing itself in very improper places, and it is needful that the proper alignment of the river channel or bed on either side should be determined; that between these lines and the banks planting should be regularly attended to; and that within the limits of the bed proper no grass or other obstructions to free flow should be allowed.

State of river bed.

There is still a considerable set on to the right bank at about a mile below the anicut: the deep channel at the latter is at about the middle of the river with an inclination towards the right bank. Nothing has, it is understood, been done since 1869 when the propriety of remedying this set was pointed out.

35. The villagers ask for bridges across this channel at 2¼ and 3¾ miles. Sungadies* would be very useful at many points, and would probably meet the requirements of the people, but it should be ascertained whether the traffic at

North main channel.

* Rafts formed with two canoes cut out of palmyra or cocoanut trees.

either of the places referred to is such as to make it proper to provide a bridge. There are the Sovaramungalum and the Mangalakurchy bridges in the first nine miles, and it is very probable that one or more would be only a reasonable convenience. The channel was in apparently good order, and, but for the evidence of a much smaller draught than is intended afforded by the water levels at the head sluices, it would have been supposed to be in very good order. The reports which have been received since my visit of the very serious damage sustained by this channel near Yeral show that there is need of immediate attention to the state of the river embankments and of the numerous tanks, the outfall of the surplus of which is ultimately across this channel. The Yeral syphon tunnel was intended to drain a definite area of small dimensions, and the results of a maximum rainfall over this area were taken into account in designing it. The breaching of the adjacent banks by the drainage from other and very much larger tracts of country led to its destruction, and at any rate no similar accident in this part of the canal should be possible in the future. All the circumstances require to be taken into consideration, and every fact bearing upon the safety of this channel, and consequently upon the security of every tank above it, should be investigated, and the necessary protective measures determined. Few channel banks could have looked more secure than did those in this neighbourhood at the end of October, and yet within a month from the drainage due to a by-no-means maximum rainfall, the surplus works proved to be altogether inadequate, and the channel was extensively breached.

Proceedings, Madras Government, No. 256, dated 29th January 1875.

36. A work of two vents which are to be fitted with screw gearing to the shutters. A sufficiently wide embankment for carts should be given from Yeral to this point, as the channel bank is used by bullocks, and apparently intentionally so; at present the bank is damaged thereby, and the risk of accidents to the carts is considerable. The sluice would have been better with one vent and an enlarged opening.

Korkay head sluice.

37. A work which would have answered its intended purpose probably well enough, though the wings did not quite fit the banks. It was destroyed at the end of November by the floods; its outfall is into the Korkay tank.

Yeral syphon tunnel.

38. A work of three vents; there is room for two more vents, as the piers are very unnecessarily thick. The bridge over this set of sluices is absurdly high, and altogether the arrangements are very inappropriate. They were the opinion formed on inspection, and the floods show that the means of disposing of surplus were altogether inadequate, and they must be entirely revised to accord with the maximum discharge of drainage from the area having its outfall in this direction. A lower masonry apron with water wings is necessary to the security of the sluices.

Pungudam surplus sluices.

39. This bridge is just below the sluices, and the banks in its neighbourhood have been carefully secti[illegible] protected.

Sivalanda bridge.

40. This work consists of what are usually called inlet and outlet weirs. It is said to be of much greater capacity than is needed. The outlet for two-thirds of its length has high ground below it. What is required should be carefully determined, and the usefulness of the work must not be nullified by high ground, the removal of which may be necessary. Earth-works of the channel hereabouts want putting to rights.

Aramugamungalum double dam.

41. A shallow tank with a very long bund in extremely bad order. At several places the bund had been so far worn down at crossings as to be very dangerous, and instructions were given for immediate attention being given to these. At all recognized crossings ramps should be given, and at places at which villagers draw water some special arrangements, such as palmyra steps, or something simple and effective, should be made. It is better to spend a few rupees, if need be, in the removal of causes of accidents than a great deal of money in remedying their effects. This tank is the first in the chain of what are called the north tanks, and the supply is from it passed on by an open cut in the eastern part of the bund into the *Marathony tank*, a small shallow reservoir; there is a disused calingulah near the cut. From the Marathony water is passed on by a regulating calingulah and sluices into the *Puttukulum tank*, and then again from this into the Korumpollem tank by a similar work of regulation. None of these tanks, except the last which receives the drainage of a considerable tract of country by the Uparoday (stream), has any work for discharging surplus directly to the outside of the chain, and it is requisite that it should be ascertained conclusively whether this is, or is not a safe arrangement. The atlas sheet of Tinnevelly is not to be relied upon, and it does not give at all an accurate idea of the circumstances of this part of the district.

Peycolum and other north tanks.

42. The soil of much of the bunds of these tanks is very bad, and the depth of water at the bank will not admit of a sufficient protection being afforded otherwise than by a revetment which will need, moreover, to be very carefully built with a good backing, or the soil will wash out and lead to the necessity for rebuilding. Elsewhere, however, it is believed that nanel plantations, or in some places perhaps nanel revetments, will be an efficient and economical substitute for stone facing, and the District Engineer has been requested to save the expense of stone wherever this can safely be done. Something has already been done in this direction, and the nanel has grown well. With perseverance and due attention to the planting up of every part to be so treated wherever the water level in the tanks way be suitable, successful results may be anticipated. The District Engineer has been instructed to charge the nanel planting to the item for revetments, but to show the cost separately in the accounts under that head.

Protection of bunds of lower tanks of the chain.

43. South of the Uparoday dam in the Korumpollem tank there is a two-vent sluice, the shutters of which are fitted with regulating screw gearing which was designed to irrigate 4,000, whereas now considered that only 1,500 acres

Irrigation sluice, Korumpollem tank.

are likely to be supplied from it. The front wings are cracked, and there is some useless masonry in front of the vents. The sill appeared to be rather high, especially as there is to be a drop of 2½ feet in rear.

Uparoday dam.

44. This work has been so called, because it is built across the Uparoday or salt stream. It is the surplus weir of the Korampollem tank, and indirectly of the Puttucolum, Marathony, and Peycolum tanks. At present the body wall is at four feet above sill level, as the tank is not complete and is not capable of holding nearly a full supply; for the same reason all the sluice vents in it had been left open until after the burst of the monsoon, which precaution was shown at the end of November to be necessary, as a small breach then occurred at the north end. The front wings have exhibited a tendency to weakness, and there are cracks in them; it is said that this is due to the bund being now higher than was intended when the weir was designed; three buttresses should be built in front of each wing, and these will probably render the walls sufficiently stable; the cost which is estimated at Rs. 210 is to be charged to the dam. Iron ladders should be fitted to either abutment wall on the crest line to give access to the latter; this facility will be needed by the Lascars who will have to work the sluice shutters.

Irrigation sluice, two vents.

45. This sluice to the north of the surplus weir shows cracks in the wings. In rear the banks have not been properly made up. It is not clear why the sluice was built in the position it occupies, seeing that the channel from it has been carried for a long distance in rear of the bund nearly as far as to the Tuticorin town-supply sluice. Apparently a good deal of earth-work might have been saved by placing the sluice at the point in the bund where the channel turns away from the tank.

Water-supply of Tuticorin.

46. The sluice for the supply of the Tuticorin channel in the bund of the Korumpollem tank has more cracks in its masonry than is right. Such works should be founded on an all over bed of concrete of ample thickness, and then settlements would be rare. It is said that the sill was built 1½ foot too high, a mistake made by the maistry for whose guidance a bench mark was provided. There were 3½ feet of water on the upper sill and about 1 foot below, but it was not practicable to estimate the discharge with any great accuracy, though an approximation may be made. Much of the supply channel consists of a right bank with nothing on the left side to keep the water in a defined channel, and the waterspread being considerable, unnecessary wastage is occasioned both by absorption and evaporation over a large area; this defect can be remedied without difficulty by constructing a bund about 1 foot above F. S. L. on the left side. There is a small tank not far from the head formed by the embankment crossing a hollow, and here the waterspread cannot well be confined, except at an expense which it would probably not be worth while to incur. The soil is sandy everywhere, and nothing but sand at the lower part of the channel, though here it is in cutting considerably exceeding the depth of water, and consequently something might be done in the way of a clay lining to check wastage by absorption. The Government have, however, decided that the measurement of the town-supply is to be made at Meylur where the Municipal distributing works are situated, and this being the case it may perhaps be desirable for the present at any rate to postpone any attempt to reduce absorption, because the sandy soil on either side of the channel will do very well for a Government plantation, and trees will thrive if the infiltration be continued. The Collector, who is interested in such matters, might see to the utilization of this land in the way suggested. At the time of my visit any measurement of the water at Meylur was impracticable. The little dividing dams it appeared did not pass water fast enough to fill a fresh water tank south of the town, and so an opening had been made round one of these to give more waterway. However, the proper way to measure the water is to construct a weir for the purpose near the lower end of the supply channel and above the town distribution works. This weir should have a crest about twice as long as the mean width of the supply channel, and this crest should be of cast iron or angle iron carefully fixed, and having its level so arranged as to maintain the proper surface fall in the channel when that is carrying a full supply. Two cylinders with gauges should be placed, one above and the other below the weir, to determine accurately the water levels, and then the discharge should be calculated for depths of half inches from one half inch to the full depth to be allowed. These calculations should be verified by measurement of velocities, so that the proper co-efficient may be obtained. A table of discharges should then be drawn up, and the charge made to the Municipality accordingly. The District Engineer has been instructed to carry out these arrangements at once. Care must be taken that the wings of the measuring weir are surrounded with good soil, and that some clay is laid down in the channel bed for a short distance above the crest, so that the work may be fairly watertight. Hydraulic mortar should be used for this and all other masonry works in contact with water or wet soil. It may be added that it is thought that the alteration of the level of the sill of the sluice at the head of the channel is not necessary: its high level will, no doubt, prevent water being drawn off when the Korumpollem tank is very low, but the supply then would not be good for drinking purposes; and when the irrigation channels are drawing off water, practically the lengthening of the time, during which the town channel would get any supply were the sluice sill lowered, would be very small.

Storage of water above Papanassum.

47. The character of the freshes in the Tambrapoorny and the rapidity with which freshes rise and fall, together with at times the large quantity of water which escapes out to sea, have naturally led to proposals to construct reservoirs on the upper parts of the river or of its tributaries, and some investigations in connection with such arrangements have at different times been made, though in a desultory sort of way. So far as is known, there are only three sites available for reservoirs: the first is about two miles above Surumuthiyen Covil, or some seven miles above Papanassum. This place is at the entrance of a narrow valley, and above it there is a considerable extent of comparatively open valley in both directions. It is possible, though perhaps not very probable, that a fairly economical project could be worked out here. The ground is covered with jungle, and no detailed information regarding the site has been obtained. The second site is at

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Surumuthiyen Covil, and is mentioned [illegible]her because it has been proposed for adoption than for any suitability it appears [illegible]ossess. It would be easy to construct a masonry dam here, and there would be [illegible] difficulty in disposing of surplus, the hills on either side and the bed of the river being solid rock; but, unless the fall of the river between the first and second sites be smaller than is probable, the intervening very narrow valley would add but little to the capacity of the reservoir, and the dam would be considerably higher, and therefore more expensive to construct. The third site is two miles, or perhaps somewhat less above Papanassum, and is at a point where the river passes in two channels through some low rocky hills, the valley above being wide and open, but the ground of little or no value. Here it would be practicable to construct a reservoir of considerable capacity and at a moderate cost. A reconnoissance of the locality was made some years ago, but the information then put on paper is insufficient to allow of any idea being formed of the extent or contents of the reservoir at any depth at the dam site.

Probably a regulating dam would be the best form of work.

48. Looking to the fact that a large volume of water is needed in the river at any time, and that it can at once be disposed of by the eight anicuts mentioned in paragraph 2 above, it seems worth consideration whether a dam, with a considerable opening, would not be the best form of work to adopt. Such a dam would cost less than a reservoir with its extensive waste weir, sluices, etc., and it would, it is thought, answer the intended purpose. For instance, suppose that there are, or will be, 100,000 acres of irrigation under the Tambrapoorny, and that the existing channels from the anicuts can conveniently dispose of, in the tanks connected with them, on the average 10 cubic yards per acre per hour, then one million cubic yards an hour, or 7,500 cubic feet a second, may be allowed to pass the regulating dam at any time. Suppose, also, that it be arranged that the difference of water level above and below the dam is ordinarily to be allowed to rise to 40 feet, then the velocity through the opening would be about 35 feet a second, and the size of opening required would be, say, 215 square feet, and a vent 14½ feet wide 10 feet high to the springing, with a semi-circular arch, would suffice. The points to be decided for the determination of the details would be—

1st.—The discharge of the river in the average maximum annual freshes as distinguished from the floods which occur once in 25 or 30 years.

2ndly.—The capacity of the basin above the regulating dam site at 15 feet contours from 50 to 75 feet above ordinary ground level, not river bed level at the site.

3rdly.—The level to which the water would rise above the dam in a maximum annual fresh, taking into account the concurrent discharge through an opening of given size.

4thly.—The maximum extraordinary flood discharge of the river based upon the area of its catchment basin and corrected on the best information obtainable.

5thly.—The level of the water above the dam corresponding to such extraordinary fresh.

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By successive approximations then the size of the opening and the height of the dam, so that this should in no case be overtopped, would be capable of sufficiently accurate determination, and it should be remembered that, while the size of the vent must be sufficient to prevent the water rising above the maximum level fixed, unless, indeed, it be found that at any given level surplus could be discharged elsewhere on the line of hills without requiring any expensive works for its disposal, so on the other hand this opening should, if possible, not be of larger area than is requisite for passing the maximum discharge which can be utilized by the irrigation main channels when the water rises to the level above the dam corresponding to annual maximum freshes. In this way a self-acting flood moderator would be obtained, and undoubtedly a great deal of the water which now runs to waste would be secured and turned to account. Whether or no such an arrangement could be carried out at a moderate cost must necessarily remain to be decided after the details have been worked out, but it may be noticed that there are *prima facie* grounds for believing that it would be worth while to construct such a work for—

1st.—A glance at the imperfect particulars of area of irrigation and revenue given in paragraph 2 above will show that in Tinnevelly water is exceptionally valuable.

2ndly.—The area of the river basin above the dam site is but small, and the quantities of water to be dealt with are not therefore unmanageable.

3rdly.—The dam would be built on solid rock, and, with the exception of the masonry of the opening or vent which would have to be built of hard stone dressed to 4 or 5 feet from the face and set in cement, good rubble masonry would do very well.

4thly.—The only precaution necessary during construction would be the keeping of the masonry at a level from end to end, and then freshes might go over it and do little or no harm.

It will be necessary in deciding what quantity of water should be allowed to pass through the vent to take into account that there are two considerable affluents of the Tambrapoorny, one on the right bank falling in above the Cannadion anicut and the other on the left bank joining 3 or 4 miles above the Ariyanaikapuram anicut, which have their heads among the hills, and which will generally be in fresh at the same time as the Tambrapoorny though their supply is not so reliable. A project of this kind cannot be worked out by the Range Officer, for it will need a good deal of continuous thought and calculation, so that it must remain in abeyance until an officer can be spared to make the necessary investigations, and to ascertain whether such a flood moderator as has been suggested, or an ordinary reservoir, will be best adapted to the circumstances of the locality.

Franjairy tank of Gopalsamudram.

49. This tank is supplied by the Cannadion channel. A road runs along the [illegible] bund which is in good order. What appears to be intended for a surplus work has a breach behind the left wing. The surplus arrangements should be investigated and made efficient and adequate. A channel takes off at the east end for the supply of another tank of Gopalsamudram.

50. This tank also is supplied from the Cannadien channel. The bund is low, especially so at the right wing of the
Kottancolum. — olaingulah. There was a full supply.

51. This tank is about 3 miles from Palamcottah on the Nanganeri road. Its bund is about 2 miles long, and was
Punagudi tank.
19th October. repaired in 1872. The top of the bund is fairly level, but were it not for the exceptional lowness of the two ends, it would be pretty sure to breach were any thing approaching to a maximum rainfall to take place. As far as can be gathered from the atlas sheet, the catchment basin is about 4 square miles, and there would seem to be four tanks in the upper part of this basin. It has four escapes, three at the north and one at the south end, and their lengths between the wings are 50, 55, 43, and 18 feet, respectively, but the upright stones of the second occupy some 20 feet, and of the fourth 6 feet, so that altogether there are 142 available for discharge. The crests are on varying levels. The overfall from the northern escapes is on to rock or rocky ground. The first and second escapes are divided only by a wing wall; between the second and third there is a bit of bund 42 feet long. The north wing of the north escape is only 3 feet above crest, and parts of the bund to the north of it are considerably lower. The south wing, which is also the north wing of the second escape, is about 4½ feet above crest. The short length of bund is very low behind the wing walls, and 2 feet of water could not pass over No. 1 weir without going over the low parts of the bund. All the crests of the escapes should be placed on a uniform level, corresponding with that of full tank; and from those which have upright stones these should be removed; the wing walls should all be 4½ feet above crest level. If the catchment basin be not larger than has been supposed, and, if the tanks above be made secure, the means of disposing of surplus will be adequate, while, if more capacity be needed, it can be provided by making the three northern escapes and the space between the second and third into one weir about 200 feet in length, which, with 2 feet passing over, will discharge the drainage from rather more than 3 square miles. Some repairs are required to the wings and body walls of the surplus weirs.

The bund should, where lower than 4½ feet above F. T. i.e., be raised to that
Proper height of bund. — level; and as, wherever village paths cross it, it is now, and will always be liable, if proper arrangements be not made, to be worn down, at all such regular crossings ramps at about 1 in 6 should be formed, and on either side of these for a distance of 100 yards along the foot of the bund, but at a distance of 3 or 4 yards from the toe of the rear slope, an aloe fence should be planted, so that cattle may be prevented from going anywhere but over the ramps.

The aloe fences may with advantage be subsequently extended along the outside throughout, for a good deal of damage has taken place since the repairs were executed, and there is plenty of room for cattle away from the bund.

The sluices appear to be in very indifferent order, and some of them are
Sluices. — unserviceable and have been blocked up. If indeed this process was not soon accomplished. To enable the — re examined and repaired, also to admit

of their being cleared out, the minimum dimensions convenient are 2 × 2½ feet. These sluice tunnels are 1 × 1, or even less in some cases, and it is not surprising that they are inefficient.

No. 1 from the north has ceased to be used; No. 2 is a comparatively modern structure of indifferent brick-work; the head was either never finished, or it has fallen into disrepair; there are no means of regulation; the tunnel is very small, about 9 inches square, and, on the whole, it appears to be desirable to demolish this sluice and build a proper one with its head at the bund, with suitable means of regulation, and with a tunnel that can be kept in working order. It must, of course, be considered whether at this site the sill will be on a sufficiently low level.

No. 3 *sluice* has, when the tank is full, about 6 feet of water on the step at the foot of the upright stones; there are no means of regulation.

No 4 *sluice* was evidently an important work at some time: it has massive upright stones with carved tops and three cross stones, and regulation was practicable by swimming out to the upper cross stone through which the plug rod passed. The head of this sluice has been abandoned, and a few feet to the south and much nearer the bund a new head, No. 5, affords access to the old tunnel; the brick-work of this latter head is much out of repair.

No. 6 *sluice*, the head wall, has one upright stone in it, apparently to indicate its position when there is water in the tank; the vent and arrangements of the head were hidden in sand. There is a cistern in rear, in which there was a considerable depth of earth, about 2 to 2½ feet. A ryot worked for some time with a mamaty about the size of a mason's large trowel to uncover the exit of the tunnel, but he succeeded in showing only a little bit of it.

The northern part of the bund is not revetted, but from a little to the north
Revetments. — of No. 3 sluice there is stone lying on the flat slope; there was once a revetment here. From some 60 yards north of No. 4 sluice there is revetment standing, and thence to near the south escape there is a belt of stone, some of which is in pretty good order, but most of it either more or less in disorder, or else standing away from the earth-work like a dry stone wall. Near the south escape some pitching, having the interstices between the large stones filled in with small stone and chunnam, was, it is said, executed in Major Payne's time, and this, for the most part, is in good order: the slope and top level vary. What stone there is can be repacked somewhat in the form adopted by Major Payne, but with a rather flatter slope, with a backing and without chunnam. Protection to the interior slope of other parts of the bund can be afforded by planting a belt of grass on the flat slope below the slope proper of the bund. Some nanel is growing at the south end, but it evidently fares very badly, and it is perhaps hardly surprising that cattle should incline towards it when there is really no grazing. However, it is good for the grass that it should be cut annually, if not oftener, and it can be sold, if not needed for planting; the hard stumps will then offer but little attraction to cattle. There will be no objection to a double or treble line of palmyras being grown outside the nanel belt.

The condition and requirements of the — k have been noticed at length, because it is the first tank in this district which — been inspected in detail, and

because it forcibly illustrates the causes which lead to so many accidents to works of this class on the occurrence of a heavy monsoon. Apart from the revetments and sluices the outlay required to make the tank safe is very moderate, but at present it is certainly not safe, and when the last repairs were executed several important and essential conditions of safety were overlooked. The following are the Revenue particulars of the tank :—

Ayacut area	Acres	301
Do. assessment	Rupees	1,705
Average Revenue...	„	1,856
Highest do.	„	2,204

Expenditure of last five years, Rs. 1,5[illegible]. Part of the supply of this tank is obtained by a channel from the Pachiyaur.

Nanganeri Perianeelum and water-supply of this part of Nanganeri.

52. A large tank with but an indifferent supply depending on rainfall in the neighbourhood, which unfortunately, as in this year, has failed to a considerable extent. The hill streams whence many of the tanks in this part of the district obtain the more reliable part of their supply come from no great distance, and there are numerous tanks near the foot of the hills which intercept the water from moderate falls of rain almost completely. The Talsildar of Nanganeri gave a very full account of the difficulties and distress arising from the absence of even drinking water in many villages of his taluq, and said much about the great anxiety of the people of Nanganeri and other villages to obtain an increased supply from the hill streams. The District Engineer is of opinion that not much in this direction can be done, the water-supply, except occasionally, being already fully utilized; and when there is a heavy rainfall, the tanks get filled by local drainage, and do not want water from the hills. The only improvement which may possibly be practicable would seem to be the diversion southwards of some of the water which now flows by the Pachiyaur into the Tambrapeorny.

Nanganeri tank channel.

As regards the Nanganeri tank, work is in progress for the improvement of the channel, and an embankment is being constructed along the right side. At the same time the alignment of the channel should be rectified as far as possible, for in the lower part at any rate it is extremely crooked, and the result is a succession of sets which on the one hand have a tendency to cause breaches, and on the other to cut away the banks, thus adding rapidly to the accumulation of silt in the tank bed. On a channel, the bed of which is generally quite dry, it is almost impracticable to get grass to grow, otherwise panel might be employed to cause the silting up of bays which are out of the proper line of the bed, and which are objectionable on account of the re-action which they occasion. The common aloe affords a means of protecting the right bank and embankment where re-entering, and has been used for this purpose successfully just above the road where there is a bay altogether out of the proper line. If the channel bank from the level of the deep bed and the foot of the embankment be so protected, probably breaches may be altogether prevented. About 50 feet would seem to be the proper normal width of the lower part of the channel, and the latter will become far more efficient and less liable to damage if the bed be restricted t[illegible]dth, and be laid out on the best alignment available.

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The tank is by no means in good order. The levels of the top of the bund are irregular. Where revetted the stone is in disorder, owing to the washing out of the soil immediately in rear, there being no backing. Here, too, the bund is highest at the top of the rear slope, and there is a long and rather flat slope towards the revetment, so that the amount of drainage, all of which has a tendency to displace the revetment, is greater than it need be. The slope of the earth-work above the revetment should not be flatter than 1½ to 1, and the drainage of the top of the bund should be carried to the rear.

Tank.

The sluices want some repair. There are some old decayed trees on the bund, and these should be removed.

There are also some very fine trees, part of an old road avenue on the lower part of the rear slope, and these may remain, but the roots, which spread into and over the bund above the level at which the trees stand, should be removed. The principal surplus work which is at the north end was accidently not seen: the small escape at the west end of the south bund is without proper wings, and is altogether inefficient: it has a drop of about 8 feet on to the remains of what appears to have been a rough stone apron; an overfall of this height should be on to very substantial masonry. There has been no surplus of consequence for a long time, but a considerable discharge might lead to a breach, and the ground behind being 5 or 6 feet lower than the tank bed, the resulting damage would be considerable. It is not clear from the atlas sheet what the area of the catchment basin is, but taking the supply channel as the southern boundary, it is probably 6 or 7 square miles, and the maximum flood discharge, including the water brought down by the supply channel, would be perhaps about 1,800 cubic feet a second. If the small escape be required for sending part of the surplus to tanks to the south-eastward, it should be put into proper order, and the balance of the surplus should be provided for at the north end. The revetment may be left as it is, until more pressing work elsewhere shall have been attended to; but when rebuilt there should be a proper backing given. The earth-works should be put to rights at an early date. At the Nanganeri temple part of the bund is superseded by a wall forming an outer enclosure of that building.

Vizianarayanum tank.

53. This is one of the large tanks of the Nanganeri Taluq. It has fallen into disrepair, and recently levels have been taken with a view to its being put into a thoroughly efficient state. One, the western sluice, has just been restored, the original design, with a slightly higher tunnel, having been adhered to, and the head is a long way from the bund. It was, before the restoration was affected, quite choked up with roots and sand: the trees near its lower end should be removed, and the effect of coal-tar in preventing roots penetrating masonry works may be tried.

Has not been filled for many years and only once has been three-fourths filled in recent years.

The tank has not been filled to the former level of 20 feet above the sill of the deep sluice for at any rate a great number of years. In 1300 it received a larger supp[illegible] than in any other recent year,

and then what is called the three-fourths tank level was reached. That was a year of heavy floods, and but for the breaching of the supply channel in many places, more than the quantity of water required to fill the tank would have entered it, but could not have been retained. The ayacut of the tank is 1,500 kotays = 2,430 acres, and it is said that the full tank would irrigate the whole of this. The contents up to that level would be 16,537 millions of cubic yards, and the quantity stored per acre would be 6,800 cubic yards. The three-fourth tank holds 11,474 millions of cubic yards, and is said to irrigate 900 kotays, or 1,458 acres; the quantity per acre would then be nearly 8,000 cubic yards. These are the accounts given by the villagers of the cultivation, and are perhaps as accurate as could be expected.

1 Kotay = 1·62 acres.

The revetment of the tank is, with the exception of a few places where it would seem to have been thrown down to form pathways, or where possibly it having fallen down pathways were established, is standing. Much of it is away from the earth-work which has been washed out from the bund: it is much below full tank level. With slight repairs it will stand for some years to come; a backing of gravel might be rammed in behind it, and then if the front slope of the bund be brought on to the stone so as to throw the drainage to the front, and if the top of the bund be placed nearer the revetment with a steeper slope so as to diminish the quantity of water draining in this direction, the top also having a slight slope towards the rear, this part of the tank will be easily maintained in fair order. There is an old culingulah at the south-west end of the bund much out of repair. It would seem to have had its body wall lowered between the upright stones when it became no longer safe to retain water at a high level. The wing walls are very low. The site is a good one for a surplus work, and it will not cost much to make an efficient weir at this point.

Revetment.

Escapes.

At the north-east end of the bund abutting on a low hill of rock is another culingulah, the length of which is about 105 feet including the rock which is low enough for the water to pass over. Formerly there was a weir having its west end in the same position but with the east end thrown forward on to higher rock, and the level to which the water reached with a full tank was pointed out, and is 3 feet above the body wall. The crest of the present escape is very low; its discharging capacity is inadequate, and there is great difficulty in both opening and closing the spaces between the upright stones. By turning the bund outwards from the point a few yards distant, where thirty or forty years ago there was a breach, an excellent site for a weir with an unobstructed crest may be obtained, the overfall being on to rock. The catchment basin from the supplying channel on the south to the water shed on the north would seem to be about 55 square miles, in addition to the basin of the Nanguneri tank, or altogether say 60 square miles. This area has a very large number of tanks within its boundaries, and in ordinary seasons the drainage finding its way into the Vaimanaryanum tank is very small indeed, while in heavy monsoons it has not been an unusual thing for many of these smaller tanks to give way. A large part of the [illegible] drainage finds its way south, and is got rid of when in excess by the surplus weir [illegible] supply channel, but at least 35 square miles

drain directly into the tank, and the drainage therefrom should be provided for by the tank escapes. It is not desirable that the difference between full tank and maximum W. L. should be very gre[illegible] and 2½ feet may be fixed as the limit. The maximum flood discharge from 35 square miles will be about 6,000 cubic feet a second, and the length of surplus weir crest required will be 450 feet, of which about 250 feet can be provided at the north-east and 200 feet at the south-west end.

The District Engineer proposes, looking to the unreliable character of the supply, to make the tank at any rate for the present fit to hold water up to the three-fourth tank level, and I think that this is a wise and proper arrangement; at a future period, if the record, which will be kept, should show that any considerable quantity of water passes over the weirs, the capacity of the tank can be increased. In view of this contingency the weir crest walls can be made 4 feet wide at top, and the wing walls 2½ feet thick, and then any future raising can easily be carried out.

Former F. T. L. 32·79.
Former ½ T. L. and intended F. T. L. 29·94.
Top of bund to be 34·94.

There are many bushes and some trees which should be cleared off the bund when the earth-works are taken up and put in order. There is a little panel on the flat slope at the foot of the interior slope of the bund, and arrangements should be made for forming a plantation all along from a foot or two below full tank level for a horizontal width of 8 or 10 yards. The planting should be done at the proper time, which is as the water falls in the tank; and, if the grass be planted in six inches to one foot of water, it will take firm root and be well grown before the ground becomes dry. The difficulty will be the obtaining of a supply of grass for planting; at any rate all that can be got should be made use of. The first essential is the rendering of the tank fit to hold a supply of water; the next is to do all that may be practicable to convey to it the water wanted. For a succession of years, the remissions owing to want of water have been very large, and depending as this tank does, and will always depend, upon the rains of the north-east monsoon, the necessity for remissions cannot be entirely removed. What is wanted, however, is that water which may from time to time be available should not be lost by the breaching of the supply channel, and that the supply from the Numbiyaur should be increased by constructing an anicut across that river at or near the head of the present Korambu, for it is a mistake to call the latter an anicut, and the channel of the river has never apparently here been bunded. To deal with the latter point first, an anicut about 3 feet* high will probably suffice; there is rock all across the river, so the cost of this small dam will be but little; the Korambu or leading wall to the head of the channel may be 1 foot higher than the anicut, and at the wing at the lower end there should be a set of under-sluices worked from a platform above; close by a head sluice should be constructed. With these arrangements, whenever there is water in the river, a supply will be obtained; the

Clearance of bund before earth-works are carried out.

Panel.

Supply channel.

About 5 vents of 3 feet.

* Above proper bed level of channel.

leading channel will be kept as clear as may be, and floods and silt will be excluded from the channel. Water should never be allowed to pass over the crest of the anicut, unless there be more than can be disposed of at the under-sluices.

Reverting now to the channel. Its requirements are—

(1.) Banks, or a right bank, of sufficient and regular height above the bed.

(2.) A width of bed in proportion to the water to be conveyed.

(3.) The elimination of sets where practicable, and the adequate protection of the bank by stone pitching or planting where the sets cannot be got rid of. No height of bank will secure safety if there be sets which will wash it away.

(4.) Ample means of disposing of the surplus from the large area of country, the drainage of which is crossed and diverted by this channel. It seems probable that 25 square miles drain into this channel, and, as maximum should not exceed ordinary full supply level by more than 2 feet, at least 500 feet of surplus weir will be required. Some of the existing works can be made perfectly efficient, but the old works with upright stones should be demolished and rebuilt. Those which have or are to have supply or sand sluices must have proper shutters for these, and the capacity of the vents for discharging surplus should not ordinarily be taken into account. The wings should be 5 feet above the crests, which latter will be at ordinary full supply level, whatever that may be determined to be, and the form of the wings should be adapted to the slopes, the front wings at the ends being 2½ feet above the crests; revetments in continuation of the wings will frequently be necessary, the surface soil being for the most part sandy, the sub-soil rock.

(5.) Ramps for all regular crossings.

(6.) The protection of the bank by fences of some sort on the outside; the common aloe will be the cheapest and most effective. A carefully prepared survey and levels have been taken, and there is consequently detailed information available on which to work out the necessary arrangements. The bedfall of the channel is most irregular, varying from 1·05 to 12 feet a mile. The average surface fall is 7·45 feet a mile, and the banks will approximate consequently to a fixed height above this surface line rather than above the bed. That the quantity of water ordinarily received by the tank will be considerably increased hardly admits of doubt when the present condition of the channel is considered, and it will probably pay to put it to rights and kept it in order, but, after all that can be done shall have been accomplished, the irrigation will be precarious. Something may possibly be done to divert hill drainage now going in other directions, but certainly the sanguine anticipations of those who greatly desiring to benefit this somewhat wretched taluq, thought or hoped that there was plenty of water if only the proper means of securing it were used, or that the Numbiyaur might be converted into a second Tambrapoorny, are not likely to be realized. The greater part of the moderate supply coming from the hills is already utilized by the villages close to the hills, and the eastern villages will in the future as in the past be dependent principally on rainfall drainage from the plains.

Water-supply will always be precarious.

54. This anicut is situated a short distance above the head of the Vizianarayanam channel, and the latter could without difficulty be supplied therefrom, but it will be cheaper and better to construct a separate dam.

Chittoor anicut.

The anicut supplies the Chittoor channel on the right and the Pannisicolum channel on the left bank. It is a substantial work, built on rock. The crest for about one-third of the length from the right wing is a few inches lower than the other part. The bank in connection with and behind the right wing is very much out of repair. The Chittoor channel is greatly in need of a complete clearance; its bed at present is so high, that it must get but a very poor supply. It has no head sluice, and under existing circumstances shows no need of one, unless for the exclusion of sand rather than for the regulation of water to be admitted. The Pannisicolum channel is supplied by the water passing over a certain length of the crest of the anicut, and, as its level is low, all the water so passing over and not in excess of the requirements of the channel is passed on to the tank of the same name. Excess is passed back into the river over a low wall, and lower down by two surplus works. The bank of the channel is out of repair, and liable to be breached by a very moderate quantity of water.

55. In G.O. of the 10th March 1869, No. 762, an examination of the Numbiyaur, a stream in the southern part of the Tinnevelly District, was ordered to be undertaken with especial reference to a project advocated by Dr. Caldwell, and subsequently Mr. Grant, an Assistant Engineer, was deputed to make the investigation. From various causes, which are mentioned in the District Engineer's letter of the 26th June 1874, No. 53, the inquiry was much delayed, but then a preliminary report was submitted, and on visiting the district in October last, the circumstances were discussed and the character of the project ascertained. The idea was that a large quantity of water escaped into the sea, and that this might be utilized in the tract of country between the Numbiyaur and Manapad rivers; also that a portion of a large lake or taruvei might be converted into a tank, and the rest of the bed cultivated. The water-supply was to be drawn off from the Numbiyaur at the Govencolum anicut, taken by an existing channel to be much enlarged into a small stream, led off from the Motacolum anicut on that stream by a new channel into the Thessanvelly stream which now falls into the lake. The channel from the Motacolum anicut would run through bad soil, viz., sandy loam, and this is one difficulty, but the main obstacle to the scheme is the low level of the bed of the lake which approximates to mean sea level and to the absence of any outfall therefrom, except a narrow cut 13 feet above bed level which was made to relieve the lands in the upper part of the bed when under cultivation from small affluxes of

Numbiyaur project.

Vide Sketch map.

water. As a consequence, if a tank were constructed at the upper or western end of the bed of the lake, the surplus could not be carried into the lake without submerging the cultivation, and it would be necessary to divert the surplus before entering the tank by an artificial channel to be carried in a southernly and then south-westernly direction into the Numbiyaur. It is not necessary perhaps to suppose, as does Mr. Grant, that the breaching of tanks need be considered to be a complication which could not well be avoided: these could, and, if they are to be maintained, should be made safe, but the diversion of the drainage of some 25 square miles would certainly be an expensive and difficult matter. Mr. Grant's approximate estimate amounts to Rupees 1,87,500 and the probable return to Rupees 10,000, so that even were the estimate not to be exceeded when the works were planned in detail, it is improbable that the project would be sanctioned.

56. The observations of the freshes in the Numbiyaur do not give an encouraging aspect to the water-supply. Water would perhaps be available for about seventeen days in the year were the old works higher up the river to remain unimproved and unrepaired, but there is a much greater need of water for the tanks in the upper part of the taluq than for lands in and near the lake bed, and I have no doubt whatever of the advantage and propriety of attending to the wants of such old works as the Vizianarayanum tank already referred to in these notes, in preference to taking up new projects. Something has already been done in that direction as noticed in paragraph 9 of the District Engineer's letter, and much more is in contemplation. When these improvements have been completed, there will, in ordinary years, be no water to spare; and indeed the large volumes of water which are stated to escape to the sea exist only in years, like 1869, when the rainfall is exceptionally heavy, and when, were this project carried out, none of them could be turned to account, but on the other hand the great difficulty would be to get rid of them.

Water-supply precarious and required for existing Irrigation works.

57. The suggested formation of a tank at the upper end of the lake would submerge land, a greater part of which now bears only palmyras, but, on the other hand, it would swamp a good deal of valuable garden land which is already highly cultivated. I was in this part of the country at the end of a very dry season when the greater part of the Nanguneri Taluq was suffering from a scarcity of water. I was surprised, therefore, to find that in the neighbourhood of Thesanavelly, Poochikad, etc., and along the border of the lake bed there was plenty of water in the wells at no great distance from the surface, and that the country generally presented a remarkable contrast to the arid tracts through which I had just before marched. The Theris or red sand hills appear to store a large quantity of water, which keeps the springs at a high level at all times, and as a result, in the immediate neighbourhood of these sand hills, excellent cultivation is always practicable; of course, the area thus affected is comparatively small, but, on the whole, there is no part of the southern portion of the Tinnevelly District which is so well off as is this sandy tract, and, as far as c[illegible]dged from riding through many of the villages, the condition of the [illegible]gards houses, clothes, etc., is much better

Valuable lands would be swamped; existing condition of country better than that of Nanguneri taluq generally.

than elsewhere. That enormous benefits would be conferred by an abundant and reliable supply of water there can be no doubt, but such a supply is not available from the Numbiyaur; all the water of which, except after very heavy rainfalls, is already utilized, or will be shortly made use of under existing anicuts and river channels. It being, therefore, extremely improbable that were further time spent upon this project, the Government would be prepared to sanction it; time and attention should be given rather to putting the channels and tanks supplied from the Govencolum anicut upwards in order—a work which will take several years. Mr. Rundall's letter and Mr. Grant's report will be found appended to these notes.

58. This weir has had some indifferent rubble stone masonry added to an old native work. The rock on which it is built varies in character, and the anicut has evidently been undermined, resulting in settlements; and when inspected, at one place the undermining commencing in rear had apparently extended beyond the up-stream face of the dam. The state of the foundations should be examined. A masonry apron bedded on concrete will be necessary for part of the length. In 1869 a breach occurred behind the right wing, and the anicut was extended across the breach. The new wing is only 3 feet above the crest, the old right wing being a foot higher, and the wings should be 3 feet at least above maximum flood level while the water must be prevented by flood banks from turning the head works. The crest of the anicut should be of cut stone. There was formerly a right bank channel which went to Kodakarangalum; this has almost entirely disappeared, and it should be ascertained whether its restoration would be desirable. The left bank channel as already mentioned carries water into a small stream about one-third of a mile distant. Its direction is about at right angles to the river; its bed is very high, and the fall is so small that water sometimes flows the reverse way. The soil is very bad.

Govencolum anicut on Numbiyaur.

59. This work is on a small stream, and supplies three or four small tanks. The length of the dam is about 240 feet. It is built of rubble masonry on rock, some of which is rotten. The right wing is 5½ feet above the crest; the flood bank in connection with it wants repair: the left wing is 3½ to 3¾ feet high. The proper level for the wings, which should usually be of the same height, requires to be ascertained.

Motacolum anicut.

60. This tank belongs to Sathancolum. The bund is much out of repair and very low at the north end. It has a calingulah and two sluices. A fall of rain a week before had given it a good supply. The necessary repairs should be attended to.

Wodiancolum.

61. This is a fine old tank in a very wretched state. From the water marks it would seem in ancient times to have had a good supply by the river channel which is 20 miles long, and is supplied by an anicut. It is said that the water taken off by the several minor channels above the tank has increased from time to time, and that many of these channels belong to Zemindari tanks. However that may be, the tank and the lower part of the cha[illegible] of it in such an inefficient state

Manur tank.

that even in the most favorable seasons the filling of the former must be impracticable. According to the account given by the villagers, nothing has been done in the way of repairs for very many years, and this may, without difficulty, be believed. The bund is a fine one, and was once very well revetted. Now the levels are extremely irregular, and most of the revetment is in disorder. Many of the sluices are more or less out of repair, and should be at once put to rights. The tank has no surplus weir, and it may be allowed that in the bund proper none is required, but it will be nevertheless necessary and proper to provide one near the junction of the tank and channel. From the presence of mile stones along the channel it may be supposed that at some time attention was directed to this Irrigation work and, as the local drainage is small, upon the efficient condition of the channel, the supply of water received will always depend. Some clearances in the lower part of the channel had recently been carried out by the villagers, but they could be but of little use, and the sand removed and placed on the line of the bank will have to be placed elsewhere as it would be sure to breach.

The tank bund should be cleared, and all low parts raised to a minimum of 8 feet above the full tank level which may be fixed.

The channel should be capable of carrying about 6 feet of water, and its bank should be 4½ feet above that level. The bedfalls are probably not equal, and therefore water surface, with the average depth of 6 feet of water, should be determined and the level of the bank fixed with reference thereto. All sluices in the channel bank should be furnished with proper shutters. There are a great many, and a little waste at each must affect prejudicially the supply of the Manur tank.

The reconstruction of the revetment may be deferred until the more urgently required work shall have made good progress.

It will be necessary to take levels and cross sections of the bund and channel in order to ascertain the work needed. The villagers complained of the planting of babool trees in the bed of the tank. It is perhaps better to keep tank beds for their more legitimate purpose, but, if all trees be removed from between the channel and its bank and from a width of 10 yards on the other side of the channel, the flow of water will not be impeded and the rest of the plantation may remain. Near the head of the channel there are some surplus works; the lower of these is a weir with four sluice vents, two in each end. The right wing, a comparatively modern work, is only 3 inches above the crest. Near this is Subba Naik's calingulah, and in continuation of and above this there is a weir wall with two sluices and badly fitting shutters. The channel would carry about 6 feet of water to the crest of this more recent work. The left wing in rear, where it was washed away in 1869, needs to be restored.

Anicut.

The anicut was originally longer than it is now, and the channel below Subba Naik's calingulah was crossed by a bund near which was the former head of the channel. A breach led to the right wing wall of the anicut being constructed at the left end of the gap, and a wall runs up nearly at right angles to the anicut for 200 feet or so, and is there joined [illegible] a bank to the present head of the channel. This bank should be levelled, sided [illegible], and planted. The anicut is a fine old

work; it wants a little repair and concrete filling between the stones; it has met apparently with many accidents, and, unless care be taken to keep up the flood banks and to provide a sufficient margin above maximum flood level, such accidents will recur. The left bank of the river above and in front of the upper part of the wing should be planted to stop erosion.

62. This weir is at Tenkasi. It is a substantial old work with an overfall on

Kesla Puliyur anicut.

to rock. Near the centre there is a low portion with upright stones, and it would be better to substitute sluices with shutters, as regulation is impracticable at present. The channel takes off from the left bank, and has no head sluice. The banks want regulating, and the wall just below the small bridge at the head should either have a raised end, or should be raised throughout to a safe level; the former would be the best arrangement. Close to Courtallum on the same river there is another anicut.

Planting of tank bunds.

63. I had an opportunity of discussing this subject with the Collector Mr. Puckle, and he was informed that I entirely agreed with him that the interior slopes of bunds should, as far as necessary and practicable, be planted with *ranel*, and he concurred with me in the opinion that the tops of bunds should be left quite free and clear from jungle, trees, etc., and he is also prepared to give up planting with trees the exterior slopes of bund, admitting that there are objections. Trees can be planted to any extent which circumstances will allow at and beyond the foot of the bund outside, and I stated that I did not think it necessary to remove fine trees now standing near the bottom of rear slopes.

Mode of dealing with Irrigation Works.

64. Mr. Puckle expressed a desire that the minor rivers which supply irrigation should each be taken and dealt with as a whole, putting all the works in order from the upper end to the lower; also that groups of tanks should be dealt with in a similar manner. This is in entire accordance with the instructions which have been issued from this office, and the obstacle to the carrying out of this arrangement has been hitherto partly the want of sufficient money and partly the absence of the means of dealing with such works effectually. This latter difficulty has been met by the instructions given in Circular No. 62, and the former should be provided for by an increase of the repair grant to one lakh of rupees annually.

Irrigation registers.

65. For the Tinnevelly and Tenkasi Taluqs the Collector has prepared irrigation registers which are very complete so far as all revenue details are concerned, and for each village a sketch plan has been prepared showing its circumstances, sources of irrigation, etc. All works to be done by Kudimaraimat or customary labor has likewise been specified. There is a descriptive memorandum also of the settlement of each village, and this contains a large amount of information which cannot fail to be of great use to the District Engineer and his Assistants.

66. The remarks contained in these notes will show that there is a great deal to be done in that part of the Tinnevelly District which has been visited, to put the numerous Irrigation works into an efficient state. It will be necessary not only to increase the grant for repairs and [illegible]ew Works which can be once

be done, but to take care that the money is well spent and that the safety and efficiency of particular works is not compromised by inattention to such matters as the proper height of banks, wing walls, the good order of sluices, and the state of such parts of works as are perhaps not easily inspected; on no account should the cause of accidents and damage be over-looked, and no officer of the Irrigation Department should be content with merely the repair of damage, but should see that all reasonable precautions are taken to prevent any probability of its recurrence.

FORT SAINT GEORGE, *6th February* 1875. (Signed) JOHN MULLINS, Lieut.-Colonel, R.E., *Chief Engr. for Irrigation.*

No. 613. From J. W. RUNDALL, Esq., District Engineer, Tinnevelly, to Lieutenant-Colonel J. MULLINS, R.E., Chief Engineer for Irrigation, dated Palamcottah, 26th June 1874, No. 53.

I HAVE the honor to forward, herewith, a preliminary report regarding the Nambyar project received from Mr. Grant, Assistant Engineer.

1 Copy of Mr. Grant's report.
1 Plan.

2. This project was in G. O. No. 762, of the 10th March 1869, ordered to be investigated, and Mr. Grant was sent down for the purpose.

3. In explanation of the delay in forwarding this report, I have the honor to state that although arriving in this district, viz., in April 1869, Mr. Grant was during the year 1870 employed for a considerable time in carrying out repairs to works damaged in the flood of November 1869, and from August 1871 to December 1872 engaged on the Salochanam bridge restoration, together with a good deal of ordinary executive work. In 1873 he assumed charge of the Shermadevi Range, the duties of which are heavy.

4. The levels for the channels sketched out in the report are all completed, and but very little if any more field work is wanted; but the whole scheme seems to me so unpromising that, before expending any labor in working up details, I thought it better to forward you the results of Mr. Grant's investigations.

5. I have been over the ground with Mr. Grant, and have seen most of the other irrigation works from the Nambyar river. If there is any water wasted at Govanculam it is due to the fact that the existing works on the higher part of the river are not in an efficient state.

6. Mr. Grant's observations show that there is water passing Govanculam for seventeen days in the year, but it seems to me that the first aim should be to put all the existing works into proper order, and if they cultivate their full ayacut and there is still water to spare, we can then project improvements on the lower reaches.

7. In a letter printed with G. O., Public Works Department, No. 149, dated 26th March 1870, Mr. Stuart, the then Sub-Collector, states that 12 per cent. of the ayacut of existing works is not cultivated.

8. A more recent return received by me from the Sub-Collector shows that the average of remissions of assessment during the ten Fasles, 1272 to 1281, amounted to 12·82 per cent. of the ...ue.

9. During the last ... Tamariar anicut has been rebuilt, the Vallyur channel has been ... The large Vallyur tank and several of the

lower tanks under it have been repaired, and the Pulicolam and other tanks under the Govanculam anicut have also been repaired, as much has been done for the upkeep and improvement of this system of irrigation as the general allotment of the district would admit of. The insufficiency of this allotment has frequently been brought to notice. I propose to take up the Vizianarayanam tank next. The remissions on this have averaged 20 per cent. during the ten years from 1272 to 1281.

10. With regard to Dr. Caldwell's project, Mr. Grant's report and its accompanying map will, I believe, be found explanatory of the whole matter.

11. The disposal of the water from the large Oday which now drains into and forms the Turavei or lake is the principal difficulty, and the chief item of expense would be the diversion of this Oday in another direction.

12. The expense of deepening the old cut from the Turavei, the bed of which is entirely rock, precludes any thought of that being attempted.

13. There are two objections to the tank proposed by Mr. Grant, one is the nature of the soil of which the bank must be composed. The whole tract is sand with a rocky sub-stratum, and the tank bank would have to be composed of soil very little better than pure sand. The second is the impossibility of getting rid of the surplus from the tank except by swamping land in the Turavei, these seem to me to bar the carrying out of the project.

14. Please inform me whether there are any points on which you think it desirable to obtain further information, and whether you think it advisable to work up into detailed estimates the information already collected by Mr. Grant.

15. Mr. Stuart, when Sub-Collector, and Mr. Grant explored places at which it was thought possible to divert water from the western to the eastern slopes of the hills. There seem to be no practicable sites for such diversion.

From J. D. GRANT, Esq., Assistant Engineer in charge Shermadevi Range, to J. W. RUNDALL, Esq., District Engineer, Tinnevelly, dated Shermadevi, 18th April and 21st May 1874, No. 280.

I HAVE the honor in accordance with your order to forward a sketch map showing the country surveyed in connection with the scheme proposed by the Rev. Dr. Caldwell for extending cultivation in the neighbourhood of Turavei and other places near Edeungoody, and to submit briefly the conclusions I draw from an examination of the proposal.

This report should long before this time have been submitted, but, as you are aware, I have been so constantly engaged on other work as to have no time for any but my current duties. Dr. Caldwell's scheme printed with G. O., No. 762, of 10th March 1869, was, roughly speaking, to cut a channel from some point above Pulicolam and lead the water now diverted from the Nambyar at Govancolam round by Edeungoody to Turavei, supplying on the way any tanks that it might be found possible to reach; the Turavei lake was to be utilized by converting the upper half into a tank for the irrigation of the lower half, and several other lakes were intended to be similarly made use of.

In addition to the water from the Nambyar river a supply was expected from the drainage stream now leading into Turavei. In order that the scheme may be clearly understood I should give some description of the features and area of country to be dealt with.

This area is nearly triangular in form, having the Nambyar and Manapad rivers as its sides, and the coast line as its base, with the large Vizianarayanam tank as the apex. Nearly bisecting the triangle is the stream from which the ... ary supply of water was anticipated.

This stream though generally dry when rain falls ... brings down a large body of water, and on exceptional occasion receives a small quant... surplus of Vizianarayanam tank

All along its course, and between its source and Vizianarayanam, there are numerous rainfed tanks, which in ordinary years arrest a large part of the surface drainage, their supply being at all times precarious and often very scant.

In heavy rain, as in 1869, this stream is a very formidable body of water, and, augmented by the contents of breached tanks, fills up the Turavei lake.

Such an occurrence may be taken as happening once in seven years or so.

After passing Thesianvelay (Pegayanvelay on the Ordnance map) the stream is stopped by the sand ridge and turned sharply round to the north into Turavei lake.

Turavei and other lakes are separated from the sea by sand hills from 60 to 90 feet high, and the only outlet for flood waters is either by the Nambyar or Manapad river, between which rivers Ayencolam lakes stands at the water shed, and when filled discharges its surplus water through Anagoody lake into Turavei.

The bed of the Turavei lake is found to be about mean sea level, and is always a swamp at best, while (as at present) after an exceptionally heavy rainy season it remains for years a lake. The water it received in 1869 has not yet dried up.

The sides of all these lakes are turned to account for the cultivation of rice, cotton, plantains, and vegetables of all sorts, the cultivators following the water as it subsides, and supplying their crops by means of picotahs and similar contrivances. This mode of cultivation is at best laborious, and has the further disadvantage of being liable at any time to destruction by floods. For the latter reason some years ago a drain was dug from the north side of Turavei lake into the Manapad river, with the object of decreasing the loss from the lake filling, but as the head of the drain is 13 feet above the deep bed of the lake, the large quantity of land below the level of its head is in no way benefited by its construction.

From examination I find that rock prevents the further deepening of this drain, and prevents the possibility of draining any more of the bed of the lake. There still remain however available for cultivation, above the level liable to submersion, 2,000 acres of land, and to this alone I have directed my attention.

There are also several small lakes which are capable of improvement, and to which water could be led from Turavei lake at an expense that would probably be sufficiently low to render them remunerative, but as the main difficulty is to bring the water to Turavei lake and to control it, it will be sufficient if I give the rough out portion of the scheme and show what I believe to be the case, that the project would not pay, and would be difficult to carry out, and, when carried out, that it would be liable to destruction unless extraordinary care were taken. The Rev. Dr. Caldwell proposed to carry an embankment across the bed of the lake, thus forming a tank in the upper half, which tank would irrigate the lower half of the lake, and its surplus water, through the drain I have mentioned, into the Manapad river.

To this proposal there are certain objections, which appeared to me to render its execution undesirable, viz.:—

1st.—The lower half of the lake having no drainage would become a swamp even if flood waters were allowed to get through the surplus channel.

2nd.—The land proposed to be turned into a tank being above the level of the drainage channel can now be cultivated, and is cultivated.

After going over all the ground I selected as a site for a tank the point marked A B on the plan, where a large tank might be easily constructed, to contain about 15 million cubic yards of water, sufficient for the irrigation of 2,000 acres of land, which quantity could be found on the sides of the lake.

The land to be swamped by the tank is covered with palmyrahs, a very small quantity of paddy and some garden land. There would not however be much difficulty in obtaining this land, as the landowners have sold it to the lake also, and would willingly take a low rate of compensation.

The difficulty which appears to me to be fatal to the scheme for a tank in this locality is the impossibility of getting rid of the surplus water during the supply, for as the Turavei lake is hemmed in by sand hills, except on one side in which case the outlet would be to be crossed, it is impossible to discharge the surplus water except at that

To carry the surplus water round the margin of the lake would be most expensive and would be impracticable, as no channel could be kept open among heaps of moving sand, such as these "Theris" are, and to ensure the safety of a tank it would be accordingly necessary to obtain full command of the water before it reaches the tank and so to arrange the supply works that any excess of water could be absolutely prevented from entering the tank.

To stop the water in the river channel would be a matter of no difficulty, but to provide works capable of disposing of the flood waters of the Thesianvelay Oday is a matter of extreme difficulty, and one requiring great care, for should the tank at A B breach it would carry before it the cultivation in the narrow neck leading into the lake and swamp any cultivation below the level of the drainage channel, to say nothing of a village near the site proposed, which village would probably be carried away.

The Govancolam Anicut would require to be repaired, and a head-sluice built, at the point where the new channel leaves the existing one, and a channel would require to be dug from that point to a point in the Thesianvelay Oday.

There is great difficulty in choosing a good line for the new channel, but after several trial lines I found the one shown in lake on the sketch map the most favorable, being shorter and passing through slightly better soil than elsewhere met with. In some places, however, the soil is very bad, the surface being of light colored powdery earth, which melts away when brought in contact with water, and the sub-soil being rock so near the surface that it would be necessary to carry the channel along in bank for some distance, the remaining portion of its course passes through gravelly soil with a covering of sand and earth.

By this channel the water would be thrown into the Thesianvelay Oday, whence it would run into the proposed tank.

With regard next to the means of getting rid of the excess water of this stream in case of floods. From the configuration of the ground it is impossible to divert it in a northerly direction into the Manapad river, it must therefore be taken south into the Nambyar.

For this the most favorable point is that marked 7 on sketch map, and here I should propose the construction of an embankment across the stream with sluices, which being closed the water would flow through the large tank shown, and so down past Pulimancolam, to the river; when not in cutting, that is near Pulimancolam, it would be necessary to bank it in to prevent damage to the fields.

The drainage area of the stream is 25 square miles, which with 6 inches of rainfall off the ground per day would give 348½ million cubic feet per day to be disposed of by the diversion channel.

In taking 6 inches as the amount of water which will run off in 24 hours, I have considerable doubt of my calculation being sufficient for all contingencies, and I am at a loss how to treat the possibility of tanks above breaching, among which the Vizianarayanam Periadolam has 1,400 acres of cultivation, and probably therefore will contain 8½ million cubic yards, equal 229½ million cubic feet of water, while the numerous smaller tanks will bring the total quantity of water which could possibly break loose to at least an amount equal to what I have assumed as likely to come down the stream from rain. Again, these tanks if breached would fail all one after the other, hence taking the most unfavorable circumstances, viz., heavy rain and a sudden collapse of the irrigation works above, the amount of water to be diverted becomes enormous.

Allowing, however, for a channel to carry off the rainfall over the catchment basin at the rate of 1 inch per hour, a channel capable of discharging 4,033 cubic feet per second becomes necessary.

Owing to the presence of rock, 4 feet is the greatest depth of water that can be carried in the channel, and with this depth a fall of 1½ feet per mile and a bottom breadth of 350 feet the required quantity could be discharged.

After passing for 1¼ miles in cutting, the channel falls into a small stream leading through Pulimancolam tank into the sea.

This stream will require to be embanked on each side to prevent damage to the Nanja and other fields. Culingulahs will also be required where shown on sketch map, and some bunds

will require to be strengthened. The Nambyar river is in slight fresh for about seventeen days a year, but all observations taken are most unsatisfactory and unreliable, but taking all circumstances into consideration, and from the information of villagers in the neighbourhood, I do not think seventeen days will fall short of the average number of days we could depend on, if any thing I think it too sanguine an estimate.

This being so, we require a channel capable of supplying a little less than one million cubic yards a day, and this I have estimated for.

The following abstract of the works necessary, with numbers corresponding to each item on the sketch map, will give a clear idea of what is proposed.

The compensation allowed is based on the values of similar land, and the whole estimate is but an approximation to what would be arrived at by more accurate calculation, it will be I hope, however, sufficient to enable an opinion to be formed as to the advisability or otherwise of preparing detailed estimates.

No. on Sketch in blue figures.	Item of Work.	Estimate.
		Rs.
1	Repairing Govancolam Anicut, providing apron where required, and sundry repairs to the body	800
2	Cutting a new head to the channel 900 yards long, average depth 6 feet, bottom width 25 feet, depth below Anicut 3 feet, fall 2½ feet per mile, to discharge 16,000,000 cubic yards in 17 days	2,500
3	Anicut across present channel to divert the water into the new channel ...	1,500
4	New channel from the above to throw water into Aypady tank, 2 miles long; bottom width 50 feet, depth of water 2 feet, fall 1½ feet per mile, discharge same as No. 2, soil very bad	5,500
5	Strengthening the bund of Aypady tank, providing a calingulah at its east end 51 feet long	300
6	Cutting a channel from above calingulah at the Odai, 2¼ miles, section the same as No. 2 but depth of excavation only 3 feet, hard gravel soil ...	5,300
	Bridge under the road, 3 vents 6 × 4 each	700
	Sundry repairs to calingulahs and tanks in the bed of the Odai	1,000
7	Embankment to divert flood waters, with three under sluices to pass the ordinary supply, each 6 × 4	2,500
8	Bridge under the road or road dam, which latter is preferable	600
9	Improving Yerumeykolam	700
	Do. Avakkycolam	300
10	Two calingulahs in the above tanks at 600 Rupees each	1,200
11	Diversion channel 1½ miles long, 360 feet broad, average digging 5 feet; 4th being rock, and the rest hard soil	77,000
	Embankment to protect cultivation at Pulimancolam 1½ miles of double embankment 2 yards high, 1½ top breadth, slopes 2 to 1	3,000
	Enlarging Pulimancolam calingulah from 36 feet to 150 feet long ...	1,400
	Building revement walls to protect the 2 tanks shown	1,500
12	New tank near Arasoor, bund 2,000 yards long, average height 4½ yards, top width (to carry road) 8 yards, outside slope 2 to 1, inside revetted ...	25,000
	Two sluices, and distribution channels each 1½ miles long	1,200
	Compensation for Item No. 6, at 50 Rupees per acre	5,000
	Do. Item No. 10, diversion channel at about 50 Rupees per acre ...	
	Compensation for land swamped by new tank (Item No. 12) 1,100 acres at 30 Rupees per acre	33,000
	Total ...	1,70,500
	Contingencies at 10 per cent. ...	17,000
	Total Estimate ...	1,87,500

The local cost of the works detailed in detail it might be found to be Rs. 1,86,890, and possibly if the estimate were calculated in detail it might be found to be a less sum.

The land to be irrigated, as mentioned above, is 2,000 acres, which at 5 Rupees per acre would yield 10,000 Rupees per annum, or not quite 6 per cent. on the outlay.

So small a return would of itself be sufficient to preclude the adoption of the scheme, but in addition I find from the returns of remission granted that the average yearly remission given is for 1,019 acres of river-fed tank and channel cultivation out of a total of 8,522 acres. This being so, it cannot but be cheaper and more advantageous in every way to take up systematically, in the first place, the repair of all river-fed tanks and channels rather than large new works of doubtful success.

Having put the existing works in thorough order, it would then be time enough to project new works.

As for some years I have been in charge of the [illegible] I have had every opportunity of seeing the irrigation works, and I have no hesitation in saying that there is not a channel which could not be greatly improved, and the improvement of which would do more good, in proportion to the expenditure, than the scheme under notice.

I have also examined, as directed, the range of hills between Nangumeri and Travancore, but have failed to find any stream, flowing into Travancore, that could be diverted. In the Range Officer's Memorandum on the Numbyar river* mention is made of the "Vizianarayanam Anicut" No. 8, but this anicut has no existence, and its construction would materially improve the Vizianarayanam tank, the largest in the taluq but one. Neither have I been able to trace the "new project" referred to as feasible, the particulars given are however so vague that it is scarcely possible to appreciate the proposal. In the Sub-Collector's letter printed with the same Government Order an anicut "on the Mahendragherry" is spoken of, but on the Mahendragherry there is nothing that can be called a river, and no stream it would be possible to divert into the Nambyar for any reasonable sum of money.

* G. O., No. 762 of 10th March 1869.

In conclusion, therefore, I would most strongly recommend that before searching for new schemes of irrigation, the existing irrigation works, be year by year, brought into good repair, on some definite system, and all available water utilized in cultivating the part of the ayacut now left waste, and in bringing under the river channels the outlying rain-fed tanks. After this is complete any surplus water can be easily and profitably used in cultivating dry land near existing channels, and when this also is complete I feel satisfied no water will be lost.

No. 614. ORDER THEREON, 31st March 1875, No. 848.

IRRIGATION, No. 45.

IN paragraphs 2 to 14 of the foregoing memorandum the Chief Engineer gives a brief description of the Tambraparny river, and notices the condition in which he found them. It is quite clear that they have not received adequate poorny irrigation and of the old anicuts on attention, and they are far too important and valuable to be allowed to become either unsafe or inefficient. The District Engineer's attention having now been called specially to their requirements, no time should be lost in dealing with each one according to its circumstances. Arrangements have, it is observed, been made for the early construction of all the head sluices needed from the Cannadion anicut downwards, and the estimate for that for the Nathiyuny channel is awaited.

2. The District Engineer's special attention will be given, with as little delay as possible, to the requirements of the tanks which surplus across or into the several anicut channels, and the river embankments also must be rendered efficient. It will be expected that within a moderate [illegible] all that has been shown to be necessary will have been fully completed, [illegible] more preventable accidents may occur.

3. The subject of establishing plantations along the line of the Tuticorin town supply channel, so as to turn to account the water now absorbed by the sandy soil, will be referred to the Revenue Department for consideration. If the water can be thus utilized, it may be better not to carry out works for preventing absorption, as there appears to be some difficulty in doing so effectually.

Paragraph 46.

4. The suggestions for the storage or holding back of water above Papanassum, so as within certain limits to equalize the discharge of the Tambrapoorny, will be acted upon as soon as the District Engineer may be in a position to make the necessary investigations, and then the survey establishment required will be made available.

Paragraphs 47 and 48.

5. The observations on the water-supply of part of the Nanganeri taluq, and on the state and requirements of the Nanganeri and Vizianarayanum tanks, should be attended to in carrying out the much needed improvements noticed.

Paragraphs 52 and 53.

6. The circumstances of the Nambiyaur and the results arrived at from the preliminary investigations made by Mr. Grant indicate that it is not desirable to carry out a new project for the extension of irrigation to lands beyond the influence of existing channels, and that it will be better to improve and render efficient the latter. Such being the case, the reference made in G. O., dated 10th March 1869, No. 762, may be considered disposed of.

Paragraphs 55 to 57.

7. The Government hope that the remarks contained in the foregoing memorandum generally and particularly in the concluding paragraph will lead to an improved and more systematic treatment of the Irrigation works of the Tinnevelly District, and result in their much greater efficiency and freedom from accidents.

(True Extract.)

Colonel, R.E.,
Secretary to Government.

To the District Engineer, Tinnevelly.
" Chief Engineer for Irrigation.
" Revenue Department.

Encl. 41 Gradient.
" Spare Copies.

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APPENDIX.

Letter from District Engineer Tinnevelly, and report on Numbiyaur project.

No. 1165

Revenue Department

Govt. of Fort St. George Madras.

PUBLIC WORKS.

To

THE LOCAL ENGINEER, TINNEVELLY

Madras, &c. &c.

Dated March 1875.

Read April 2d

G. O. [illegible] March 1875, No. [illegible]

MARCH

Nos. [illegible]

[illegible]

No. 658, 8th April 1875

W. H. Broder

Communicated

Revenue - Their attention is requested to [illegible] of the G. O. in the P. W. D. above recorded.

[illegible] April 75

14 [illegible] Order of 7 April