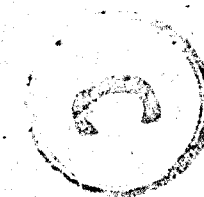


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Report on Papanasun-
Reservoir Project: Tinnevely
Dist. 1913.



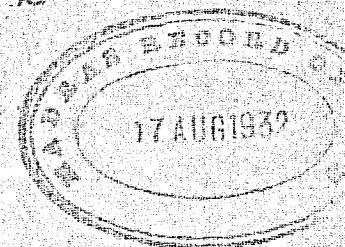
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OF

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ABOUT THE



PANASUM RESERVOIR PROJECT

TINNEVELLY DISTRICT.

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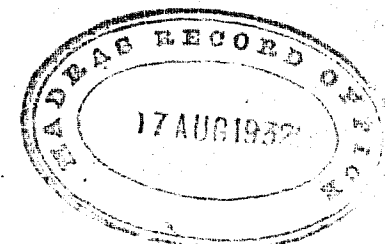
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1913.

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No. 2449.

FROM

The Chief Engineer in the Department Public Works.

TO

The Secretary to Government, Department Public Works.

SIR,

I do myself the honor to forward for submission to Government a set of papers * which Captain Horsley of the Engineers, and late Civil Engineer in the 8th Division has been good enough to draw up in compliance with my suggestion. I think that his final report on the Provinces of Madura and Tinnevely, will be perused with considerable interest by the Right Honourable the Governor in Council, who will not fail to notice the present very unhealthy state of the labour market in Tinnevely as affecting the measures that might be taken with great advantage for the improvement of the districts, particularly that of a capacious supply reservoir situated in the Hills amongst the main feeders of the river Tambrapoorney which Captain Horsley does not consider feasible in the present condition of the people; and His Lordship will doubtless also observe how greatly the want is practically felt of suitable legislation for the care and management of works of irrigation, and of the available supply of water, so much of which is now wasted and misused.

2. It was my misfortune to incur a very severe rebuke from the Government in the 7th para of the Extract Minutes of Consultation, No. 2907 of the 27th October 1855, for using the language of praise in speaking of an officer of the Department who had apparently gone beyond the strict limits of the duty that had been assigned to him; and I should much regret to call forth renewed reprehensions by injudicious expressions of approbation towards the officer whose closing labours, I have now done myself the honor to bring to your notice. I hope however that I shall not be considered to again exceed the proper limits of my office, when I solicit the attention of Government to Captain Horsley's zealous and successful services as Civil Engineer in the 8th Division for a period of very little less than fifteen years, hardly broken by a day's absence from duty. It is a peculiarity attaching to the long labours of this officer, that without having brought forward any new projects of notable magnitude or extensive influence, the result of a careful, assiduous and skilled attention to the duties of annual repair and improvement to no one locality more than another, but to the steady patient maintenance of efficiency throughout all the numerous works of irrigation in his range, is an increase in wet cultivation during the last five years of his incumbency over the first five, of no less than 60,000 acres, with a corresponding revenue in excess, of (3,60,000) three lacs and sixty thousand Rupees. I believe I do not err in reporting that in no other division of the Madras Presidency are the hydraulic works of every kind in a state of equally general efficiency and good repair owing mainly to Captain Horsley's professional management; and I think it is impossible to contemplate his long service without arriving at the opinion that the beneficent intentions of Government have been admirably carried into effect, by one of the most conscientious and diligent public servants. The improvement of the communications in the Madura and Tinnevely districts has gone hand in hand with the measures for increasing the produce; and numerous large bridges and several important roads now open to the growing traffic of the provinces, attest both the liberality of the Government, and the industry and ability of the professional officer whose long employment has now drawn to a close.

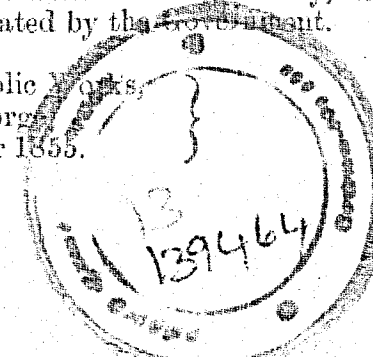
3. I venture, in conclusion, to express a hope that such public notice may be taken of Captain Horsley's labours on leaving India, as may evince both to himself, and to the Department Public Works generally, how justly his long and useful services have been appreciated by the Government.

Central Office of Public Works,
Fort St. George,
5th November 1855.

(Signed) C. E. FABER,
Lieut.-Col. of Engineers,
Chief Engineer, D.P.W.

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No. 107.

From

Captain W. H. HORSLEY,
Civil Engineer, 8th Division.

To

Lieutenant-Colonel C. E. FABER,
Chief Engineer, Department of Public Works,
Fort St. George.

Sir,

1. As directed in your letter No. 1207, dated 24th September 1855, I have the honour to furnish you with a list of projects already submitted and of such as are with the Collectors of Madura and Tinnevely, respectively, for their approval and counter-signature previous to submission for sanction.

2. As respects the drawing up of a general report for the guidance of my successor both of my past labours and prospective plans, indicating what I consider the most profitable direction of future efforts at improvement in Madura and Tinnevely, I will gladly do all that lies in my power to meet your wishes but I really do not see that I can add much to what has been already said in the annual reports on important works executed in this division for many years past, nor can I suggest anything with regard to prospective plans that I have not already suggested in my letter to the Chief Secretary to Government No. 170, dated 9th May 1855, copy of which was forwarded to the Board of Revenue in the Department Public Works with my letter No. 36, dated 17th idem.

3. With reference to the 3rd para. of your letter under reply, I regret to say that it has not been in my power to follow up the investigations in the Hills above Ponnasam with a view to the formation of supply reservoirs for the safety of the crops dependent upon the Tambrapoorney river irrigation. My own time has been so completely taken up with the ordinary duties of the division, which year by year are becoming more onerous, and with the long delayed project for improving and extending the irrigation to the Eastward of Stréevigootum, that I really could not undertake the further investigation of the Tambrapoorney reservoir project without neglecting current work. It appears to me that if the Civil Engineer is required personally to investigate large projects of this nature he must be relieved of the correspondence and ordinary duties of the division, for both cannot certainly be carried on together.

4. As mentioned in my diary (general observations) 16th September 1854, I believe it to be perfectly practicable to form an extensive reservoir in the valley of the Tambrapoorney in the vicinity of Shoraymootien coil provided the requisite labour be forthcoming; but I foresee great, I may almost say, insurmountable difficulties in procuring labour for a work of this magnitude, situated as it would be in the midst of jungle and far removed from all villages and markets. If it is with difficulty that 500 coolies are collected in the vicinity of Tuticorin for the trunk Cotton road work with wages varying from 2 to 3 annas per diem, it stands to reason that it will be far more difficult to procure and locate an efficient working party in and out of the way place like Shoraymootien coil. Every article of food would have to be brought from distances varying from 10 to 15 miles, and the pay of the coolies would require to be increased in proportion; still, notwithstanding the expense, it certainly would be worth while for Government to undertake the work, if coolies in sufficient number could be procured. I confess I feel very doubtful on the subject in the present state of the labour market in Tinnevely, but perhaps, a few years hence, when the working classes are more accustomed to the new system, there may not be the same difficulty in procuring labour that there now is.

Civil Engineer's Office,
8th Division, Madura,
16th October 1855.

(Signed) W. H. HORSLEY, Capt.,
Civil Engineer, 8th Division.

P. S.—The report referred to in the 2nd para. of this letter is herewith forwarded.

(Signed) W. H. HORSLEY.

(A true Copy)

C. E. FABER, Lieut.-Col. of Engrs.
Chief Engineer in the D.P.W.

List of Projects already submitted and of such as will be hereafter forwarded for the Budget of 1856-57.

District.	Description of Work.	Amount of Estimate.	Date of sanction for works to be entered in the Budget of 1856-57.	Date of letter transmitting for sanction.	Date of letter transmitting to the Collector for his approval and countersignature.
Tinnevely.	<i>Works of Irrigation.</i>				
	A new Tank in rear of the present Noramany Peracolum.	4,376 0 0	1st Sept. 1855		
	Channel from Taravly Lake to Caroombar River	3,253 0 0	"	12th June 1855	
	New Asient at Stréevigootum with channels to Tirichendoor and Tutacoria	3,84,172 5 0	"	"	15th June 1855
	Surplus channel of Elloopacoorchy Tank	560 9 0	16th June "	"	
	Stone revetment to bund of Kristnapooram Peracolum.	917 4 0	"	"	} 22nd March "
	Earth work to bund of Vyley Peracolum.	682 7 0	"	"	
	<i>Roads and Bridges.</i>				
	Constructing a new line of Road from Palamcottah to Tutacoria.	67,363 10 0	"	24th July "	"
	Do from do to Coolahagaraputnam.	69,891 14 0	"	"	"
	Do. a portion of Road No. 4 between Sautoor and Virdeapatti	24,749 14 0	"	"	"
	Do do between Gaingoondan and Shady Khan's choultry.	9,939 8 0	"	"	"
	Bridge across the supplying channel of Manaboer Tank on Road No. 2.	499 12 0	2nd June "	"	"
	Constructing a Jetty at the Port of Tutacoria.	4,350 0 0	"	"	} 28th Sept. "
	Do. do. at do. of Coolahagaraputnam.	1,620 0 0	"	"	
	<i>Buildings.</i>				
	Travellers' Bungalow at Palamcottah	1,933 0 0	"	10th Feb. "	"

Civil Engineer's Office, 8th Division,
MADURA 16th October 1855,
Despatched 24th do.

(Signed) W. H. HORSLEY, Captain,
Civil Engineer, 8th Division.

(A true copy)

(Signed) C. E. FABER, Lieut.-Col. of Engineers,
Chief Engineer in the D.P.W.

List of Projects already submitted and of such as will be hereafter forwarded for the Budget of 1856-57.

District.	Description of Work.	Amount of Estimate.	Date of sanction for works to be entered in the Budget of 1856-57.	Date of letter transmitting for sanction.	Date of letter transmitting to the Collector for his approval and countersignature.
Madura.	<i>Works of Irrigation.</i>				
	A Surplus Oalingulah and earth work in Kullerailputty Tank	425 0 0	24th Sept 1855		
	<i>Roads and Bridges.</i>				
	Road No. 18 between Butla- panda and junction with Road No. 15 at Pullapatty.	7,884 0 0	5th July, "		
	Road No. 25 between Thiroo- mungalum and Oosalempatty	8,812 0 0	"		
	Bridge of 6 arches across the Shunmoooganuddee	15,425 0 0	"		
	Do. of 3 do. across the Geo- dair on Road No. 8	7,300 0 0	"		
	Road No. 22 between Mayloor and Tirupuvanam	3,610 4 0	18th June "		
	Road No. 1 between Trihima- poly and Dindigul	14,170 0 0	24th Sept. "		
	Road No. 15 between Madura and Dindigul	14,510 0 0	"	13th Oct. 1855	
	Bridge of 25 arches across the Vigay River	41,600 0 0	"	"	
	Bridge of 3 arches across the Manjelaar	3,233 7 0	"	7th May and 14th Sept. 1845	
	Palney Hill communications ...	47,040 0 0	"	30th Aug. 1855	
	Road No. 17	26,560 0 0	"	"	16th Aug. 1855
	Do. " 19	17,210 0 0	"	"	"
	Do. " 23	35,400 0 0	"	"	"
	Do. " 27 from Careyapatty to Arooppecottah	41,190 0 0	"	"	7th Sep. "
	Do. " 16 between Madura and Oosoothee	1,61,170 0 0	"	"	"
	Do. " 1 Strevelappothoor to Thiroomungalum	41,020 0 0	"	"	"
	Cross road from Samianalleer to junction with road No. 4 at the Northern extremity of the Pavement across the Vigay river	17,530 0 0	"	"	"
	<i>Buildings.</i>				
	New Taseek Catcherry at Thi- roomungalum	3,590 0 0	"	4th Oct. "	"
	Travellers' Bungalow at Dindi- gul.	2,600 0 0	"	17th July 1850	"

CIVIL ENGINEER'S OFFICE, 8th DIVISION,
MADURA, 16th October 1855,
Despatched 24th do.

(Signed) W. H. HORSLEY, Captain.
Civil Engineer, 8th Division.

(A true copy)

(Signed) C. E. FABER, Lieut.-Col. of Engineers.
Chief Engineer in the D. P. IV.

Report of Captain W. H. HORSLEY'S past labours and prospective plans for the
guidance of his successor in No. 8th Division.

1. Having been requested by the Chief Engineer, in the Department of Public Works, in a letter No. 1207, dated 24th September 1855, to draw up a general report for the guidance of my successor both of my past labours and prospective plans, indicating what I consider the most profitable direction of future efforts at improvement in Madura and Tinnevely, I cannot do better, I think, than go over in order the principal works connected with irrigation, as well as the more important roads, in Madura and Tinnevely, and after shewing what has been done of late years for their improvement, point out in what way the efforts of my successor may be most profitably directed.

2. To begin with works of irrigation. In the Madura district, the Vigay and its affluents, the Soorooly and Varanuddee, are the principal irrigating rivers. The two last are crossed by numerous Anicuts, formed of large square blocks of stone laid in steps, with a front wall of brick in chunam. The height from the crown of the work to the bed of the river in rear varies from 3 to 5 yards; and during very heavy freshes it frequently happens that these stones are displaced by the action of the water upon them. I have endeavoured to remedy this by coating the upper layer of stones with broken stone jelly in chunam, so as to fill up the interstices between the large stones and give a tolerably smooth surface for the water to flow over. This has answered very well in several instances, but it would be better, when extensive repairs are required, to rebuild the Anicut throughout with stone in chunam on a proper section. The Vigay river itself is crossed by 4 masonry Anicuts. The first is situated about 4 miles south of Vullelmuddee, in the Thenkurry Talook, and has been rebuilt within the last 7 years by the renter of the Guntapandickenoor Zemindary. At present it serves only to supply the lands belonging to that Zemindary in the vicinity of Vullelmuddee; but it would appear that formerly the tanks of Andipatty, belonging to Government, were supplied by it, and on the 12th September 1854, I submitted an estimate of Rupees 7,898 for restoring the Andipatty channel, as well as the tanks formerly supplied by it to an efficient state, to the Collector of Madura for his consideration, stating at the same time that I did not recommend the outlay unless it could be shown that it would be repaid in 5 years by increased cultivation. Up to the present time no answer has been received from the Collector on the subject, and I conclude, therefore, that he does not consider it likely that the increase in cultivation would be proportionate to the expense. The next in order is the Coonoor Anicut. This work was in a ruinous state when I first saw it, and was restored in the years 1847 and 1848 at a cost of Rupees 1,975. Below the Coonoor Anicut are the Parcanai and Chittanai Dams, both valuable works to Government. They have had considerable outlay on them from time to time for repair, and within the last 2 years I have had a portion of the crown of each faced with cut stone, as nothing else will stand against the strong current in this river. It is highly desirable that the remaining portion should be treated in the same manner. Head sluices are required at the head of the channels (Vaddakurray and Thenkurray) proceeding from these Anicuts, to regulate the quantity of water thrown into their respective tanks. There are no Anicuts on the Vigay river below the Chittanai, but numerous channels are taken off it by means of temporary Coorumboos for the irrigation of the lands on either bank, and it is seldom that any surplus finds its way into the sea. These channels have all received attention from year to year, and the Nellyoor channel, in particular, has had a large outlay upon it for masonry sluices as well as for deepening and widening.

3. The principal tanks in Madura are those supplied by channels from the Vigay river, viz., Vuddagurry, Thenkurray, Maudacolum, Cootengoendu, Thencaul, and Vundyoer, in the Mundacolum Talook.

4. In the Thiroomungalum Talook also, there are some large tanks supplied by Goondair and Shevaracotta Rivers, of which may be enumerated those of Thundaly, Naysanairy, Shevaracotta and Corayoor. All these tanks have had constant repair under the head of "Ordinary," and are in tolerable order at the present time.

5. In the Mayloor Talook, the tanks are in general small. There are two, however, which are exceptions, viz., the Coonatoor and Angadyamungalum Tanks. For the supply of the latter a new arrangement has lately been sanctioned, which will, it is hoped, be attended with benefit to the cultivation under it.

6. In the 4 Talooks forming the sub-division, the principal irrigating rivers are the Munjalaur, Venkatadriancotay, Odavenuaur, Nangangeaur and Shunmooganudee. All these rivers are crossed by numerous Anicuts formed of large masses of stone, packed together in layers, with a front wall of brick in chunam, and in some instances coated with jelly in chunam over the crown. They are very liable to get out of order, and therefore require constant attention.

7. The tanks in the sub-division are tolerably numerous, but nothing particular as respects dimensions. They have been repaired from time to time as occasion required, and are at present in a tolerably efficient state.

8. The reports on important works furnished annually to Government show the particular works which have been undertaken from year to year in Madura, and the general results as respects increase in cultivation and revenue.

9. As regards new works or important improvements to old ones connected with irrigation, I do not see that there is much room for such in Madura, except it be by damming up some of the mountain streams flowing from the Palney range of mountains, so as to form extensive reservoirs at their foot. If this could be effected, there is no doubt the wet crops dependent upon these streams would be rendered more secure, and probably a greater extent of land might be brought under cultivation.

10. The principal irrigating rivers in Tinnevely are the Tambrapoorney and Chittaur. The former is crossed by 7 Anicuts, two of which are formed of rough stone boulders, and the remainder of solid masonry. They are all very important works and require, with the channels proceeding from them, constant attention. The Cannadien Anicut was rebuilt throughout in 1842, and that of Sootoomullay has twice had extensive repairs, viz., in 1842 and 1855. A great deal also has been done to improve the Mailacaul and Keelacaul channels thrown off by the Murdoor Anicut below Palamcottia. Several thousand cubic yards of rock have been removed and their beds widened to 14 yards. A better arrangement also has been effected for the supply of the Streevigoontum Pereacolum, and the tanks dependent upon it to the eastward, from which a large revenue is derived to Government. A head sluice is much wanted for the Mailacaul channel, and it was my intention to have prepared an Estimate for it for insertion in the Budget of 1856-57, but I have not been able to take the necessary measurements. For want of a work of the kind the channel banks are liable to be breached in high freshes. The channels from the Tambrapoorney and the tanks supplied by them require constant attention. Some stringent regulations are much wanted to prevent the ryots encroaching on the channel banks, and the channel establishments should be placed under the orders of the District Engineer. The Anicuts across the Chittaur are much more numerous than those on the Tambrapoorney, but not nearly of the same importance. They are all built of solid masonry and some of them have received extensive repairs during the last fifteen years. Considerable improvements are under progress at the present time to the Maunoor channel, in continuation of work performed in the years 1853 and 1854, with a view to secure a better supply of water for the Maunoor Tank. Dam stones have been fixed in the Anicut and furnished with Plank shutters, to be opened or closed as occasion requires, to increase the head of water at the Anicut. These improvements should be fully carried out. The Maurandy channel also is worthy of attention. From 1837 to 1841 it had a considerable outlay upon it at the recommendation of the then Civil Engineer, but the estimate was not sufficient to secure all the good hoped for. A further estimate, accompanied by a report and levels, was submitted by me in 1844, but was not sanctioned. Even in its present inefficient state, it is of considerable service by receiving the drainage of the high lands to the southward and conducting it to the Maurandy Tank. What it wants is, that the first 4 miles in the Ootamullay Zemindary limits should be widened to double its present breadth, and the left bank raised and strengthened. Below this several sandvents are required opposite Jungle streams, which bring down quantities of sand and cause breaches in the channel bank. A few more Calingulals also are wanted to let off surplus. And lastly, the bed of the channel between Myinarcooreby and Karumbooly-ooth requires deepening. A return of cultivation furnished to me by the Collector of Tinnevely shews that after deducting the first cost and subsequent repairs, amounting in the aggregate to Rupees 11,122, the gross return to Government in 15 years since the influence of the work was felt amounts to Rupees 5,235. I would strongly recommend, therefore, that my supplemental estimate for putting the channel in an efficient state should be again submitted for sanction.

11. The principal tanks in Tinnevely are those in the Streevigoontum Talook supplied by the channels from the Murdoor Anicut before spoken of. There are others, however, of considerable size and capacity in nearly every Talook, supplied by channels taken off smaller Rivers and streams, and a few that are simply "Ponay," or rain tanks. It has been my object from the time I first took charge of this Division in February 1841, to search out those tanks which either from want of repair, or an insufficient supply, did not irrigate within 50 per cent. of their Ayacut and to put them in thorough repair. I have also from time to time recommended the restoration of breached tanks, which had been out of use for a long series of years. In this way the irrigation of the District has been improved and extended, and the revenue to Government increased. A very important work in the Nangoonairy Talook, the restoration of the Carumbandien channel on the Calacaud Hills, commenced in my predecessor's time, was completed in 1843, at an aggregate cost of Rupees 6,655. It supplies about 50 Tanks in the above Talook, the principal of which is the Nangoonairy Pereacolum. Deducting the first cost and repairs up to 1852 inclusive, amounting in all to Rupees 7,338, the gross increase to Government in 10 years was Rupees 92,420. A similar, though much smaller, work was executed in the Hills above Punnagoody in the Vulleyoor Talook in 1841, and with proportionably good results. A list of the more important works performed in No. 8 Division from 1837 to 1852 was given in my report for 1852, and in that for 1853. I gave the average wet cultivation and revenue in the Districts of Madura and Tinnevely for 15 years ending fusly 1261, and shewed that the increase in the last 5 over the first 5 years amounted to 60,518 acres, and 3,60,962 Rupees. In my report for 1852, I compared the average of the previous 5 years with fusly 1262, and shewed that the cultivation and revenue was still on the increase. I would beg to refer my successor to these reports for further information on this head.

12. As respects prospective improvements connected with irrigation in Tinnevely, I have nothing to add to what has been already stated in my letter to the Chief Secretary to Government No. 170, dated 9th May 1855. An outline of the projects therein suggested is therefore all that need be given here.

1. Reservoirs in the valley of the Tambrapoorney River above and below the falls of Paupanassum.

2. The Construction of an Anicut across the Tambrapoorney River at Streevigoontum, with channels from it to Tuticorin on the North and Colasagaraputnum on the South. An Estimate of Rupees 3,84,172-5 for this work is now with the Collector for his approval and report in reference to the probable increase in cultivation.

3. Turning some of the streams on the Ghauts which now run waste into Travancore for the irrigation of the North-western portion of Tinnevely.

4. The restoration of old and breached Tanks in the Sautoor and Ootapedarum Talooks, in particular one near Sevellapairy which was formerly supplied by an Anicut across the Chittaur below Gaingoodan.

13. As respects Roads and Bridges the principal outlay has taken place on Roads Nos. 2, 4, 13, 14, 15, 18 and 27 in Madura, and upon Nos. 4, 5, 6, 10, 11, 12 and 18 in Tinnevely. My chief attention has been given to the High Road No. 4 from Trichinopoly to Madura and Palamcottia and through the Arambooly Lines to Travancore; which is by far the most important thoroughfare in the Division.

This road will shortly be bridged throughout its whole length of 185 miles, the Vigay River at Madura excepted, for which an estimate of Rupees 41,660 is about to be forwarded† for insertion in the Budget of 1856-57. The following are the principal Bridges that have been constructed in my time on this Road, viz:—

1. Bridge of 11 arches of 60 feet span across the Tambrapoorney River between Palamcottia and Tinnevely. Cost about Rs. ...	51,986	0	0
2. Bridge of 7 arches of 45 feet span across the Chittaur at Gaingoodan. Cost about Rs. ...	20,000	0	0
3. Bridge of 5 arches of 45 feet span across the Oopaur between Gaingoodan and Kytaur. Cost about Rs. ...	10,000	0	0
4. Bridge of 3 arches of 30 feet span across the Nully Oday between Coilpatty and Sauttur. Cost Rs. ...	2,987	0	0

† Forwarded on the 16th October 1855.

5. Bridge of 7 arches of 30 feet span across the Venkatasapooram Oday. Cost Rs.	5,096	0	0
6. Platform Bridge of 22 vents across the Katalumpetty Oday and Channel. Cost Rs.	3,924	0	0
7. Platform Bridge of 30 vents across the Virdoopetty River. Cost Rs.	8,213	0	0
8. Bridge of 4 arches varying from 40 to 32 feet across the Goundelunddee at Shevaracotta. Cost about Rs.	5,500	0	0
9. Bridge of 6 arches of 30 feet span across the Goondaur at Thoroomungalum, nearly completed. Cost Rs.	5,366	0	0
14. The whole of the above are situated on Roads No. 4 between Madura and Palamcotta and there are in progress at the present time.			

1. A Bridge of 15 arches of 40 feet span across the Sautoor River, estimated at Rs.	24,620	10	0
2. A Bridge of 9 arches of 36 feet span across the Vaypilley putty River, estimated at Rs.	10,313	4	0
3. A Platform Bridge of 6 vents across the Oday Cara putty Oday, estimated at Rs.	1,149	3	0
4. A Do. of 14 vents across the Asoor Oday, estimated at Rs.	2,570	7	0
5. A Bridge of 5 arches of 40 feet span across the Numbecaur South of Palamcotta, estimated at Rs.	8,859	7	0

15. In the Madura District, Road No. 4 may be considered as made throughout, but in the Tinnevely District there are still about 13½ miles requiring to be made between Virdoopetty and Sautoor, and 7 miles from Gaingoondan to Shady Khan's Chuttrum—estimates for a portion of the former and the whole of the latter were submitted for sanction on the 24th July 1855. When these portions are made and the Bridges completed there will be no obstacle whatever to traffic on this road at any season of the year.

16. In Tinnevely, the Trunk Cotton Road (No. 5) has been completed for a distance 38½ miles, and it is expected that the remainder will be finished early next year. The Branch and cross cotton Roads are likewise completed, and so if the portion of the former in the Madura District. It is highly desirable that a certain sum per annum should be allowed for keeping these roads in order, now that they are made and opened to the public. A statement shewing the length of made roads in Madura and			
Length of made road in the Madura District	674	4	0
Amount required for annual repairs Rupees, 72255 2-0			
Length of made road in the Tinnevely District,	237	6	0
Amount required for annual repair Rupees, 4,3521-1-0			

Tinnevely, and the amount required to keep them in order was forwarded to the Board of Revenue in the Department of Public Works under date the 30th December 1854, and it is hoped that some arrangement will shortly be decided upon. In addition to the bridges enumerated above, I should mention one of 5 arches of 50 feet span across the Chittaur, on Road No. 2 in Tinnevely, built by subscription in 1852, at a cost of Rupees 9,459, and another of 5 vents, each 9×16 across the Hurreehuranuddee, on Road No. 9, near Thencausee, also by subscription in 1852, at a cost of Rupees 2,205-0-0.

17. In Madura, a bridge of 5 arches varying from 32 to 24 feet span was built in 1848 and 1849 across the Kirtamanuddee on Road No. 26 between Thiroopooavanum and Tiroochuli; and subsequently viz. in 1853 and 1854, 3 bridges were built on Road No. 14 from Madura to the Port of Tondi, and paid for from the funds of the Shevagungah Zemindary. A Bridge of 11 arches of 40 feet span, sanctioned on the 27th February 1855 to be constructed across the Amaravuttee river, on road No. 2, between Dindigul and Palghat, will be commenced after the rains; and another of 6 arches of 40 feet, across the Shunmooganuddee, near Pulney on the same road, in the official year 1856-57, as per sanction of Government dated 5th July 1855.

18. I have very lately forwarded a report upon the measures required to create or improve the communications on the Pulney Hills and between them and the plains, and furnished an Abstract Estimate of the probable expense amounting to Rupees 47,040. This work, if sanctioned will probably lead to the extension of cultivation

on these Hills by affording easier means of transit to the low country, as well as inter-communication between the upper and lower ranges. Within the last two years a new Ghaut, averaging 2½ yards in width, has been made, leading up from Pereacollam on the South to Perumboo Kanul. The length of the ghaut, reckoning from Kistnapanicken tope, is 10 miles 3 furlongs, and the slope about 1 and 12. The first cost was about Rs. 4,500 and for keeping it in order an annual allowance of Rupees 786-14-0 was sanctioned by Government on the 24th May 1855.

19. For my views regarding prospective improvements to the roads in Madura and Tinnevely, I must refer my successor to my letter to the Chief Secretary to Government No. 170, dated 9th May 1855. He will there see what new lines of road are in contemplation and estimated for in each district, as well as those which I consider the most important of the present lines.

20. There is one project connected with irrigation in Tinnevely which remains to be mentioned, and that is the draining of the Tharavery Lake, in the Punjamahl Talook, for which an estimate of Rupees 3,263 was submitted for sanction on the 12th June 1855. Should this project be found to answer it will be desirable to carry the excavation 4 or 5 feet deeper, so as to drain off the waters of the Lake to the depth of 9 or 10 feet below the highest water mark, and thus enable the ryots to bring more land under cultivation. A full report on this project will be found in my diary (General Observations) of the 15th and 16th May 1855.

21. The project for the Madura town water supply is another work which I have not mentioned as yet. An estimate of Rupees 28,605-9-0 was sanctioned for this work in 1851, but for want of the necessary superintendence it is only now about to be commenced. It is intended to supply the town with good river water for household purposes, and at the same time to furnish a reservoir from whence to flush the street drains in the town of Madura.

22. For constructing Jetties at the Ports of Tuticorin and Colasagaraputnum in Tinnevely, estimates have been framed in obedience to the orders of Government No. 237, dated 1st June 1855, and are with the Collector for his approval and countersignature previous to submission for sanction.

23. Having now said all that need be said in reference to past labours and future plans for the improvement of the two districts forming No. 8 Division, I will conclude with the expression of my best wishes for my successor, that he will have all needful health and strength given to him for the performance of his duties, and that he may be able to carry into effect not only what I have suggested, but much more that he himself may propose for the benefit of the country.

Civil Engineer's Office,
8th Division, Madura,
18th October 1855.

(Signed) W. H. HORSLEY, Captain,
Civil Engineer, 8th Division.

(True Copy)

C. E. FABER, Lieut.-Col. of Engrs.,
Chief Engineer, D. P. Works.

(True Copies.)

J. D. BOURDILLON,
Secretary to Government.

No. 105.

General Observation made by Captain W. H. HORSLEY, Civil Engineer, 8th Division,
during the month of September 1854.

13th.—

BRIDGE OF 36 × 9 ACROSS THE ALOOTHACUNNUR RIVER ON ROAD No. 10,
THERNCAUSEE TALOOK, TINNEVELLY DISTRICT.

Amount of estimate Rupees 1,956—9—0 sanctioned by Government on the 15th March 1854.

Amount of advance Rupees 279—1—4 since my visit to this work on the 31st ultimo the temporary channel on the south bank has been cut, and the excavations for the foundations of the north abutment have been carried to the depth of 5 feet. Another $\frac{1}{2}$ yard will probably be sufficient, but I have directed the Tahsildar to sink them deeper if necessary. The soil at the present depth is a mixture of clay and sand. I shall have an opportunity of again examining the work when I return this way at the end of the month.

BREMADASUM TALOOK.—16th. Examined the course of the Tambrapoorney above Shoramootiencoil to ascertain the practicability or otherwise of damming up its waters, so as to form an inland lake in the manner proposed by Colonel Cotton. The Tambrapoorney is composed of two principal branches, which unite at the foot of the sacred cataract called Vanatirtum, $3\frac{1}{4}$ miles west of Shoramootiencoil. The larger of the two branches rises in the main chain of ghauts and flows almost due south with a rapid current for a distance of about 10 miles through a densely wooded valley, and then turns east for a further distance of 4 miles, till at length it precipitates itself over a ledge of rock 100 feet in height into a basin below, and thence by a succession of minor falls, amounting in the aggregate to 200 feet, to its junction with the other branch called the Pambaur. The Pambaur takes its rise in the ghauts immediately to the south of Augusta Mulla, misnamed "Coochy Mulla" in the printed map, and after breaking through an intervening range of hills, in doing which it forms an exceedingly fine cataract known as the "Pamban aruvée," it flows in a north-north-easterly direction about 6 miles to its junction with the Tambrapoorney, or main branch. Throughout the whole of its course thus far it has a very considerable fall. It is in fact nothing more than a mountain torrent. From the junction to Shoramootiencoil, the course of the river is north-east by east, and the distance $3\frac{1}{4}$ miles. As far as I can judge by Barometrical measurements, the fall in this distance is about 75 feet, or 20 feet average per mile. The slope, however, varies considerably, being much greater near the junction, and less as the stream approaches the coil, until it arrives within a furlong of it, when it is again crossed by a ledge of rock with high ground on each side, and partakes more of the character of a rapid. At the distance of 1 mile, 1 furlong, 55 yards from Shoramootiencoil, the hills open out right and left, and a considerable stream falls in on the right bank at a further distance of 1 mile, 3 furlongs, 35 yards. The ledge of rock above spoken of appears to me to be a very eligible site for a dam. There is abundance of material on the spot and the breadth of the river's bed is not more than a hundred yards. If the dam were raised 50 feet in height, it would throw back the stream for a distance of nearly 8 miles, and a very large body of water would be retained in the valley of the Tambrapoorney and in the adjacent valleys for the supply of the river cultivation, as well as for traffic, supposing the present channels were converted into navigable canals; which they might be by locking down from one to the other from Culladacoorchy to the Murdoor anicut, a distance of about 40 miles, and thence along the river to the sea at Pinnacoi; or by branch channels, having their heads at Streevigoontum, to Tuticorin on the north and Coolasagaraputnam on the south, the two principal sea ports of the district. The length of water carriage from Culladacoorchy to Tuticorin would thus be about 80 miles, from Streevigoontum to Pinnacoi 17 miles and from the former to Coolasagaraputnam 27 miles, total 124 miles, the general direction being from west to east. From Shoramootiencoil the Tambrapoorney flows in a north-easterly direction for a distance of about 5 miles to the famous falls of Paupanassum, about a mile below which is the first anicut, termed "Thalay anai," formed of rough boulders, with stakes driven in between them at intervals to support a temporary cooroomboo, by which the water is kept up at the proper level. About a quarter of a mile above this anicut, the river runs between two high rocky hills, and is not more than three or four hundred feet in breadth. If necessary, a second lake might be formed between this and the falls. It is difficult to form even a rough

guess of the expense necessary to carry into effect extensive works of this kind situated as they would be at a distance from the populous parts of the district, and in the midst of jungle there being no village of any size nearer than seven miles to Shoramootiencoil and with the scarcity of labour that one has to contend with in Tinnevely, but there can be no question that the benefit to the district would be very great. The annual revenue to Government from the Tambrapoorney irrigation is about 7 lacs of rupees, or upwards of 50 per cent. of the whole wet revenue of the district. It would be a greater matter, therefore, to secure this large extent of cultivation from drought, such as happened last fusly, and to provide the means of cheap transit from the interior to the coast for the spare produce of this fertile tract of country. The loss to Government last fusly on account of drought and short produce on the Tambrapoorney cultivation alone amounted to Rupees 1,83,616. The greater part of this would have been saved if a supply of water had been forthcoming for the last month or six weeks of the cultivating season, *car* and *pishanam*. There was abundance of water in the river at the commencement of each season, in fact nearly all the rain both in the south-west and north-east monsoons fell in the first month, or from 20th June to 20th July and from 20th October to 20th November; after the latter date there was little or none till the month of March following, which, of course was too late to save the *pishanam* crop.

SHERMADEVY TALOOK.

CUNNADIEN CHANNEL FROM AN ANICUT ACROSS THE TAMBRAPOORNEY.

Limits of cusbah.

About two miles east of Shermadevy a cut has been made in the left bank of this valuable channel, without permission, to take water to a small patch of ground in rear. The channel monegar informs me that he has brought the subject to the notice of the Tahsildar three times, but no notice has been taken of it. If the land in question cannot be irrigated by any other means, a permanent sluice of irrigation should be constructed at this point, and on no account should the ryots be allowed to cut open the bank. The Tahsildar will be written to on the subject, and if he is of opinion that a permanent sluice is necessary, the estimate I have now prepared, amounting to Rupees 416, will be entered in my occasional list as usual. I deem it necessary to bring to the Collector's notice the great liberties which are taken with the bank of this channel by the ryots. It is so much encroached on and enclosed that I found it impossible to make my way along it in some parts. The ryots seem to think they may do just as they please with it, and the indifference of the taluk authorities tends to confirm them in this opinion. In my diary list of examinations of the 2nd and 3rd June last I brought to notice similar liberties taken with the Pamban channel bank, and I am constantly pointing out the same to the several taluk authorities, but to very little purpose. I have no doubt that the necessary orders are issued from the Huzur, and some enquiry probably takes place at the time, but there the matter rests, until the subject is again brought to notice by this department. The channel monegars and Tahsildars must be made responsible for such proceedings on the part of the ryots, and then perhaps they will bestir themselves to prevent them. It is quite impossible to carry out the intentions of the Board, as expressed in the third paragraph of the extract from the Proceedings of the Board of Revenue in the D.P.W. No. 423, under date 29th May 1854, unless the banks of channels are properly defined and all encroachments strictly prohibited.

PUBLIC WORKS DEPARTMENT.

No. 925.

Extract from the Minutes of the Consultation under date the 18th December 1855.

Read the following letter from the Chief Engineer in the Department of Public Works. (Vide letter No. 2449, dated 5th November 1855.)

Para. 1. With this letter the Chief Engineer forwards copy of a report drawn up at his request by Captain Horsley, Civil Engineer of the 8th Division. Captain Horsley has held this division for nearly fifteen years: and this report contains a

summary of the improvements effected during that period, and his views of the further projects to be undertaken. It is designed chiefly for the use of Captain Horsley's successor, for which purpose it is likely to be very serviceable.

2. During the period included in the report no projects of great magnitude have been brought forward; but a steady attention has constantly been paid to the improvement of existing works of irrigation, as well as to the gradual development of a system of roads. As a consequence of his efforts under the first head, Captain Horsley was able in his report for 1851, to give a statement of the Nunjah cultivation and Revenue of the Division in the preceding fifteen years, which shewed that in the last five years of the period, the cultivation exceeded that of the first five by 60,518 acres, while the revenue in like manner had increased by 3,60,962 Rupees, being an increase of 27 per cent. in the former, and of 26 per cent. in the latter. This result, which must undoubtedly be ascribed almost wholly to the improved condition of the works of irrigation, is highly creditable to Captain Horsley's diligent and skilful care of those works. As the consequence of his attention to the roads, considerable improvement in their state can be appealed to; and all this it must be added, respecting the works of both kinds, has been effected with a very insufficient subordinate agency.

Bridge on Shunmooganuddee	...	15,425
Do. Vigay river	...	41,660
		57,085
Roads—		
Trichinopoly and Dindigul	...	14,170
Madura and Dindigul	...	14,510
Road No. 17	...	25,560
Do. „ 19	...	17,210
Do. „ 23	...	35,400
Do. „ 27 Careyaputty to Arcot	...	41,190
Do. „ 16 Madura and Tanjore	...	1,01,770
Do. „ 1 Straceyallapoottho to Theroo	...	1,020
Cross road from Samianelloor to junction	...	17,830
with road No. 4.	...	4,040
Painey Hill communications	...	4,040
		Rupees 3,55,100

4. In the Tinnevely district, a new ancient across the Tambrapoorney at Sreevi-goontum estimated to cost 3,84,172 Rupees, and the construction of four different lines of road at an outlay of Rupees 1,71,934, as well as a Jetty at each of the two ports of Tuticorin and Coolashagaraputnum are the only important works actually proposed. But among the items of prospective improvements in that District, Captain Horsley mentions the construction of a Reservoir in the valley of the Tambrapoorney river above the falls of Paupanassum. The Government believe that a work of this kind would be found easy of execution, and that it would be of great utility for the irrigation of the country below; and they request that the Chief Engineer will give his consideration to it.

5. On the whole, the Government have pleasure in recording their sense of the value of Captain Horsley's labours in the 8th Division; and they resolve to direct that the report be printed for the use of the Officers of the Department and particularly of those to be hereafter employed in the districts reported upon.

6. It remains to notice Colonel Faber's own remarks. With respect to what is styled the unhealthy state of labour market, the Government must observe that aversion on the part of the labouring classes to employment on Government works, is the natural consequence of the system of driving and compulsion hitherto in use. The penalty for that abuse must now be paid in the difficulty which will be encountered in effecting the substitution of free labour. This difficulty will be of greater or less intensity and of longer or shorter duration, according to various circumstances; and

3. The prospective plans for the improvement of the two districts are set forth in detail in Captain Horsley's report; the works already submitted or proposed for entry in the Budget of 1856-57 being given in the two Lists which accompany it. Of the latter, it is observed that those for Madura are almost entirely for completing present lines of communication, and perfecting others by the erection of Bridges. The principle of these are the two Bridges over the Shunmooganuddee and Vigay Rivers, estimated at Rupees 57,085, and the completion of various lines of road at a cost of about 3½ lacs of Rupees.

giontum estimated to cost 3,84,172 Rupees, and the construction of four different lines of road at an outlay of Rupees 1,71,934, as well as a Jetty at each of the two ports of Tuticorin and Coolashagaraputnum are the only important works actually proposed. But among the items of prospective improvements in that District, Captain Horsley

in particular according to the tact, knowledge of character, and care to prevent abuse, which may be displayed by the Officers who under the new system will be the employers of labour in the various localities. In some instances, it has been overcome almost instantaneously; and even in others, free labour is now abundant where but a few years ago it was stoutly maintained that none could be got. The Right Honourable the Governor in Council trusts that the Engineer Officers henceforward to be employed in the Tinnevely District, will not not be found deficient in that very important qualification for their work, tact and temper in dealing with bodies of labourers, and in securing their confidence.

7. Adverting to the high rates of hire stated by Captain Horsley to be necessary on the Cotton road, the Governor in Council resolves to call on the Collector for information as to the ordinary hire of agricultural labour in that part of the country. In other districts, such a labourer cannot earn more than from 15 to a maximum of 20 Rupees a year; and unless the usual wages in Tinnevely are much higher, there is a disproportion in that district between the ordinary rates and those paid for labour on the roads. This difference, so far as it is real and *bona fide*, measures, after some deduction for uncertainty and for the necessary absence from home, the dislike for Government work. All that kindness and considerate treatment can effect should be done to diminish that dislike; and every means should also be taken to insure that the rates charged do actually reach the labourers without deduction. In reporting the present actual wages of ordinary field labour, which should be ascertained with all possible care and accuracy, the Collector will state also the causes which in his opinion operate to make the necessary wages on Government works so much higher as they seem to be. It is requested that he will give his most careful consideration to this question, which the Government regard as one of much importance, and that he will report on it at an early date. The Chief Engineer will obtain an answer also from the Acting Civil Engineer if he thinks proper.

8. Colonel Faber has mistaken the meaning of Government in the order to which he refers in the opening of his 2nd para.* The Right Honourable the Governor in Council has no objection whatever to the merits of deserving officers being pointed out, and the remarks in question were not at all intended to apply to the Chief Engineer's praise of Major Cotton for having exceeded the duties assigned him. But in the letter referred to in that order, encomiums lengthened out by numerous laudatory adjectives were passed not only several times on Major Cotton, but on every Officer mentioned in the letter. It is this undistinguishing use of high encomium to which the Government objected; and the chief ground of this objection is, that such a practice wholly destroys the value of praise, and neutralizes its own object by rendering those most deserving of praise indifferent to it when scattered about with so little discrimination. It must be added that the course now adopted by Colonel Faber, places Government in the dilemma of either ungraciously refusing a favor which he recommends, or of bestowing praise when they do not think it necessary. In fact, it makes it impossible for Government really to bestow any praise or approbation at all; for all that they could have said has already been not only anticipated but much exceeded by the Chief Engineer.

Ordered that the foregoing Proceedings be printed and circulated to the Officers of the Public Works and Revenue Departments, together with Captain Horsley's report and its enclosure and the Chief Engineer's letter.

(A true Extract.)

J. D. BOURDILLON,
Secretary to Government.

No. 250.

To

1. SILVER, Esquire, Collector of Tinnevely.

Sir,

I have the honour to forward herewith for your approval and countersignature an estimate amounting to Rupees 1,50,000 for the formation of a reservoir, near Sooremoodencoll, on the Hills above Paupanassum.

2. The construction of such a reservoir has, as you are aware, been a subject frequently discussed; and Government, in Extract Minutes of Consultations No. 925 under date the 18th December 1855, state their belief that "a work of this kind would be found easy of execution, and that it would be of great utility for the irrigation of the country below, and they request that the Chief Engineer will give his consideration to it."

3. As regards "facility of execution" there may, I imagine, be some difference of opinion, but of, "utility" none.

4. I have twice visited the spot in company with the Sub-Collector, Lieutenant Paxton being likewise present at the former visit and Lieutenant Payne at the latter, and I am assured that the site selected by me meets with the concurrence of all these gentlemen.

5. The leading features of the Project now brought forward are as follows:—

A rough stone dam is to be thrown across the Tambrapoorney and is to have three vents at bottom each 3' x 4'. The length of the dam at top will be 265 yards, breadth of the dam at top will be 8 yards, greatest depth of the dam at top will be 63 feet. The top and side surfaces will be filled in with stone jelly in chunam to render them more compact, and at once if possible, impervious to leakage.

6. The vents will be closed by shutters or sluice-gates with iron plates, and will be opened either by screws in the manner of cotton screws or by chains worked by a capstan; perhaps the latter method will be found the simplest.

7. It is calculated that the drainage of 25 square miles will be received into the reservoir which being capable of containing 18,200,000 cubic yards will require a fall of 8 inches of rain to fill it.

8. Should a fall of rain to this extent occur in 24 hours, as is not unusual in a heavy burst of the monsoon, the reservoir will accordingly fill in that time.

9. The discharge of surplus water will be carried over a natural calingulah of rock on the left bank of the river.

10. The object of the reservoir is not so much the retention of water for immediate irrigation but the storage of a certain amount of water which can be made use of towards the end of the season when whole crops are frequently destroyed for the want of perhaps but a week's additional irrigation.

11. In the statement attached you will perceive that though the water stored would only suffice for 3,000 acres of actual irrigation, yet it might perhaps, for the reasons above given, be sufficient to save ten times that amount or 30,000 acres of cultivation in a failing season.

12. It is calculated that the sluices are capable of emptying the reservoir in 34 hours.

13. For further particulars regarding the reservoir I must refer you to my Diaries General Observations for February and March.

14. I should point out that the opportunities I have as yet had of going into this project are but slight considering its great magnitude. To make a proper survey and take sufficient levels to judge, with accuracy of the form that the reservoir would take, and so obtain a more correct idea of the advantages to be gained by the proposed expenditure, would occupy an officer's sole attention for at least one or two months.

15. I therefore propose suggesting to the Chief Engineer the propriety of Lieutenant Payne, by whom the accompanying line of levels were run, being deputed to this work and that a sum of Rupees 100 be placed at his disposal to cover the expenses of cutting jungle, of excavation necessary for determining the probability of obtaining line in the vicinity fit for the purposes required and for clearing spots in order to ascertain from what places the rough stone required must be obtained.

16. I shall feel obliged by your returning the enclosures to me at an early date with any opinions you may have to offer on the subject so that I may be enabled to obtain the Chief Engineer's opinion and sanction of the survey in sufficient time for it and the estimate to be completed and submitted for sanction and entry in the Budget of 1857-58.

I have the honour to be,

Sir,

Your most obedient servant,

R. A. ROBERTS, Lieut.,

Ag. Civil Engineer, 8th Division.

Civil Engineer's office, 8th Division,
Poothoogody, 11th April 1856.

*General observations made by Lieutenant R. A. Roberts, Acting Civil Engineer,
8th Division, during the month of March 1856.*

5TH.—*Road No. 11, Shermadevi taluk, Tinnevely district.*—Being informed that a more direct line than the present one between Shermadevi and Tinnevely was available, I inspected the same in company with the Sub-Collector.

This line however turning out to be that of the Codagan channel, to fill up a portion of which, as proposed, would require a large outlay, quite disproportionate with the advantages to be gained, as it is by no means direct, its adoption is quite out of the question.

7th to 10th.—*Bremadasum taluk.*—Engaged in taking levels of the proposed site for a dam, to form a reservoir above Paupanassum. In my Diary General Observations for February last a description of the site for the proposed dam across the Tambrapoorney above Paupanassum is given, and a further inspection of that site strengthens me in the opinion there offered as to its advisability and practicability.

As I shall have to enter into some details on the subject, when submitting for sanction the estimate to be prepared from the levels taken by Lieutenant Payne and myself, in preparing transverse and longitudinal sections of the river's bed, I need not enter into many particulars here.

I will only say that, by the construction of a dam 60 feet high, it appears that a reservoir may be found about 3 miles in direct length and on an average about 500 yards broad.

Calculating from measurements taken off the printed map, this reservoir will be fed by the drainage of at least 25 square miles, and, as it will contain some 18,200,000 cubic yards of water, it will require only a fall of 8 inches of rain over that surface to fill it.

The object of such a reservoir being not so much the retention of water for immediate irrigation, as the storage of a certain amount of water which can be made use of to save crops all but ripened that would be destroyed in a failing season, the above amount of water, though only sufficient perhaps for 3,000 acres of actual irrigation, might be the means of saving ten times that amount, or 30,000 acres of cultivation, and of thus securing a fair crop to the district or perchance even saving it from actual famine.

It is not easy to make at all an accurate estimate from the necessarily short time I could devote to the inspection of this work, of the outlay required. The data I am obliged to take are in truth mere suppositions, the accuracy of which must be tested properly, as also a correct survey taken of the locality before anything but an approximate estimate can be made.

I propose therefore devoting the services of an officer of this department, Lieutenant Payne, to these investigations, which will probably occupy him at least one month, when the proper season for visiting these hills comes round, and there is no risk of fever, which is by no means the case at present.

The estimate will probably amount to $\frac{1}{2}$ lakh of rupees, an outlay which on the hypothesis assumed above, and with a Government tax of Rupees 8 per acre might be recovered, it will be seen, in one season of discontinuous monsoon by the saving of loss it would effect.

12TH.—*Corayaur anicut*.—The Sub-Collector having brought to my notice the inconvenience and losses to which the ryots of Vickramasingapoorum and other villages are subjected by the constant breaching by every heavy fresh of the temporary dam erected by them across the Corayaur, for the cultivation of their lands by the water taken down the Codamailalaghyen channel from the Tambrapoorney river, where that channel crosses the Corayaur, I proceeded in the company of that gentleman and Lieutenant Payne to inspect the spot this day.

18TH.—*Bremadasum talook*.—Inspected the proposed sites for damming up the Tambrapoorney above and below the Paupanassum fall. Pursuant to the directions of Government contained in Extract Minutes of Consultations No. 925 under date the 13th December 1855 that consideration should be given to Captain Horsley's proposal for the construction of a reservoir above the falls of Paupanassum I proceeded to Paupanassum and examined carefully the valley of the Tambrapoorney with this object in view.

Captain Horsley in his report suggests that a reservoir may be made both below and above the falls of Paupanassum.

After a minute inspection however of the bed of the river below the falls I am not myself prepared to recommend the formation of such a work there.

Of the feasibility of making a reservoir and that a large one by connecting with a dam the two hills pointed out to me as selected by Captain Horsley for that purpose there can be no doubt none whatever.

But it is of the advisability of the project that I entertained doubts.

The bed of the river between the bottom of the fall and the proposed site of the dam descends very rapidly, in fact it is a succession of cascades and as the slope of the containing hills is very precipitous the amount of water that would be stored by such a reservoir is perhaps the minimum that a dam of the height required could possibly give.

In an undertaking of the kind where the amount of work and expenditure must be equally prodigious it appears necessary that the greatest possible advantages must be obtained.

Such however is not the case in the present instance. Moreover, the fact must not be lost sight of that the dangers to which the dam would be subjected by breaching, etc., owing to the enormous pressure of water are those which a reservoir containing perhaps ten times the actual amount of water spread over a shallower surface, might offer.

As regards the formation of a reservoir above the falls, I have every reason to think that the bed of the river in the vicinity of the Shoramootienail is in every way adapted for such a purpose.

The bed here consists of solid rock, is tolerably narrow, and if closed by a dam would offer a natural calingulah for the discharge of surplus water. The river too appears to rise very gradually all the way to the foot of the Vanateertum or rocket-fall a distance of some 3½ miles.

I shall take an early opportunity of revisiting the spot and taking the necessary longitudinal and transverse section of the river to enable me to draw up a report sufficiently accurate for a conclusion being arrived at as to the expediency or otherwise of constructing a reservoir on this site.

PROCEEDINGS OF THE BOARD OF REVENUE, DATED 10TH NOVEMBER 1868.

Read the following letter from R. K. PUCKLE, Esq., Collector of Tinnevely, to the Secretary to the Board of Revenue, dated Circuit Cutcherry at Sankaranayinarkovil, 6th March 1868, No. 108:—

I have the honour to furnish the information called for in the Board's Proceedings, No. 7514, dated 18th November 1867; this would have been submitted earlier, but I have endeavoured to go into details, and have spent the last three months in a close examination of the area proposed to be irrigated.

2. The following projects, though separate and distinct from each other, may all be classed as the extension of irrigation from one river and its tributaries; they are:—

- I. The construction of a large reservoir on the Tambrapurni river above the point where it falls from the hills at Paupanassam.
Ambasamudram talook.
- II. The construction of a large reservoir on the Gatina tributary below the point where it falls from the hills at Alwarkurichi.
Ambasamudram talook.
- III. The re-construction of a ruined anicut on the Sittar tributary, and the repair of a large ruined tank at Sivipperi formerly fed from this anicut.
Tenkarei talook.
- IV. The extension of irrigation on the east bank of the Tambrapurni from Tinnevely and Tenkarei talooks. the Marudur anicut.
- V. The extension of irrigation on the west bank of the Tambrapurni from the Marudur anicut.
Tenkarei talook.
- VI. The construction of a new anicut in the Tambrapurni at Strivycuntam.
Tenkarei talook.

3. The irrigation works already existing have made Tinnevely the prosperous district it is, and have enabled it to rank next to Tanjore and Godavery in a revenue point of view. The greater part of these works, however, existed when we came to the country, and those of later date were mostly constructed by Colonel Horsley, whose name is remembered in this district as that of Colonel Lawford is in Trichinopoly and Tanjore: in addition to the works he constructed (by which he increased the revenue by three lacs of Rupees) Colonel Horsley projected the larger works now reported on; and had the mutiny not intervened, and had he remained in the district, he might have irrigated another 100 square miles of country, and have added another five lacs to the revenue.

Nos. 1, 4, 6.

Names of Rivers.	Talooks in which they are.	Area irrigated by them in acres.
1 Karuppanar ...	Tenkai ...	3,337
2 Anumanadi ...		4,806
3 Hartharanadi ...		361
4 Bandanadiswaranadi or Guddar.		143
5 Aindalaravinadi ...		216
6 Sittar ...	Ambasamudram.	13,200
7 Arudakanaiyar ...		1,755
8 Ramanadi ...		413
9 Varanadi ...		2,001
10 Jambunadi ...		63
11 Ramanadi ...	Nanganeri.	854
12 Ilapanadi ...		193
13 Gatina ...		6,232
14 Tambrapurni ...		59,803
15 Manimucta ...		1,117
16 Koryar ...	Total	373
17 Pachaiyar ...		5,110
18 Tanariyar ...		2,330
19 Karumpandi yammankal		7,250
20 Nambiyar or Sindunadi.		7,007
21 Anumanadi ...		1,599
Total		117,787

4. The Geographical position of the district at the foot of the Western Ghauts is of course very much in its favour, as twenty streams that have their rise within the influence of the south-west monsoon descend the hills to the eastward, and irrigate 184 square miles in the valley that extends from the hills to the sea. These rivers are crossed by no less than sixty anicuts, and hundreds of channels carry water to tanks throughout the whole length of the valley; these tanks, however, are badly supplied towards the sea, as the last anicut is nearly thirty miles from the mouth of the principal river, and vast floods of water are annually lost to the district.

The Strivycuntam anicut, which will cross the river nineteen miles from the sea —

No. 3	...	3,250 acres.
" 4	...	5,550 "
" 5	...	6,000 "

Total 14,750 acres = 23 sq. miles.

6. There is not an Engineering difficulty in any one of these projects; † all that is required is to make use of the water now wasted, and let it flow over a country which is naturally laid out to receive it, and which is now partially irrigated from the very same points on the river.

7. Nos. 1 and 2 are, however, more difficult works, and are intended to act rather as auxiliaries of irrigation by securing the crops for a month during any severe season of drought, than as sources of irrigation in themselves; they are quite independent of the other works, and are not of the same pressing importance.

8. No. 1.—The site of this work has been surveyed, and data for an estimate were collected in 1856. The object in view is to block up the pass through which the Tambrapurni discharges itself over the Papanasam water-fall, and so head up water ‡ to be sent down the river when the stream is low, and there is danger of losing the crops which now often partially fail for want of a few weeks' water; the remissions for withered crops down the course of this river have averaged 17,474 Rupees a year during the last fifteen years, and this sum represents the minimum return that may be expected from a work estimated to cost 1,50,000 Rupees, but which at present prices would probably cost three times that amount, or say five lacs of Rupees.

† Estimated at 13,200,000 cubic yards or sufficient to irrigate 15,000 acres of rice for a month; calculating that each acre requires 40 cubic yards a day, the entire area under the Tambrapurni is 60,000 acres, so that one-fourth of this area or about the extent that ever would be in danger from drought would be saved.

‡ 1,83,616 Rupees were remitted for withered crops in this district in Fusly 1263, while the scheme was in course of projection—vide Lieutenant Roberts' letter of 26th August 1856.

9. Besides saving the crops from failure, a very large area at the ends of the channels and under the more distant tanks would be converted from single to double crop, but I cannot now give exact statistics for this.

Ex. Minutes Procs., No. 295, 18th Decr. 1856.
Engr. to Collector, No. 250, 11th April 1856.
Collector to Engr., No. 664, 30th May 1856.
Engr. to Collector, No. 414, 4th June 1856.
Collector to Engr., No. 694, 7th June 1856.
Collector to Chief Engr., No. 697, 7th June 1856.
Ex. Procs. of the Chief Engr., D.P.W., No. 5911, 20th August 1856.
Civil Engr. to Chief Engr., No. 143, 26th August 1856.
Collector to Chief Engr., No. 1040, 1st Sept.-mber 1856.
Ex. Procs. of the Chief Engr., No. 665, 4th September 1856.
Collector to Supp. Engr., No. 1179, 27th September 1856.
Ex. Minutes Procs., No. 1,004, 20th May 1857.
Collector to Dist. Engr., No. 235, 8th June 1857.
Engr. to Collector, No. 317, 9th July 1858.

13. No. 2.—The Gatina tributary descends the hills in a magnificent cascade some two hundred feet in height, and has a considerable further fall in the next two miles of its course; it then flows through a gorge

in a rocky ridge where it would be apparently no great work to topple over the adjacent rocks, and so head back the water to form a lake between this ridge and the hills. Such a scheme would be especially acceptable to the neighbouring cultivators whose crops are now destroyed by the deer, pigs and jungle fowls that inhabit the wild tract of country that would form the bed of the lake.

14. At the very spot proposed to be bunded across there is a small natural anicut which turns water through an orifice in the rocks to supply a channel that irrigates 1,000 acres. A very little labour bestowed on this anicut and channel would double the water supply, and this might be done at once irrespective of forming a reservoir. The construction of the proposed reservoir would throw water into several high

5. No. 6 in the foregoing list * will partially check this wastage, and will irrigate sixty-four square miles on the coast, while Nos. 3, 4 and 5 higher up the stream will irrigate twenty-three square miles, total eighty-seven square miles.

is required is to make use of the water now wasted, and let it flow over a country which is naturally laid out to receive it, and which is now partially irrigated from the very same points on the river.

7. Nos. 1 and 2 are, however, more difficult works, and are intended to act rather as auxiliaries of irrigation by securing the crops for a month during any severe season of drought, than as sources of irrigation in themselves; they are quite independent of the other works, and are not of the same pressing importance.

8. No. 1.—The site of this work has been surveyed, and data for an estimate were collected in 1856. The object in view is to block up the pass through which the Tambrapurni discharges itself over the Papanasam water-fall, and so head up water ‡ to be sent down the river when the stream is low, and there is danger of losing the crops which now often partially fail for want of a few weeks' water; the remissions for withered crops down the course of this river have averaged 17,474 Rupees a year during the last fifteen years, and this sum represents the minimum return that may be expected from a work estimated to cost 1,50,000 Rupees, but which at present prices would probably cost three times that amount, or say five lacs of Rupees.

† Estimated at 13,200,000 cubic yards or sufficient to irrigate 15,000 acres of rice for a month; calculating that each acre requires 40 cubic yards a day, the entire area under the Tambrapurni is 60,000 acres, so that one-fourth of this area or about the extent that ever would be in danger from drought would be saved.

‡ 1,83,616 Rupees were remitted for withered crops in this district in Fusly 1263, while the scheme was in course of projection—vide Lieutenant Roberts' letter of 26th August 1856.

9. Besides saving the crops from failure, a very large area at the ends of the channels and under the more distant tanks would be converted from single to double crop, but I cannot now give exact statistics for this.

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Engr. to Collector, No. 317, 9th July 1858.

10. The Government have recorded their opinion that "a work of the kind" would be found easy of execution and "would be of great utility for the irrigation of the country below."

11. Enclosed is a sketch of the drainage at the head of the river and a map of the Tambrapurni and its tributaries from Papanasam down to the sea

12. The correspondence on this subject is noted in the margin.

13. No. 2.—The Gatina tributary descends the hills in a magnificent cascade some two hundred feet in height, and has a considerable further fall in the next two miles of its course; it then flows through a gorge

in a rocky ridge where it would be apparently no great work to topple over the adjacent rocks, and so head back the water to form a lake between this ridge and the hills. Such a scheme would be especially acceptable to the neighbouring cultivators whose crops are now destroyed by the deer, pigs and jungle fowls that inhabit the wild tract of country that would form the bed of the lake.

14. At the very spot proposed to be bunded across there is a small natural anicut which turns water through an orifice in the rocks to supply a channel that irrigates 1,000 acres. A very little labour bestowed on this anicut and channel would double the water supply, and this might be done at once irrespective of forming a reservoir. The construction of the proposed reservoir would throw water into several high

level channels to irrigate all the dry lands of Azhwarkurichi, Ambur, Durmapuram, Madam, and Papankulam, and so convert into rice fields a poor tract at the foot of the hill that the people now hardly cultivate.

15. The spot is very inaccessible, and I made my way to it with difficulty; but when once there I was struck with its capabilities, though I do not think that the project has ever engaged the attention of an Engineer officer

16. I have classed the lands below and seen how the channels would run; the Gatina now irrigates 6,000 acres, and this area might be increased to 10,000 acres with a store of water always in hand to throw down the river in case of drought at any particular season.

17. The idea is my own, and there is no correspondence on record.

18. No. 3.—The Sittar tributary is crossed by fifteen anicuts, the last of which is eight miles above the point where the Sittar falls into the Tambrapurni; there was another anicut once, some three miles

The Siviliperi tank and anicut.

lower down, but it now lies in ruins, and much of the stone has been taken away for reverting the bank of the river.

19. This ruined anicut once fed the large Siviliperi tank breached in 1796 and never since repaired; the bed of this tank is now cultivated with dry grain, but the ryots have suffered so much of late years from drought that they will gladly resign their cultivation in the bed of the tank, and will render all aid in their power to make the tank hold water, as they feel convinced that on this the prosperity of their village depends.

20. I have lately been over the ground, and feel hopeful of not only heading up water sufficient to cultivate a large area of fine rich soil in Siviliperi and Kaliyayur on a low level, but by diverting the Puvanipatti nullah which crosses below the tank, and carrying the surplus from the waste weir of the tank along the nullah south-eastwards, to throw water into the high level tanks of Kaliyayur, Valnad, and Manakarei, and command the whole country between the Valnad hills and the proposed high level branch of the eastern channels from the Marudur anicut.

21. The work now reported on was surveyed in 1856, by Mr. McNair, who has given a full description of it; the cost of re-construction was then estimated at 20,000 Rs, and the people engaged to

cultivate 1,500 acres, which would have given a return of 7,200 Rs per annum in Siviliperi alone. Nothing then came of the project, and no extension of the irrigation beyond Siviliperi was thought of; but it is perfectly certain that the surplus water from the fields in Siviliperi must find its way to the south-west into the Kaliyayur tank below, and that every good flood in the Sittar must send water over the waste weir in the tank to flow, if properly guided, towards the sloping ground on the south-east, where it will be caught in a series of tanks till every drop is exhausted.

22. The best criterion of the feasibility of the scheme is the eagerness of the villagers to embark in it, and their offer of 10,000 Rs as a contribution towards it. They wish to tax themselves at the rate of 5 Rs for each cottah of land to be irrigated, and they calculate that 2,000 Cottahs or 3,250 acres will be irrigated.

23. The tank is 2½ miles from the Sittar which is crossed by a rocky ledge, said by Mr. McNair to be a level with the top of the waste weir: allowing three feet for the fall of the channel to the tank, a six foot anicut on this ledge would head up water in the tank three feet above the top of the waste weir, which will consequently have to be heightened: the sluices are all in good order, and a great deal of the bank remains; it is nearly three miles in length, and 3,000 cubic yards of rough stone are lying along it all ready to be placed in position; any further quantity of stone is procurable within a mile of the bank.

24. The tank has a water-spread of three square miles and was calculated by Mr. McNair to be capable of heading up 62,81,740 cubic yards of water, or enough to irrigate 1,500 acres. Mr. McNair, however, calculated that it would be filled but twice in the year, while in reality the Sittar comes down in fresh perhaps twenty times in the year, and the Kyattar nullah between the Sittar and the tank, and which will be diverted into the tank, brings down a flood of water after every shower that falls.

25. The work would now cost 40,000 Rupees or double the estimate of twelve years ago, and the extension towards the foot of the Vainad hills would cost 10,000 Rupees more, total 50,000 Rupees.

26. The returns from 3,250 acres, at a water-rate of 4 Rs an acre, will be 13,000 Rupees if a single crop only is grown; to this add 3250 Rs, the land assessment of 3,250 acres, at 1 Rupee an acre, total 16,500 Rs, from which deduct 5,000 Rs, the present assessment of the irrigable area, and of the land to be resigned in the bed of the tank, the remainder 11,500 Rs represents the net revenue to be derived from the work.

Engineer to Collector, No. 592, 25th August 1856
Collector to Engineer, No. 1304, 25th Octr. 1856

The Marudur Eastern channel

the last on the river) is a matter of the greatest importance. The anicut is of native construction, and is so contrived as to turn all the water that does not flow over it, or through the sluices, down two large channels, one on either side of the river. The

The proposed Strivayountam anicut nine miles below Marudur is calculated to turn water sufficient for 40,000 acres.

27. The correspondence on this subject is noted in the margin.

28. No. 4—The extension of the Irrigation from the Marudur anicut (now water so turned is not stored to the best advantage, as only 21,378 acres are irrigated from a work capable of irrigating quite double that area.

29. The eastern channel supplies but 8,339 acres, and is capable of irrigating at least 12,000 acres more. My proposals for the improvement of this channel are—

(1.) To heighten the anicut one foot.

(2.) To add three more tanks to the present chain of tanks.

(3.) To raise the embankment all along the channel and tanks, and so render The fall is excessive, upwards of two feet in the mile. each tank capable of holding a much larger water supply than at present.

(4.) To take off a branch from the main channel further north to supply a fresh chain of tanks parallel to, and above the chain now supplied by the main channel.

30. The cost of these works would be 1,50,000 Rupees, namely, embanking twenty-five miles, at 2,000 Rupees a mile, 50,000 Rupees, constructing one new tank and extending the main channel to two tanks already existing 20,000 Rupees, and cutting a high level branch and repairing ten old and constructing five new tanks along it, 80,000 Rupees.

31. This is a liberal estimate, and supposes the work to be done entirely with borrowed capital; but I could get it done for a fifth of this sum, * or an actual cost

* 1,50,000 Rupees.

to Government of not more than 30,000 Rupees.

(1) There is an allotment of 44,600 Rupees from the Road Cess for a new road along the north bank of the river from Tinnevely to Strivaicuntam; if this road is entrusted to me, I will have it carried for the last ten miles on the top of the channel bank instead of parallel to the channel, and will see that the bank for this distance is strengthened, and the road completed for the amount allowed in the estimate for these ten miles of road alone.

20,000 Rupees.

(2) There is an allotment of 1,940 Rupees for strengthening the Strivaicuntam tank bank; if the expenditure of this is entrusted to me, I will make it enough to widen the bank sufficiently to carry a road; this brings the road-way and line of irrigation as far as the Perur tank.

(3) One of the new lines about to be proposed from the Road Cess is from Strivaicuntam to Perungulam along the Perur, Sevalai and Perungulam tank banks; Will be entered in next year's Budget. with 2,000 Rupees a mile for this, or 20,000 Rupees from the Road Cess, I can finish

both road and bank; this brings the road-way and line of irrigation up to the Perungulam waste weir, the end of the eastern channel.

32. The water that finds its way through and over this weir now floods a lower level, and is drawn off to the river by means of a syphon sluice, after doing considerable damage to a large extent of country; it is this water that I propose to economize by arranging the waste weir, so that the water will flow on to two tanks beyond Perungulam, instead of returning to the river; these tanks are owned by single proprietors who undertake to bear all the expenses of carrying the water on to them; in addition to this the villagers along the line offer 15,000 Rupees towards the work, and engage to find labour and material at the lowest possible rates.

33. If my scheme is adopted the total sum to be laid out on the line from the Road Cess will be 40,000 Rupees, from contributions 15,000 Rupees, and from allotment for repairs 2,000 Rupees, total 57,000 Rupees; and the existing channel and the lower chain of tanks may be improved for this sum without any actual cost to Government.

34. The returns will be the certainty of saving the crop on every acre between the channel and the river, the bringing under cultivation 550 acres of dry land assessed (at a four Rupees water-rate) at 2,200 Rupees, and securing a second crop on 3,000 acres, assessed (at a two Rupees water-rate) at 6,000 Rupees, total 8,200 Rupees.

35. The high level channel and the upper chain of tanks proposed will irrigate all the north of the taluk, and will carry water to a fine cotton plain where the richest crops may be produced; many tanks already exist, and others can be constructed with ease; the people of these northern villages express their readiness to pay another 15,000 Rupees towards this work, and if Government will give double this sum, say 30,000 Rupees, 5,000 acres of dry land, assessed (at a 4 Rupees water-rate) at 20,000 Rupees, may be brought under cultivation at once.

	Rs.	36. The total returns expected are thus
By lower channel	... 8,200.	28,200 Rupees per annum, and an enormous addition to the wealth of the talook
By upper channel	... 20,000.	for a present outlay from Imperial Funds of only 30,000 Rupees.
	28,200.	

37. The work could not be done in this way by the Department of Public Works, but it can be done by the Revenue Department working hand and glove with the villagers at a time when they are anxious to improve their lands, and are willing to lay out their money freely; unskilled labour must, however, be under professional guidance, and though the work may be done in a popular manner it should be thoroughly well done, and must, therefore, be under the superintendence of an Engineer Officer to be associated with the Collector for laying out and superintending the work.

38. The idea is my own, and there is no correspondence on record.

39. No. 5—The western channel from the Marudur anicut now irrigates 13,039 acres, and might irrigate very much more, were the water not wasted by being discharged back into the river in freshes, instead of into branch channels to the rain-fed tanks above the present line of irrigation; on the south, the crops under these rain-fed tanks have, this year, failed entirely, more notably in the village of Ponakolam, where there are no less than forty rain-fed tanks, many of which may hereafter be supplied from the river.

40. The Palayan channel from the second anicut above Marudur ends at Krishnapuram in the Tinnevely talook, and the western channel from Marudur continues the irrigation along the south bank of the river; a branch from the western channel taken off below Krishnapuram would catch up the surplus water of the Palayan channel, and would also be well supplied from the western channel itself; this branch would pass south-west of Seidunganallur, and irrigate part of a fine cotton plain in Tadankulam and Karaseri, the frontier villages of the Tinnevely and Tenkareli

talooks. From thence it would pass to the Vallakolam tank diverting several nullahs that now flow across the line; further south the rain-fed tanks would all get a certain supply, until Ponakolam is reached, where the channel would be nearly exhausted.

The terei is peculiar to Tinnevely and consists of loose stone below, with gravel earth and sand in distinct strata above. These teries rise to the height of 60 or 80 feet and are generally some miles in length by from 1 to 2 miles in breadth; they run north and south along the coast, and the red dust raised from them is visible for miles out to sea: the surface is shifting sand, made more shifting by the people pulling up every weed that grows, for fuel; an attempt is now being made to fix this sand in places by encouraging the umbrella thorn and undergrowth, and I think there is every chance of success. The low hills at the back of Pondicherry are not very dissimilar in appearance, but they are free from the shifting sand; the country west of the terei is for miles deep in sand.

rich, that the whole country round is supplied with the plantains and pumpkins that grow there.

41. The total area to be irrigated would be 6,000 acres, which at a 4 Rupees water-rate would pay 24,000 Rupees.

42. The line has not yet been surveyed, but is said to have been thought of by Captain Oakes when acting Civil Engineer of this district. It is, moreover, a popular idea with the villagers, and they have accompanied me over the ground and shown me how apparently easily the water may be taken from tank to tank, and what vast benefits the water will confer on one of the poorest tracts in the district.

43. The feasibility of the scheme is of course dependant on levels, and if levels admit of the water flowing by the course I have indicated, the cutting would be inexpensive, as the tanks already exist and they all lie close together.

Less than half a lac of Rupees.

44. The villagers offer the same assistance as on the other side of the river, and will pay 15,000 Rupees if the Government undertake the work.

In my rough estimate of cost I have set down the Government contribution as double this sum or 30,000 Rupees.

45. The idea is my own, and there is no correspondence on record.

46. This anicut was sanctioned by Government in 1856, but the mutiny intervened and the work was put off indefinitely; an allotment of 58,100 Rupees has, however, now been made in the Budget

The Strivikuntam anicut.

(for 1868-69) and there is every prospect of the work being shortly pushed forward with vigour.

47. An Officer of Engineers has been sent down to see if Colonel Horsley's scheme can be extended, and I have taken the opportunity to accompany him over the ground, and prepare a Statement of the probable results of the work in a revenue point of view.

48. As this work has already been sanctioned, under ordinary circumstances, it would have been unnecessary to trouble the Board with further particulars of it; but it forms so essential a part of the scheme I now advocate for extending irrigation in this district, and its magnitude and probable results are so little known and appreciated, that as I have had rare opportunities of acquiring local knowledge by conducting settlement operations in the villages likely to be affected by it, and as I have lived surrounded for months past by people all deeply interested in a scheme that promises them so much good, I take the opportunity of placing on record the statistics I have been able to glean.

ed, were it not reinforced by the greater part of the Tenkarei surplus, which now flows into the Kadamba tank and irrigates 3,000 acres below; the Kadamba tank will not need this surplus, in fact would be better without it, when its own separate channel is cut, as it shortly will be, from the river at Strivaicuntam; the Tenkarei surplus will thus be available for the irrigation of 3,000 acres elsewhere, and may be carried on in the channel proposed towards the foot of the western face of the terei, to convert into rice fields the shifting sands on which only palmyras now grow; this soil indeed is almost useless when dry, but when irrigated (as it is in some places from springs in the terei) it is so very

49. Colonel Horsley proposed to irrigate about 3,000 acres to the south, and

There is a large area of "Ayant Nanjah" land irrigated only on paper in the villages between the Kadamba tank and the sea; this was no doubt excluded from Colonel Horsley's calculations and only fresh ground brought to account.

5,000 acres to the north of the river; whether he fixed on this minimum area to be on the safe side as to returns, or whether intending to adapt the channels to the system of coast canals then projected he wished to make irrigation secondary to navigation, is more than I can say; but this

is certain, that he only proposed to irrigate 8,000 acres, while he showed by statistics that he had water enough to irrigate 40,000 acres.

50. As the idea of making the canal navigable has fortunately been abandoned, I have given my attention to finding 40,000 acres to irrigate, and have succeeded in finding about this area in such positions has to be commanded by tanks of sufficient size to render irrigation permanent.

51. In this I have been greatly assisted by the villagers who have accompanied me over the ground, and have pointed out the best sites for tanks and the area to be irrigated by them, and have otherwise given me much useful information.

52. The Board are aware of the confidence felt by these people who have paid down Rs 32,450, and are now cutting a channel at their own expense to connect the

Kadamba tank with the river. Their enterprise indeed is unbounded. Men, money, and material are forthcoming. All they ask for is the assistance of authority to reconcile rival factions, and keep all working together;* and as this has been afforded them, I trust that the enthusiasm of the people may not be allowed to cool, and that funds may be forthcoming to enable

* In every village the cry is the same; "keep us together and drive us to it they say and we will do all we can for the common good; but if you expect us to aid ourselves, and depart from the beaten track without orders, we are all so split into factions that the thing is simply impossible".

the local officers to do all that they are anxious to do to bring this great work to completion.

53. The anicut will have two channels, one on either side of the river; that on the north side exists, and that on the south is being cut. The object of the southern channel is to turn water from the river into the great Kadamba tank, the high-water mark in which is on a level with the bed of the river. As the river always has water in it the tank will be always full, and the water will stand throughout the whole length of channel, a distance of five miles, whenever there is more than three feet of water in the river. The tank is three miles long, and the low water level in the river at Strivycuntam is thus carried eight miles nearer the sea; we have thus an immense head of water, capable of irrigating 20,000 acres, only twelve miles from the sea but thirty-one feet above it.

54. The country slopes gently down from the Kadamba tank to the sea, and once was more or less irrigated throughout from the Kadamba tank, which was connected with the river by the very line now being cut; but the flood that destroyed the Siviliperi tank and anicut in 1796 breached many of the tanks between the Kadamba tank and the sea, and destroyed the head sluice from the river; at all events the head sluice is in ruins, and the tanks have never held water within the memory of man; the river channel then silted up, and the Kadamba tank reduced to dependence on drainage from higher levels has since continued to irrigate but 2,658 acres direct, and to throw its surplus into seven tanks which irrigate 1,711 acres more.

55. The only other irrigation besides this to the east of the taluk on the southern side of the river is at Attur, where 2689 acres are supplied by a channel taken off from the river some miles below Strivikuntam. The head of this channel will draw little water when an anicut is built above it, but a fresh head can be opened in the channel now being cut between Strivycuntam and the Kadamba tank to carry off water sufficient for 1,300 acres in addition to the 2,689 acres now cultivated.

56. One-fifth of the water turned from the river, or enough for 4,000 acres, will thus be drawn off from the channel before it reaches the Kadamba tank which will have to provide storage for but water sufficient for 16,000 acres; of this enough for 3,284 acres in six villages, or for 626 acres in addition to the 2,658 acres now irrigated in these villages, will be discharged through the sluices, and enough for

Tentipari.	Varandivayal Sanbattu
Angamangalam.	Naluvavadi
Kurumbur.	Sugandalai

4,015 acres under the seven subsidiary tanks, or for 2,304 acres in addition to the 1,711 acres now irrigated by these tanks, will be discharged through the existing channels that lead to these tanks, leaving water for 8,300 acres to be passed on to other tanks which have yet to be connected with the Kadamba tank.

57. Colonel Horsley's main channel passes on from the Kadamba tank and commands two tanks at Pallipat and Kayampuli; these will irrigate 469 acres and 1,254 acres respectively: four breached tanks under these if restored will irrigate 4,618 acres, and three others still lower near Trichendur 4,464 acres more; all these are of very large size and extend across and across the watershed.

58. The total thus accounted for is 782 acres more than Colonel Horsley's calculation gives water for; but the calculation is no doubt on the safe side, and by careful storage we shall probably be able to irrigate some thousands instead of some hundreds of acres more than Colonel Horsley allowed for.

59. A channel on the north side now exists and irrigates 4,886 acres: another channel taken off lower down irrigates 1,000 acres more; in addition to this, there are 2,221 acres capable of irrigation or a total of 8,107 acres to be irrigated on the north side of the river in the Tenkarei talook alone: beyond this, a Zemindary Estate* runs down to the sea on the frontier of the

* Maniachi.

Ottapidaram talook and contains 1,000 acres well capable of irrigation. North of the Zemindary the channel crosses the Madagiri river which is constantly in flood; this will help to refresh the channel which for the last five miles will have had to pass through a dry sandy soil in Mullakadu; adjoining there are sites for two very large tanks which may irrigate 3,000 acres.

60. The numerous existing tanks in adjacent villages will irrigate 4,000 acres more: this brings the channel up to the back of Tuticorin with a fall of ten feet to spare. This fall will carry it on to irrigate 2,000 acres more up to the Arasady river, beyond which lies the Ettiyapuram Zemindary; this is a difficult river to cross, the bed being soft and treacherous, and the water so much mixed with soda that it would not be of any great value for irrigation purposes; the Zemindary ryots too have a rich soil and grow very superior dry crops; these they think as valuable as the produce of irrigated land, and they would not care much for the water even should it be carried on to them.

61. So far we have a total of 18,557 acres to be irrigated on the north bank. My data here are, however, not so accurate as on the south bank, as it is difficult to get reliable information about irrigation from people who hardly know what river irrigation is. Colonel Horsley, however, has coloured the whole of the area mentioned as not already irrigated yellow in his map, which shows that the levels admit of its being irrigated beyond a doubt.

This is in supersession of all former estimates of area.

perhaps altogether 150 square miles, of which I reckon a little more than one-third to be irrigable.

62. The area to be irrigated is thus 40,666 acres in a tract of country thirty miles long by an average of five in width, perhaps altogether 150 square miles, of which I reckon a little more than one-third to be irrigable.

This is in supersession of all former estimates of returns.

Anicut ... 24 lacs.
Bidge ... 2 "
Channels, etc. ... 3 "

63. The returns to be derived from the work are 1,62,664 Rupees at a 4 Rupees water-rate on the entire irrigable area, with an additional 40,000 Rupees at a 2 Rupees water-rate for a second crop on 10,000 acres on either side of the river. Colonel Horsley, indeed, calculated that he had water sufficient for a double crop on 40,000 acres, and with our vast facilities of storage, and the constant flow from the river, I have no doubt but that we shall be able to keep very many of the tanks always full; add to this 2,02,664 Rupees water-rate, 40,666 Rupees land assessment at 1 Rupee an acre, the total 2,43,300 Rupees represents the revenue to be derived from this area; the present assessment of the land is, however, 1,28,627 Rupees minus an annual remission of 10,000 Rupees; so deducting 1,18,627 Rupees from 2,43,300 Rupees, 1,24,703 Rupees represent the actual gain by the work.

64. The work is estimated to cost seven and a half lacs of Rupees, but the estimate generally may, I think, be greatly reduced.

65. I have already laid down free of charge all the stone required for the anicut and apron valued at 50,000 Rupees; the channel the ryots are cutting will further reduce the estimate by 30,000 Rupees. The Attur people have raised 5,000 Rupees

and are about to cut a branch channel that will save Government 10,000 Rupees, and the other branch channels will all be cut and the tank banks strengthened with a very small Government subsidy.

66. All the firewood wanted for burning bricks and chunam will be given at the cost price of cutting and cartage; cheap labour is procurable by making use of the Pallers who enjoy Maniyams for maramut work, and I really think if the Engineer builds the masonry and marks out the lines of channel, that I can get all the earth work performed under his general management better and far more expeditiously than he could unaided, for about a lac of rupees; half of this sum we could raise by selling the right of occupancy of 6,874 acres of immemorial waste land in lots, and the other half would have to be paid by Government.

Civil Engr. to Collr., No. 220, 15th June 1855.
Ex. Pro. s. of Chief Engr., No. 3537, 13th Decr. 1855.

Ex. Procs. of the Chief Engr., No. 5803, 15th Aug. 1856.

Board's Procs., No. 4903, 25th Oct. 1860.
District Engr. to Collr. No. 590, 27th Sep 1862.
Procs. Madras Govt., No. 218, 11th Sep. 1863.
Procs. Madras Govt., No. 3,596, 6th Dec. 1865.
Procs. Madras Govt., No. 210, 18th Jan. 1866.
Offg Supg. Engr. to Collr., No. 654, 11th Aug. 1866.

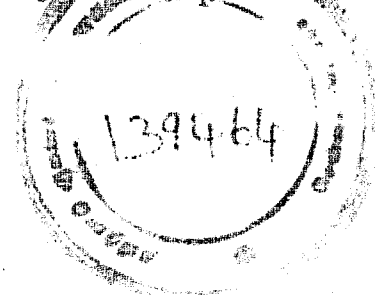
Do. do. to do. , 13, 16th April 1867
Collector to Supg. Engr., No. 95, 24th April 1867
Supr. Engr. to Collector, No. 282, 9th May "
Board's Procs. No. 5610, 26th August 1867.
Procs. Madras Govt. No. 2143, 11th Sep. 1867
Board's Procs. No. 6,259, 1st Oct. 1867.
Procs. Madras Govt., No. 2,987, 25th Sep. 1867.
Board's Procs., No. 6,525, 10th Octr. 1867.
Procs. Madras Govt., No. 2366, 8th Oct. 1867.
Board's Procs., No. 7885, 6th Dec. 1867.
Procs. Madras Govt., No. 3016, 18th Dec. 1867.
Board's Procs., No. 614, 24th January 1868.

67. The people are already levelling their fields, and getting all ready for the water that they shortly expect to have; and should I succeed in completing the channel now cutting, and take water to the eastward in June, I think that the Government could perhaps be induced to push on the work at once in a cheap and popular manner by placing Rs 50,000 to my credit and giving me a *carte blanche* to do all that is needed in the way of earth work under the Engineer's guidance.

68. The correspondence on the subject is noted in the margin.

69. To summarize the foregoing, Nos. 1 and 2 may be constructed at any time and are not specially needed now. Nos. 3, 4, and 5 are all of pressing importance, and No. 6 of still greater importance has already been sanctioned; these works will save much of the water that is now allowed to waste, and will add enormously to the wealth and resources of the district. Their aggregate return will be nearly 2 lacs on an outlay of 9½ lacs of Rupees of which the Government need not pay more than 7½ lacs; the outlay on new irrigation works has averaged but Rs 2,190 yearly during the past ten years, during which period the net revenue from irrigation has aggregated 171 lacs of Rupees; the total outlay on both new works and repairs has amounted to 5½ lacs of Rupees during the last ten years, while the remission for failure of crop partly caused by defective irrigation has been 11½ lacs of Rupees.

	Returns.
	Rs.
III.	11,500
IV.	28,200
V.	34,000
VI.	1,24,703
Total ...	1,88,403
	Cost.
III.	65,000
IV.	1,02,000
V.	45,000
VI.	7,32,450
	9,44,450
Deduct.	
Value of stone supplied.....	50,000
Value of earth-work done...	40,000
Value of firewood supplied	25,000
Money yet to be contributed	50,000
	1,75,000
Net cost ...	7,69,450



70. 32,450 Rupees have already been paid towards the anicut, and upwards of half a lac of Rupees has been promised for other works now proposed. Setting

* For all the projects.

carried out in the usual manner, the other earth-work* may be done very much by village labour if the Government will add

In paragraph 32.

allow me to make use of Local Funds in the manner described above. The great drawback is want of labour, the pallars being the only labourers, and in the Tenkare

Personally I have no wish to undertake the task as I have much other work to do; but the people are so earnest in their request that all details of minor works in which they are directly concerned may be carried out by the Revenue Department instead of by the Department of Public Works, that I am willing to do what I can if I do not break down at first starting with the large work we have in hand which requires 2,600 labourers daily to complete before the freshes come down the river.

The river-irrigated villages will be the first settled, as considerable progress has been made in collecting data for a scheme of Settlement for them; and this I hope to submit very shortly. As I have personally classified the lands of every village in three talooks, I may say that I have seen every irrigation work in them; the other two talooks are now in course of inspection.

same opportunity of ascertaining what is actually needed, or of carrying out emergent works in the popular way that I can; if only enabled to aid Kudimaramutt† by

† Village labour.

the district in order during the next five years while the Settlement is in course of completion, some entirely by Kudimaramutt, and others by Kudimaramutt aided by Local Funds or by Government subsidy; and if all works are put in order and the irrigation is extended to the utmost, I anticipate that the increase of revenue thus acquired will more than make up for the general reduction likely to be effected by settlement.

72. As an illustration of the course I proposed to adopt, I will mention two particular instances:—

I. A road along the course of the Sittar from road No. 2 to the mouth of the river is needed; an Engineer would connect the two points by the shortest possible line and prepare an estimate for, say 30,000 Rupees at 2,000 Rs a mile: when done there would be a good road, but a road and nothing more; the tanks would remain as they were, and not an acre of land would be benefitted; the shortest line is not always the best, particularly for village roads; a village road should connect the villages, and, if possible, should follow the line of tank banks and secure and strengthen these; along the route in question there are seven tanks and two channel banks, all greatly in need of repair, and along them I propose taking the road;

At a 4 Rupees water-rate and one Rupee land tax. repairing them would cost a large sum, but the road would save the outlay, and by improving the banks would bring under cultivation 850 acres of waste land assessed at 4,250 Rupees.

II. A road from Sankaranainarkovil to Vasudevanallur is needed; the Sankaranainarkovil talook, where I am now making Jummahbundy, has suffered more than any other talook this year, except perhaps Nanguneri, and the remission that has had to be made is far more than sufficient to have put the small works in order that would have saved most of the crops.

73. One of these is a channel to the rain-fed tanks near the Cusbah, a river descends the hills at Vasudevanallur, and two branches from it supply the Talavan-kottei and Maleiadikurichi tanks. The waste weirs of these tanks are close together,

aside the masonry and the cutting of the main lines of channel, which must be two-fold to the amount of subscriptions and village labour if the Government will add. The great drawback is want of labour, the pallars being the only labourers, and in the Tenkare talook they are not accustomed to employ their women on earth work; if we get over this difficulty and are successful in cutting the trial line now in hand, perhaps Government may consent to render us further assistance by dispensing with the usual routine and allowing the other works to be carried out in the cheapest manner possible.

71. My reason for pressing the subject now is, that the people expecting much good from the settlement are eagerly seeking for the means to improve their lands; and as it is my business to go into every village as Settlement Officer and make myself well acquainted with the condition and wants of the people, no other Collector in the country perhaps has the Funds, I can put every irrigation work in

and their surplus waters unite to form a small river which nearly all runs to waste in high freshes, a channel once led off from this river to a chain of tanks near the Cusbah, but it has long been choked up and useless. I now propose restoring this channel and am able to do so at once.

74. A line of road from Sankaranainarkovil to Vasudevanallur is entered in this year's Budget, (1868-69,) and this, instead of following a straight line will be carried along the course of the channel, so that the earth dug out of the channel will

Nageram.
Viridupu.

form the road; it will also pass along two tank banks now much in need of repair, and will permanently strengthen these. An Estimate for 1,000 Rupees has been framed for repairing a small channel from the southern sluice of the Maleiadikurichi tank, but this may be diverted to the more important work; with this and the 2,000 Rupees allotment for the road, plus 2,000 Rupees that we can easily add to the allotment from the surplus Local Funds elsewhere, we shall make up 5,000 Rupees, and the ryots will give the rest.

75. The work can be done this year and will bring under cultivation 800 acres of dry land assessed at 4,000* Rupees, besides securing the crops from all chance of failure in future; had this channel been in

* At a 4 Rupees water rate and a one Rupee land tax. order this year it would have saved us 10,000 Rupees, as the crops under river fed tanks are flourishing, while those under the

75 per cent. of the assessment on the rain-fed tanks near the Cusbah had to be remitted.

channel banks for these roads, not a yard of good land will be wasted. The banks will be repaired in the most substantial manner, and will never need repair again. Every Sluice and Calingulah along the lines will be put into working order, and the outlay will be repaid by a few years' revenue, from land which would not be in the least degree benefitted if the roads followed the Engineer's lines.

76. There are many places where tanks and channels can be improved by some such schemes as these, and these in the aggregate will repay the cost of the roads,

I have to-day been to a spot where a small outlay on a little ancient and channel would bring under cultivation 200 acres.

It is proposed to get rid of the very small tanks at Settlement by making them over to the people at dry rates, so that it is only those tanks that irrigate upwards of 20 acres that need receive any attention—Vide Board's Proceedings, No. 8,132, dated 12th Nov. 1866.

slowly over the face of the country will act as the forest does on the hills, and avert to a great degree those sudden rushes which lose us so much water and prove so destructive to irrigation works.

77. I feel quite confident that one-half more may be added to the area and one-

It will naturally be asked why we cannot add 50 per cent. to the revenue if we add 50 per cent. to the area; but I take for granted that the best lands are now cultivated, and my calculations of future revenue are based on what will stand in the settlement.

fourth more to the revenue, of the irrigated lands of the district generally, by a present outlay on a liberal scale, and that this outlay will be re-paid by an interest of 20 per cent. throughout.

78. The information required in paragraph 4 of the Board's Proceedings cannot be given in full, as none of the large projects proposed are single works with a fixed

4 Rupees for a first crop, and 2 Rupees for a second crop.

ayacut below them; but the present cultivation is given with the probable extent to which it can be increased; the revenue returns are based on the assumption of a water-rate being charged on a small land

assessment of say one Rupee an acre; the existing assessment is high, from 8 to 10 Rupees an acre, and will be considerably reduced by Settlement with or without a water-rate.

79. I have looked through the Public Works reports for the last ten years but can find little in them worth notice; they are mostly extremely meagre and utterly devoid of interest; they are indeed, merely the covering letters of Annual Financial Statements. The only applicable remarks

Paragraphs 8, 9, and 11 of letter, No. 11, are those of Messrs. Silver and Wedderburn. Mr. Silver says—"As regards the

"Public Works in general, I am decidedly of opinion that the transfer of the executive charge of these works from the Revenue to the Professional Department, attended as it is with great additional cost to the State, has not produced the beneficial results expected from it, at least in this district.

"Repairs to works of Irrigation which are numerous and scattered in Tionevelly, as well as repairs to roads, are not now executed so speedily under the present system as they formerly were, and I have never heard but one opinion expressed by the ryots on this head, generally coupled with the expression of a wish, that the executive was again in the hands of the Revenue Officers.

"As it is a matter of great importance that works of Irrigation should be maintained in a state of efficiency to preserve the existing cultivation, and revenue under them, and that repairs should be completed before the commencements of the cultivating season, and as complaints are occasionally made of backwardness in letting water to the channels and tanks, on account of the dilatory execution of repairs, I beg to recommend strongly, that petty earth repairs to works of Irrigation costing less than 50 Rupees, which are numerous, should be entrusted to the local Revenue Officers, as recommended in my letters of 4th May and 19th June 1861, Nos. 203 and 262 respectively, as such an arrangement would be very acceptable to the ryots. When I spoke to the people on this subject at the Jummahbundy, they all begged it might be carried out, many adding, they wished all repairs without reference to this limit might be executed under the local Revenue Officers as formerly." And Mr. Wedderburn says, that "the Irrigation works in this district are in need of much improvement."

80. The following statement exhibits the area and assessment of the irrigated lands of the district during the past ten years, the amount of remissions made, the amount of allotment sought for, and the amount granted for new Irrigation works and repairs:—

Year.	Irrigated area in Acres.	Gross revenue in Rupees.	Deduct remission in Rupees.	Net revenue in Rupees.	Amount of allotment sought for in Rupees.	Amount sanctioned for.	
						New works in Rupees.	Repairs in Rupees.
1857-58	1,24,133	20,74,157	1,26,451	19,48,006	.....	4,156	43,691
1858-59	1,38,083	22,89,459	56,761	22,32,698	.....	939	59,106
1859-60	1,59,270	15,54,225	2,836	15,51,389	.....	186	47,078
1860-61	1,54,861	15,54,177	1,56,686	13,97,491	.....	409	49,219
1861-62	1,77,913	17,91,771	1,25,278	16,66,493	.....	5,173	49,872
1862-63	1,79,725	17,87,537	33,173	17,54,364	.....	1,625	45,394
1863-64	1,81,369	18,34,093	76,775	17,57,318	.....	3,010	50,969
1864-65	1,81,366	17,91,489	3,41,239	14,50,250	.....	1,978	51,783
1865-66	1,73,310	17,55,999	1,57,853	15,98,146	1,54,000	3,345	46,770
1866-67	1,73,188	17,95,951	37,066	17,58,885	1,23,400	5,573	55,050
Total	.....	1,26,65,466	1,143,288	171,22,178	.....	26,898	4,90,113

(True Copy.)

(Signed)

R. K. PUCKLE,
Collector.

Forwarded, as requested in Memorandum, No. 956, dated 4th September 1868.

ENCLOSURES Nos. 1 to 3 — Maps.

SUBMITTED for the information of Government.

2. The first project on Mr. Puckle's list is a hill reservoir for storage of the head waters of the Tambrapurni.

3. From the Memorandum of the Superintending Engineer on the subject of the Tambrapurni river system, communicated with Proceedings of Government, Public Works Department, 28th September 1868, the Board learn that Colonel Wilkieson does not advocate the scheme unless in the remote contingency of the channels being hereafter made navigable.

4. It is, however, well known that at certain seasons the supply is barely sufficient for the existing cultivation, and as works IV., V., and VI., are for the purpose of extending cultivation to a very large extent, it seems by no means improbable that this project may hereafter recommend itself on considerations of irrigation requirements alone. This and No. II., however, may well be set aside for the present.

5. Nos. III., IV., and V., will naturally be among the first objects to which the attention of the Special Range Officer to be appointed for this river will be directed.

6. No. VI. has already been fully discussed and only awaits the sanction of Government, so that it is not necessary to allude to it further here.

No. 132. Minute by the Honorable A. J. ARBUTHNOT.
(Here enter 3rd December 1868.)

No. 133. Minute by the Right Honorable the President.
(Here enter 17th December 1868.)

No. 134. Minute by the Honorable H. D. PHILLIPS.
(Here enter 4th January 1869.)

No. 135. ORDER TIERRON, 4th February 1869, No. 365.

IRRIGATION, No. 4.

1. The Government have perused with much interest Mr. Puckle's report, dated 1st March 1868, No. 108, communicating a project for the development of irrigation from the river Tambrapurni and its tributaries. The zeal and energy which he has bestowed on the enquiry mark him as a public Officer warmly devoted to the welfare of the people committed to his charge; and the several suggestions he has submitted merit the careful consideration of Government.

2. Mr. Puckle's scheme embraces the construction of reservoirs near the head waters of the Tambrapurni and one of its branches, the restoration of a weir on the Sittar river, with its main dependant tank, and the general extension of irrigation from the existing channels on both banks of the Tambrapurni; also the construction of the Strivigoontum weir, which, however, having since been formally approved by Government, may be set aside in the present consideration. Mr. Puckle further brings forward a proposal for the employment of peculiar executive agencies and resources in carrying his projects into effect.

3. While the Government recognize that Mr. Puckle has adduced the strongest *prima facie* evidence in behalf of all the projects enumerated by him, they think it desirable to subject them to professional scrutiny, and to have the whole of the works proposed for the improvement of the irrigation under the Tambrapurni treated comprehensively as portions of one general plan. They moreover consider it very desirable that these undertakings should be brought under the category of Loan Works, and without regular plans and estimates, furnished by competent professional authority, funds will not be advanced by the Government of India. Nor is it improbable that there may be errors and short comings in the designs of Mr. Puckle, which would be discovered and amended by an Officer in the Public Works Department, and it is possible that the scheme may admit of still further extension.

4. The various projects submitted by Mr. Puckle will accordingly be referred to the Superintending Engineer of the 8th Division, who will issue instructions to the Officer in charge of the Tambrapoorni Range to prepare a general scheme for the development of the irrigation of that river and its tributaries to the full extent to which it is capable of being carried, keeping the suggestions of the Collector particularly in view. In conducting the investigation the Range Officer should place himself in the most cordial correspondence with the Collector, whose local knowledge cannot fail to be highly beneficial to him. The Strivigontum project will meanwhile be carried out as a separate work under its special Executive Officer, but it may hereafter be connected with the other works under the Tambrapoorni with a view to facilitate the concession of a single loan for the whole system.

5. With regard to the agencies and means which Mr. Puckle has proposed for carrying the various works into execution, which would involve many innovations in the existing system of executing Public Works, the Government while of opinion that they are all of a legitimate character, and while they are confident that Mr. Puckle's authority would not be exerted in a manner prejudicial to the independence of the monied classes or to the liberty of the lower orders, consider that there would be some difficulty in harmonizing these agencies with the ordinary routine of the Public Works Department, and that a practical solution can only be found in the hearty co-operation of the Collector with the Superintending Engineer and the Executive Officer in charge of the Range. Mr. Puckle would point out the subordinate works which could be executed entirely by means at his disposal, and any contributions in money, labor, or materials which he might collect for other works of a larger class would have to be duly taken into account by the Public Works Officers in their estimates of the total cost.

6. In cases in which district roads may be combined conveniently with the repair or improvement of banks of channels or tanks in the manner proposed by Mr. Puckle, the local Officers will be guided by the following rules:—

(1.) In every case in which it is desired to incorporate a district road with a water dyke and to execute the combined work in whole or in part from Road Funds, the Collector and the Range Officer should submit their conjoint opinion that the road is a necessary work. In this way the interest of the rate-payers and the general public would be protected against the partial and exceptional interest of the cultivators of wet land.

(2.) In every case in which it is proposed to incorporate a district road with a water dyke, and in doing so to deviate in some measure from the natural course of the road or to incur a greater expenditure than the road alone would have involved, a careful estimate should be made of the necessary cost of the road alone in its most direct and natural course, and the amount thus ascertained should be charged to the Road Fund, the excess of expenditure on the combined work being charged to the irrigation funds available from whatever source provided.

7. The Government are of opinion that the manner in which Mr. Puckle's report has been dealt with by the Board of Revenue is not a suitable mode of acknowledging the exertions of an able and zealous Officer, who is evidently actuated by a most sincere desire to promote the welfare of the important district under his charge. Mr. Puckle's letter, after having been detained by the Board of Revenue for eight months, has been submitted to Government with a few very brief remarks containing no allusion to several of the suggestions which the Collector has made with the view of economizing the money of the State and utilizing to the utmost the interest which the people have shown in the speedy prosecution of the works to which he alludes.

8. The Board, in the opinion of His Excellency in Council, has committed an error which ought not to pass unnoticed. The retention of a paper of such importance as the one under consideration for so great a length of time is unjust to Government and unjust to the author. Such delays deprive the Government of that timely information to which it is entitled and are very discouraging to a District Officer who is really interested in his work. They are also most prejudicial to the progress of the country. The Government have moreover a right not only to expect from the Board a reasonable promptitude in the despatch of business, but also such reflections and arguments on the topics submitted as may aid Government in maturing a definitive opinion.

(True Extract.)

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

Extracts of Mr. John Mullins' notes on works inspected in the Tinnevely district in October and November 1874.

No. 159-A.

Para. 47. The character of the freshes in the Tambrapoorni 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 Surumuthiyencovil, 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 Surumuthiyencovil and is mentioned rather because it has been proposed for adoption than for any suitability it appears to possess. It would be easy to construct a masonry dam here, and there would be no 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 reconnaissance 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 of any depth at the dam site.

Para. 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 Tambrapoorni, 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—

FIRST. The discharge of the river in the average maximum annual freshes as distinguished from the floods which occur once in 25 or 30 years.
SECONDLY. The capacity of the basin above the regulating dam site at 15 feet contours from 30 to 75 feet above ordinary ground level not river bed level at the site.
THIRDLY. 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.
FOURTHLY. The maximum extraordinary flood discharge of the river based upon the area of its catchment basin and corrected on the best information obtainable.
FIFTHLY. The level of the water above the dam corresponding to such extraordinary fresh.

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 anywhere 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 utilised 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.—

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

SECONDLY. 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.

THIRDLY. 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.

FOURTHLY. 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 the Tambrapoorny, one on the right bank falling in above the Cannadien 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 adopted to the circumstances of the locality.

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

6th February 1875.

Extract of para. 4 of the Government Order thereon, 31st March 1875, No. 848.

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.

(Signed.) G. W. WALKER, Colonel, R.E.,
Secretary to Government.

(True Copy.)

To

The Secretary to the Board of Revenue,
Madras.

Sir,

In their order No. 365, dated 4th February 1869, para. 4, the Government instructed the Superintending Engineer of the 8th division to prepare a general scheme for the development of the irrigation of the Tambraparni to the full extent to which it is capable of being carried, keeping the suggestions of the Collector (Mr. Puckle) particularly in view.

2. Since that time a good deal has been done to improve the irrigation under this river; but a great deal more remains to be done, and it is time, I think, for the Government to be supplied with the comprehensive scheme required by that order.

3. Experience has shown that the projectors of the Srivaikuntam anicut were somewhat over sanguine in estimating both its cost and the revenue to be derived from it. But the work has been more or less satisfactorily completed, and it has been sufficiently successful to justify reasonable expectations though it has cost more and produced less than was generally expected owing mainly to a miscalculation as to the amount of water available in the river during low freshes. What I am anxious to prove now is that it is well worth while to spend more money on the project and on the river generally in order to secure all the advantages it is capable of affording both to Government and the country.

4. A frequent perusal of the reports of the many able officers who have served in this district has convinced me that what is wanted to complete the stability of the Srivaikuntam anicut project (and I may add, the other irrigation works of the Tambraparni valley) is greater attention to the securing and storing of flood waters. It is clear, I think, that the present channels do not draw off the water during our short freshes fast enough, and that the present reservoirs are not capable of storing sufficiently large supplies. Consequently under all the channels more or less, but especially under those connected with the Srivaikuntam anicut, there is generally a difficulty about water for a month or so towards the close of the seasons as observed by Mr. Puckle in para. 8 of his letter embodied in the G.O. referred to above.

5. The widening of the South Main channel last year was the first practical step in the direction of improving the supply on the south side of the river, and the result has been most satisfactory: but the subsidiary reservoirs are not capable of storing the extra supply, and a good deal of water was unnecessarily wasted even in a bad season like the last. The tanks in the village of Tiruchendur especially being at the very end of the channel require enlarging and deepening considerably and the people are so convinced of this that in spite of all their disappointments they are not only willing but anxious to pay part of the cost of improving them. The Ellappa naikankulam in particular is obviously inadequate for the irrigation of the vast area, that might be transformed from a salt swamp into a sheet of paddy: but unfortunately it has already cost a great deal of money, and it is difficult to prove that it will ever pay a fair rate of interest on the capital already spent on it. But though a good deal may have been spent in vain, that is no reason why a little more should not be done in order to give it a chance of paying at any rate better than it does; and this would, I think, be the effect of a very small extra expenditure now. So much has been done that it seems a pity not to do a little more to secure such vastly increased advantages to the ryots certainly, and probably, to the Government also.

6. Everywhere the capacity of existing tanks should be increased and new tanks should be constructed if possible, but of all the schemes that have been conceived for protecting the valley against the effects of drought the most promising, in my opinion, is that of the Papanasam reservoir referred to by Mr. Puckle in paras. 8-12 of his letter quoted above. Mr. Puckle indeed observed that it was not of the same pressing importance as others in his list; but most of the others have been receiving a good deal of attention since he wrote, and at the present time I believe it would be the opinion of every officer who has studied the subject that a reservoir which would secure all the crops at the ends of the channels in bad seasons is the greatest boon.

that could be conferred on the Tambraparni valley. As observed by the Chief Engineer in the note quoted below (para. 9) Major Payne, (who was probably more intimately acquainted with this river than any other officer has ever been) was of opinion that in ordinary freshes the supply was inadequate even for existing cultivation in 1869; and that some scheme for securing and storing the surplus in high freshes was essential to any project for extending cultivation.

7. It is interesting to know that this work was originally proposed by Colonel Cotton (see General Observations of Captain Horsley for September 1854), but notwithstanding much correspondence and many favourable orders, it does not appear that the project was ever thoroughly investigated. Colonel Wilkieson alludes to it, and concludes that it was unnecessary unless all the channels in the district were made for navigation (as originally proposed); but then he estimated that water enough for the Srivaikuntam project was a "perfect certainty" (para. 6 of his memo. on the Tambraparni river, dated 1st August 1868).

8. In his report on the estimate for the Srivaikuntam project, para. 4 of his letter, dated 8th August 1868, G.O., dated 26th October 1868, No. 529, Captain Prendergast observed that no provision had been made for storing flood waters because the existing tanks would hold a moderate reserve, sufficient to provide against the very probable event of a failure of the ordinary flow after the north-east monsoon has ceased. He added that in the flat sandy plains near the coast there are no natural facilities for storing a large body of water, and in fact there is no inducement to consider such a proposition, for there is but a limited area of land between the existing cultivation and the seashore. If (he continued) the flood waters of the river are ever to be turned to account it must be in their being stored up in reservoirs before the river leaves the hills or in moderate sized tanks higher up, at any rate, than Srivaikuntam.

* In this he was apparently mistaken. There is still plenty of land available for the extension of irrigation.

(he continued) the flood waters of the river are ever to be turned to account it must be in their being stored up in reservoirs

before the river leaves the hills or in moderate sized tanks higher up, at any rate, than Srivaikuntam.

9. Unfortunately all the anticipations as to the abundant supply of water available have been falsified, and it has been found necessary to adopt various expedients to improve it, (see note by the Chief Engineer in G.O. No. 760-I., dated 2nd October 1878, especially para. 2). None of these however seem to me to have gone to the root of the matter, and the Papanasam Hill Reservoir seems to have been thought beyond the scope of practical suggestions (though favourably spoken of by Major Mullins in para. 19 of his note No. 311, dated 27th November 1869, (G.O. No. 198, dated 18th January 1879)). Yet it was considered by good judges to be likely to put a stop to an uncertainty in the irrigation which often results in considerable remissions; and it is a fact that it is the certainty of a constant supply that makes it possible for the ryots of Shermadevi for instance, to pay Rs. 20 to 25 an acre with ease when the ryots of less favourably situated villages could not pay Rs. 10. If this reservoir is likely to have the effect predicted by Mr. Puckle, namely of securing the crops on 15,000 acres of land the irrigation of which is more or less precarious at present, it may be safely predicted also that the assessment of those 15,000 acres might be raised considerably at the next revision; and in the meantime the ryots would have reaped a golden harvest. For it is not the direct pecuniary gain to Government by such improved irrigation that is the true measure of its value; Government gets its revenue all the same from land the assessment of which has been compounded for both crops even though the 2nd crop may have failed entirely and the ryot may have lost half his rent; so that such projects ought not to be made contingent on the direct benefits to Government alone. It should be considered that Government cannot fail to benefit also by the increased prosperity of the people, though it may be impossible to estimate such indirect returns in figures.

10. Even directly, however, as observed above, the benefit to Government at the next revision would be immense; for as it is, the certainty of irrigation which makes land valuable, and as much of the land towards the ends of the channels is assessed at extremely low rates on account of the uncertainty of irrigation, it may fairly be assumed that the assessment on the 15,000 acres now in jeopardy every year might be doubled at the next revision, and in this way the direct benefit could hardly be less than Rs. 60,000 a year. In the meantime, it may be hoped that remissions which from 1854 to 1868 averaged Rs. 7,474 a year, and in one year (1863) reached the high figure of Rs. 1,83,616, would be almost entirely saved. I enclose a statement

showing the remissions granted since 1868, but it is more or less delusive as it includes what might have been irrigated if the Srivaikuntam canal had been successful which it never has been, chiefly, I believe, for want of this very Papanasam reservoir. There is one satisfactory feature about all irrigation schemes in this district which has been noticed by every officer who has had experience here and that is the extraordinary enterprise of the people; only provide water and the people will do all the rest. There is no fear of their declining it or failing to utilise every drop. They are therefore, as Colonel Mullins has lately observed, peculiarly deserving of the consideration of Government, and the more so as the Tambraparni is, for its size, the most valuable river in the Presidency.

I venture therefore to suggest most earnestly that an officer be once more specially appointed to thoroughly investigate the scheme for constructing a reservoir for reservoirs in the hills above Papanasam and the similar auxiliary project suggested by Mr. Puckle for the construction of a reservoir on the Gatah nad. If of those described by him in his letter No. 108, dated 6th March 1868, embodied in G.O. No. 305, dated 4th February 1869. If I might venture to make a further suggestion on the subject it would be that some officer familiar with the river should be selected for the work and not a stranger; and that of all the officers I know either Mr. Randall or Mr. Grant might best be relied upon not only to do justice to the project, but also not to lead the Government into useless expense, neither of them being oversanguine as to the capabilities of the Tambraparni and its irrigation works. In communication with such an officer, I should be able to decide once for all on many schemes for the improvement of the project which at present it is scarcely worth while even to enumerate. I need hardly say how important it is that early orders should be passed in such cases. I cannot pretend to the intimate personal knowledge of the locality possessed by some of my predecessors (notably Mr. Puckle); but it would probably be some years before my successor became so familiar with the requirements of the district as I am now.

J. B. PENNINGTON,

Collector of Tinnevely.

P.S.—Since writing the above my attention has been drawn to G.O. No. 848, dated 31st March 1875 (which I had somehow overlooked), passing orders on a Memorandum of the Chief Engineer, dated 6th February 1875, which shows that Colonel Mullins is fully alive to the advantages of a reservoir in the hills, but unfortunately nothing has yet been done to carry out his suggestions.

J. B. PENNINGTON,

Collector of Tinnevely.

RESOLUTION.

Submitted for the orders of Government.

2. The Board support the Collector's proposal that an officer of the Public Works Department be specially deputed to investigate and report further upon the best means of developing irrigation under the Tambraparni. The people of Tinnevely will doubtless avail themselves fully of any advantages in the way of irrigation which may be offered to them.

(Signed) E. GIBSON,
Acting Secretary.

Enclosure No. 2 (to Mr. Pennington's letter).

Extract from the Proceedings of the Madras Government, Public Works Department, 18th January 1870.

No. 198.

19. Major Payne's investigations are connected with the Tambraparni; and, as I had an opportunity of discussing the subject with him, a few remarks on the work to be done may properly be appended to this report. This officer has run levels along the Tambraparni from Srivaikuntam to Papanasam, and it will be well to use mean sea level as the datum for all the levels in the Tinnevely district, as their connection and relation will then be the more readily understood. He has also been engaged in compiling a general map of the Tambraparni irrigation showing all the channels, nunjah lands, etc., etc. The Revenue Survey maps have greatly facilitated this work, and it will shortly be completed. At present the first thing to be done is to establish water registers in order to ascertain both the supply received by every existing channel and the quantity passed on at each anicut as surplus. The circumstances to be dealt with in seeking to improve and extend the irrigation under this river will then be known. It is necessary also to find out what will be the proper proportion of storage in connection with each anicut. This is an important point, as upon the sufficiency of the tanks to supplement the supply in the channels when the river is low, will depend the security of the cultivation. It will be found that the proportion of storage requisite will be comparatively small in connection with the channels under the first anicut, and that further to the eastward a much larger storage will be necessary. It should be ascertained as early as may be practicable what facilities, if any, for the construction of reservoirs on the upper part of the Tambraparni and its feeders exist, as it may be more economical to store among the hills than in the plains. This point must be first settled, because upon it depends the general course of the work to be done in the low country. If water be stored in the hills the river will convey it to the anicuts, existing channels will for the most part suffice for its distribution, and the existing tanks will not need enlargement. If, on the other hand, no reservoir sites should be found on the hills, the anicut channels will have to be enlarged to draw off more of the flood-waters, and the tanks must be re-arranged to hold the additional supply. Major Payne is well acquainted with the Tinnevely district, and it is his opinion that the spring or ordinary supply of the river is insufficient for the channels and cultivation as now existing, and that upon the utilization of more or less of the flood-waters must depend the carrying out of either any radical improvements or extension of cultivation. The freshes are of very short duration, as might be expected from the short length and small area of the catchment basin of the river. Some of the existing channels are likewise very long; the tanks are many of them surrounded by valuable cultivation, so that altogether the conditions are not favourable unless water can be stored in the hills, and then, indeed, the problem will be comparatively simple. Doubtless the old works may be improved. Head sluices to the main channels are very necessary and should certainly be provided. The extreme crookedness of some parts of the channels may be corrected; the cross section and fall may be adopted to the demands upon the several parts of the channels; the arrangements by which drainages are received and disposed of may be rendered more efficient. Some of the tanks may be enlarged, and it may be possible to give them an improved supply by short new channels from the river to draw off flood waters, for at present many of these tanks are very inadequately supplied.

Copy of letter, No. 251, dated 9th April 1898, to Board, Land Revenue, Madras.

I have the honour to reply to para. 22 of the Board's Proceedings, dated the 23rd May 1892, Forest, No. 252, regarding the scheme referred to by the Conservator of Forests, Southern Circle, in his letter embodied in the above proceedings for damming the Tambraparni river near its source.

2. The scheme referred to is an old proposal which appears to have been first put forward by Captain Horsley so far back as 1854 (E.M.O. 18th December 1855, No. 925, P.W.D.) to form a reservoir to dam the upper waters of the Tambraparni in the hills above Papanasam. Government directed the Chief Engineer to give his attention to the project and in 1856 Lieut. R. A. Roberts, R.E., submitted an estimate for a reservoir to be constructed near Sorimuthieyankoyil. The object of the reservoir, it was explained, was "not so much the retention of water for immediate irrigation but the storage of a certain amount which can be made use of towards the end of the season when crops are frequently destroyed for want of perhaps a week's additional irrigation."

3. The estimate amounting to Rs. 1,50,000 was not however sanctioned pending further investigations (*vide* E.M.O. 20th May 1857 No. 1004, D.P.W.). In 1858 Lieut. Oakes made a report on the subject and in 1859 Captain MacGill inspected the ground, made surveys and took levels. The project was examined by various officers at different times in subsequent years. In his inspection notes of the Tinnevely district, dated 6th February 1875, Colonel Mullins, R.E., made suggestions (paras. 47 and 48 of the notes) for a scheme of storage which would equalize the discharge of the river. The Government approved of the scheme being worked out (G.O. No. 848, 21st March 1875). Nothing however appears to have been done on this; and in 1881 Mr. Pennington, the Collector, pressed the matter on the notice of the Board (B.P. No. 1700, dated 21st November 1881). Thereupon Government again directed that the subject should receive the early consideration of the D.P.W. (G.O. 21st November 1881, No. 1760 R.D.). Finally in 1884 Colonel Haslam, the Chief Engineer for Irrigation, after inspecting the proposed sites (in para. 3 of his inspection notes printed in G.O. No. 905, dated 8th October 1884) observed that while the site above the Papanasam falls "might do . . . it must be remembered that the area of the catchment basin is small and it is certain that the rights of the cultivators under the upper anicuts of the Tambraparni must be interfered with if the reservoir is to be of any use to the cultivation lower down; there is therefore an uncertainty about these old projects which renders it undesirable to employ a special establishment on them while there are other projects of undoubted advantage to the country remaining unexamined". The Government apparently accepted this opinion as finally disposing of the project at any rate for the time (*vide* G.O., 8th October 1884, No. 905, I.P.W.).

4. Major Baddeley, R.E., the present Executive Engineer, whom I consulted, believes that "no improvement to the existing system of irrigation could be made by the construction of the proposed reservoir but on the contrary existing rights under the upper anicuts would be interfered with without any certainty of benefit of the cultivation lower down the river".

5. From an administrative point of view it is of course desirable that every drop of water should be conserved for irrigation but I cannot find any ground for believing that a reservoir on the Papanasam hills would improve to any substantial degree the existing Tambraparni irrigation system, which it is to be remembered has been vastly extended and practically recreated since the proposals referred to were first mooted. As it is it is only on occasions of very heavy floods that the river water escapes into the sea. Such small improvements as might eventuate could not, I believe, be effected at a cost at all commensurate with the benefits to be expected.

6. I cannot recommend therefore that Mr. Cherry's plan should be made dependent on the construction of a reservoir in the Papanasam hills.

(Signed.) G. S. FORBES,
Collector of Tinnevely.

Copy of letter No. 1151, General, dated 21st September 1894, from the Collector of Tinnevely to the Chief Engineer for irrigation, Madras.

With reference to your endorsement No 54 T.N., dated 14th July 1894, on the note by Mr. Ashpitel, Assistant Engineer, on the distribution of water in the south main channel of the Srivaikuntam ancient system. I have the honour to state that I generally approve of the proposal contained in para. 6 of the note. The Sub-Collector Mr. J. A. Munro who inspected the place is of the same opinion and considers that the project is feasible though the owners of the high level lands of Tirukkatur and Kadaianodai are not likely in his opinion to be fully satisfied with it and may eventually require a good channel in the place of the catch drain proposed. I heard the representatives in the matter of three parties interested in it, viz., the owners of the high level lands and the ryots under Attur and Kadamba tanks and see no reason to disapprove of the present proposal. The present practice of heading up of water in the south main channel for the irrigation of high level lands the area of which is small when compared with that under Attur and Kadamba tanks, is objectionable, and should be abandoned by which the channel waters will flow freely to the lands lower down and that the grass and reeds now grown in the channel which seriously affect its efficiency will also be eradicated. As regards the position of the proposed catch drain, however, I think it preferable to have it inside the main channel. I think also the question of increasing the number and area of the vents in the head sluice of the channel may be considered with advantage.

2. In para. 8 of the note the Assistant Chief Engineer remarks that one of the causes of the recent deficiency in the water supply during the south western monsoon might be the denudation of the hills of forest. I do not think, however, that the hills have been denuded and the real cause of the deficiency of water in the low proximity is the utilisation of water by the upper anicuts. Any scheme of improvement therefore connected with the last anicut in the Tambraparni river shall also, I think, deal with the question of augmenting the supply by storing it when it is available without letting it to run waste to the sea. In this connexion I strongly recommend a fresh and full investigation of the scheme of constructing a reservoir in the river above Papanasam which has been dealt with in G.O. No. 905 L., dated 8th October 1884. The Hon'ble Mr. Arundel, the present Commissioner of Separate Revenue, who is intimately acquainted with this district looked over the project of the Papanasam reservoir during his recent inspection of this district and is of opinion that the project has been shelved in an entirely perfunctory manner. He seems to think that the catchment basin of the proposed reservoir has not been exactly ascertained and that the hill rainfall is very heavy and wholly dissents from the view taken by Colonel Hasted (Inspection notes of Chief Engineer for irrigation recorded in G.O. No. 905 L., dated 8th October 1884) that the rights of the cultivators under the upper anicuts must be interfered with in order that the project might be of use to the cultivators lower down. The lands under upper anicuts being practically sure of their supply at present Mr. Arundel thinks the proposed big reservoir above Papanasam would be of use in sending down water to the lands under the last (Srivaikuntam) anicut which generally either lose their crop or have to lie waste. This project seems therefore in my opinion to be one which in the interests of the lands at the tail end of the Tambraparni river may again have been investigated by competent officers of the Public Works Department. An additional reason in the matter is the question of the Tuticorin water-supply which it is proposed to get from the Korampallam tank which depends on the Srivaikuntam north main channel. Unless this tank is kept well supplied the expensive water-works will be a failure.

No. 4523.

FROM

S. Gopalakrishnaier, Esq.,
Executive Engineer,
Tinnevely Division,

TO

The Superintending Engineer,
VI Circle.

SIR,

I have the honour to submit the following report on the investigation of Papanasam Reservoir Project ordered in G.O. No. 53 L., dated 19th January 1898, communicated to me with your No. 78 T.N., dated 5th February 1898.

1. An estimate of Rs. 2,300 for preliminary expenses for investigating the project and the entertainment of a temporary survey establishment having been sanctioned in G.O. Nos. 507 L., dated 2nd July 1898, and 1749 W., dated 9th July 1898, respectively, arrangements were made for construction of huts on the hill for the accommodation of the survey establishment and notification for the services of a surveyor sent for publication to the *Fort St. George Gazette*. Although applications from several qualified men were received for the surveyor's post, they one by one declined to accept the post as offer was made to them and it was not till November 1898 that the services of a qualified man was secured. But this man soon fell sick of fever and as he did not work satisfactorily his services were dispensed with, and an application was made for an Upper Subordinate in January 1899. As no work could be done in the hot weather without everybody employed getting knocked down, the Chief Engineer for Irrigation considered the application too late and ordered its renewal in May so that work may be resumed in July. On the application being renewed in May the Chief Engineer pointed to the Superintending Engineer that a permanent Upper Subordinate was just then posted to the circle and that he must make his own arrangements for the work. The Superintending Engineer while informing that he would endeavour to spare an Upper Subordinate ordered the employment of a surveyor as sanctioned and the work being done by him. A surveyor was employed in July, and as his work was slow, he was paid a salary of only Rs. 60 per month instead of the sanctioned amount of Rs. 80. It was originally estimated that the survey establishment would be required for seven months, and sanction for this period was applied for. The estimate was made on the supposition that it may do to have cross sections of the river valley at intervals of two furlongs, but the Chief Engineer for Irrigation ordered them to be taken at one furlong intervals. This nearly doubled the work to be done. Further it was found impossible to do as much field work as was estimated owing to fatigue and loss of energy due to walking every day between the camp and the scene of work over a rugged country and work actually turned out was only about half of what was anticipated. Thus with the stoppage of work during the hot weather and unavoidable delay due to the indisposition of the surveyor at intervals which at one time was as long as four months when he fell seriously ill of fever and resigned his post, the cross sections of the river valley were with difficulty completed and a first trial line for the line of the dam was taken in October 1901, and as the remaining work to be done such as laying out a proper line for the dam taking longitudinal and cross sections of it and digging trial pits was necessarily slow and the employment of the survey establishment for it considered too costly, the services of the establishment were dispensed with and the work finished by the regular establishment of the division whenever there was time. The jungle clearance had also, as anticipated by the Chief Engineer for Irrigation, proved an uncertain and a more costly item than estimated. The estimate of Rs. 2,300 for preliminary expenses had therefore to be revised, and a revised estimate of Rs. 3,900 was sanctioned in G.O. No. 717 L., dated 28th August 1900.

2. The average bed level of the river at the site of the dam is 667.00 + M.S.L. Forty-seven cross sections of the river valley parallel to one another and at intervals of one furlong and running up at both ends to points above 780.00 in level have been taken and values recorded in the accompanying tracing (*vide* plan No. 1) which is a rough copy of the Madras Forest Survey Map of Papanasam Reserve Forest. Contour lines at levels 700, 710, 720, 730, 740 and 750 are drawn on the tracing as it was considered that the crest of the dam or the F.T.L. of the proposed reservoir may range within those limits and a statement of capacities of the reservoir at level 660.00 and at every consecutive 10 feet above it up to level 780.00 is prepared and attached to the tracing, with a note explaining how the capacities were calculated.

The contour lines in the tracing are transferred to the forest survey map (*vide* plan No. 2) to show what portion of the forest will be submerged at the several lines and a statement showing the capacities and the area of submergence is prepared and attached to the map. As in addition to Government forest, portions of forest belonging to Singampatti Zamindar and of Kattalamalai estate belonging to a Roman Catholic Mission, will be submerged, the area of Government and of other forests that may be submerged is also given separately in the statement. It may perhaps be noticed that the contour lines are not accurate as they do not follow the course of the petty hill streams and other details shown in the survey map. In the first place the course of the streams cannot be considered as correctly shown. *Vide* note "in the tract covered with dense forest the minor details are only approximately depicted" made at the bottom of 'references' in the map. Secondly, the contour lines were drawn from levels given in the cross sections and not from regular contour levels taken and therefore do not pretend to be very accurate; but they cannot be very far from the true lines and the area enclosed by them cannot differ to an appreciable extent from that enclosed by the latter.

Longitudinal and cross sections of the proposed line (*vide* plans Nos. 3 to 6) for the dam are also submitted. The bed of the river is rocky. On the left side of the river there is a long range of high hill running down to its margin. On the right there is no such hill. There are detached hills of short length with gaps between. The longitudinal sections are taken from the hill on the left side, across the river and over the detached hill and gaps between them on the right to a point beyond which the levels are above 780.00. Trial pits have been dug at points in the gaps considered sufficient for this preliminary investigation, till hard rock was reached, and the nature and levels of the different soils met with are recorded on the longitudinal sections.

3. To ascertain what quantity of water may be available for storage in the proposed reservoir gauges were fixed at the upper and lower ends and at the middle part of the Nathiyunni anicut and calculations made of the discharges over it as required in para. 5 of the note of the Chief Engineer for Irrigation printed with G.O. No. 53 L., dated 19th January 1898, ordering the investigation of the project. Survey and sections of the anicut are put up (*vide* plans Nos. 7 and 8). It will be observed that the anicut is very irregular in section and it appears to have been much more prior to 1884 when it was given some shape. This fact was brought to notice by the present Superintending Engineer, Mr. Willson, of the circle, and with his approval the calculation of discharges over the anicut prior to 1885 has been given up and calculation for 17 years from 1885 to 1901 made. As the crest of the anicut is not uniform throughout it was divided in three sections and calculation of discharges in the three sections was separately made till the tail water rose above the average crest level and for high water levels a single calculation was made for the whole length of the anicut, *vide* calculation sheets attached. As the anicut is very oblique to the river, velocity of approach is not taken into consideration in the calculations.

The usual formula—

for discharge per foot run—

$$D = \frac{5}{8} \times \frac{2}{3} d \times \sqrt{2} g d \text{ or } 3.33 d \frac{3}{2}$$

for clear overfall where d is depth of flow over crest—

$$D = \frac{5}{8} \sqrt{2} g d_1 (d_2 + \frac{2}{3} d_1) \text{ or } 3.3 d_1 \frac{3}{2} + 5 d_2 \sqrt{d_1}$$

for a not clear overfall or submerged weir where—

D is the afflux or difference between water levels above and below anicut,
 D is the depth of submergence of the crest below the tail water,

have been adopted for the calculations. An abstract statement is prepared showing the monthly and annual discharges in millions of c.ft. over this anicut and over Srivaikuntam (the last of the anicuts in the Tambraparni river) for all the 17 years for purposes of comparison and probable deductions.

4. As Nathiyunni anicut is on the plains and about 7 miles below the proposed site of the reservoir, a comparative statement of monthly and annual rainfall on the hills (namely, the average of the fall recorded in the Forest Department in two or more stations in the basin of the river above the site of dam) and at Kannadian anicut which is about 2 miles below Nathiyunni is prepared for nine years from 1893-94 to 1901-02 and submitted with a view to judge what portion of the discharge over Nathiyunni anicut may be the discharge of the river at the site of dam. Rainfall at three other stations on the plains in the basin of the river are also given in the statement and the average of all the four stations struck. As the rainfall on the hills has not been recorded for years prior to 1893-94 the statement has been prepared only for years beginning with that year.

5 (a) From para. 6 of the note of the Chief Engineer for Irrigation printed with G.O. No. 53 L., dated 19th January 1898, it would be seen that the total area of occupied wet under the Tambraparni channels is 73,403 acres. Allowing for expansion of irrigation anticipated by the Revenue officers if the water-supply were materially increased the maximum area that may be irrigated may be taken as 80,000 acres. It is not portion of lands under Marudur and Srivaikuntam anicuts alone that suffers from scarcity of water in the south-west monsoon, but portion of lands under the upper anicuts also. It may roughly be taken that the total area of such land including the probable extension is 35,000 acres. It therefore appears advisable to make the proposed reservoir hold water required for this area for two months from about the middle of August to the middle of October. The quantity of water required to be stored at 2 cubic yards per acre per hour is therefore $35,000 \times 2 \times 27 \times 24 \times 60$ or 2,722 millions of c.ft. As may be seen from what is stated further on, this water may or may not be available for storage in the first part of the south-west monsoon. It is therefore safe to assume that it would be available only in the north-east monsoon from October to December, say about the month of November. Loss due to evaporation and absorption for about ten months in the year in the reservoir in addition to that in the bed of the river when the stored up water is led down for irrigation has in consequence to be allowed for. Taking it to be on the whole at the rate of one foot fall per month in the level of the reservoir, the F.T.L. of the reservoir must be fixed at 10 feet above the level at which it must hold the quantity to be stored for irrigation. From the statement of capacities of the reservoir, it would be seen that—

at level 660.00 the capacity is	265.4
700.00 do	3,028.8
710.00 do	4,336.6

As it may not be worth while to utilise the small quantity of water below level 660.00 for irrigation owing to the difficulty and expense of providing means for so doing, the capacity of the reservoir at 700.00 is about what is required and its F.T.L. may be fixed at 710.00. A quantity of 4,334.7 millions of c.ft. is therefore required to be stored.

(b). A perusal of to statement of rainfall will show that while the average fall on the hills is heavy during the two periods April to September and October to March, namely, 48.65 inches in the former and 57.61 in the latter, the fall on the plains, namely, 6.00 is scanty in the first period and only about 23.63 per cent, of the fall, namely, 25.39 in the second. Irrigation in the first period must therefore chiefly depend on the rain fall on the hills. The highest area now cultivated under all the Tambraparni channels is 70,300 acres. Deducting the area of about 3,171 acres under the Kodamelalaghien and Nathiyunni channels the area to be supplied below Nathiyunni anicut is 67,129 or say 67,200 acres. Supposing crop in the first period require water for four months the quantity of water required at 2 c.yds. per acre per hour is $67,200 \times 2 \times 27 \times 24 \times 120$ or 10,451 millions of c.ft. From the statement of discharge it will be seen that for this period the average discharge for 17 years and the highest and lowest in those years over Nathiyunni anicut are 7,057.14, 15,740.82, and 1,854.78 millions of c.ft., respectively, and over Srivaikuntam 3,716.77, 13,936.79 and 2.00 millions of c.ft., respectively, and the number of years in which the discharge has been less than the average

is nine for Nathiyunni and ten for Srivaikuntam anicuts. As the mean discharge over the Nathiyunni anicut is less than the quantity required for irrigation, namely 10,451 millions of c.ft. The mean discharge over the Srivaikuntam anicut, namely 3,716.77 millions of c.ft., which is a mere waste going to the sea may be composed of portion of discharge from Nathiyunni anicut during sudden high freshes of short duration and of the discharge from the basin of the river on the plains. Though the former component will be arrested and stored by the construction of the proposed reservoir, it can only be a small fraction of 3,716.77 millions of c.ft. and therefore smaller still of the quantity required to be stored. Further the site of the dam is about 7 miles higher up the river than Nathiyunni anicut and the catchment basin of the river above the dam 42 sq. miles less than above the anicut. The discharge of the river at the dam must therefore be less than at the anicut. There can therefore be no hope of storing any appreciable quantity of water in the reservoir during the south-west monsoon. The north-east monsoon alone must be depended upon. During this season the average rainfall on the hills is heavier and on the plains still more heavy than the fall in the south-west monsoon. The average discharge for 17 years, the highest and lowest in those years over Nathiyunni anicut have been 8,398.33, 20,396.07 and 1,469.79 millions of c.ft., respectively, and over Srivaikuntam 31,080.30, 84,526.82 and 493.33 millions of c.ft., respectively, and the number of years in which the discharge has been less than the average has been 10 for Nathiyunni and 11 for Srivaikuntam anicut. The years in which the discharge over the two anicuts has been considerably less than the average discharge must have been years of exceptional scarcity and must therefore be left out of consideration. Yet without omitting them the average discharge has been 8898.33 millions of c.ft. over Nathiyunni anicut and 31,080.30 millions over Srivaikuntam. Taking crops in this season require water for five months and the area of irrigation (including probable expansion) 80,000 acres, the quantity of water required at 2 c.yds. per acre per hour is $80,000 \times 2 \times 27 \times 24 \times 150$ or 15,842 millions of c.ft. As the quantity of water going to waste to the sea over Srivaikuntam anicut is nearly double of this quantity and as the river is joined in its course on the plains by the marginally noted tributaries

1. Manimuttandy drainage area.	66½	able drainage areas, a very good portion
2. Koriyaar Do.	59	say over ½ of the discharge of the river
3. Gadamanady Do.	98½	at the proposed site of dam may be ar-
4. Pachayaur Do.	97	rested and stored in the proposed reser-
5. Chitaur Do.	957	voir. As already mentioned the site of
6. Areas directly draining into the river by petty streams.	461 sq.	the dam is about 7 miles above Nathi-

yunni anicut. In para. 6 of the note of the Chief Engineer for Irrigation referred to in para. 5 (a) of this report, the catchment area of the river above the site of dam is given as 160 sq. miles. This appears to be a mistake. From a tracing taken from atlas sheet and attached with this report (vide plan No. 9) the catchment area above the site of dam is found to be only 106 sq. miles and that above Nathiyunni anicut 148 sq. miles of which 140½ is on the hill and 7½ on the plains. Taking the area above Nathiyunni anicut to be wholly hilly and the discharge from the different areas of the same nature to vary as the square of their cube root the discharge at the site of dam must be $(106/148)$ two-third of that at Nathiyunni anicut, i.e., $(106/148) \frac{2}{3} \times 8,893.33$ or $\frac{2}{3} \times 8,893.33$ or 7,114.66 millions of c.ft. As the area above the site of dam is wholly hilly and that at Nathiyunni anicut not quite so the discharge at the former may be greater than that thus arrived at. Considered in another way this conclusion appears to be quite probable. For Periaur above Periaur dam in Madura district the run-off has been taken, if not actually found, to be five-ninth or more of the average rainfall in the basin. (Vide para. 4 of the note of the Chief Engineer for Irrigation printed with G. O. No. 992 I., dated 10th November 1897.) The form of the basin of the Tambraparni on the hills may be quite similar to that of Periaur though on a lower level and its catchment area is less. A run-off of 5.9th of the rainfall may therefore be safely assumed for Tambraparni above the site of dam. From the statement of rain-fall it would be seen that the average rainfall on the hills from October to March is 57.61 inches. The run-off may therefore be $\frac{5}{9} \times 57.61 \times 106 \times 5,280 \times 5,280$ or say 7,880 millions of c.ft. A quantity more than 4,334.7 millions of c.ft. shown in para. 5(a) as required for storage may therefore be available for the purpose.

6. Sufficient information has not been collected to form an accurate estimate for the dam and its auxiliary works nor was it intended to be done in this preliminary enquiry. The line of dam both in the bed of the river and outside it is full of boulders many of which are of considerable size and hundreds of cubic feet in contents and it would cost thousands of rupees to clear them and make a proper examination of the ground. Yet with the sections taken a rough estimate of the cost is attempted. As already stated there is a long range of high hill running down to the left margin of the river. This hill rapidly rises to more than 760.00 in level. On the right side of the river there are detached hills of short length with gaps between them. The channel supplying the Papanasam Cotton Mills takes off the right margin of the river within a short distance below the site of dam. If the surplus of the river be let out by a masonry weir in any of the gaps on the right side the mill channel and lands under cultivation will be interfered with. As deep sluices have to be provided in the masonry dam across the river for supply to irrigation it appears advisable and probably may be cheaper to pass the surplus also through it by similar sluices. The rough estimate is therefore made on this assumption. From the longitudinal sections it would be seen that in addition to the river there are three gaps on its right side to be filled up. Earthen bund may be thrown across the gaps while a masonry dam is necessary across the river. The whole place is covered by dense jungle and thorough clearance at a large cost is necessary to fix the best and cheapest line for bund across the gaps. The longitudinal section now taken may not therefore be on such a line but on a line that could in the midst of the jungle be judged as suitable. From the section of the river it would appear that the masonry dam must be about one thousand six hundred feet long of which 900 feet (400 ft. on the left 500 ft. on the right side of Zero point) is in the bed of river about 420 ft. on the left and 280 ft. on the right margin. It may be taken that the rocky bed of the river will have to be cleared and blasted down to about level 595.00 to found the dam upon. Considering the quantity of water required to be stored and the quantity that may be available, already dealt with in the previous para., it appears that the crest of the dam may for the present be fixed at 710.00, but that the design may be such as it may be raised up to about 720.00 if larger storage was needed and found available. As the capacity of the river at level 660.00 is only 265.4 millions of cubic feet and as it is not as already stated worth while to utilise it for irrigation, the sluices for supply to irrigation and for discharge of surplus may be placed with floor at 660.00. Taking 8 inches to be the minimum run off from the whole basin in a day during periods of very heavy rain fall the maximum discharge of the

river per second will be $\frac{106 \times 54.0 \times 5.28 \times 5.28}{12 \times 24 \times 60 \times 60} = 22,802$ c. ft. If there be sluices 10 feet

high with floor at 660.00, the discharge per foot run will roughly be $4 \times 10 \sqrt{28 \times 45}$ or 336 c.ft. per second. The total length of sluices required to discharge 22,802 c.ft. is therefore $22,802/336$ or 68 ft. There may therefore be seven sluices each 10 ft. broad and 10 ft. high with gates similar to that of Periaur head sluice at the head of the tunnel on the hills. So long as the discharge of the river is ordinary these sluices will have to be opened only to the extent required for supply to irrigation which may be gauged at the anicut to be constructed at the head of North and South Kodamelalagian channels, the first channel that takes off the river at the foot of the hills. When water in the reservoir rapidly rises they may be opened more and more so that water may not overflow the dam. To withstand the wear due to rapid flow of water, the tunnel in front and rear of the sluice gates must be faced with hard granite and the rear face of the dam over which the water will flow down must always be made of the same material. It may perhaps be considered that sluices may be provided for supply to irrigation alone and that surplus water may be allowed to flow over the dam. It appears to me that this will be a more costly arrangement. If the depth of water that may be allowed to flow over be limited to 6 feet, the length required for discharging

22,802 c.ft. must be $\frac{22802}{\frac{2}{3} \times 576}$ or $\frac{22802}{47}$ or 465 feet. A length of 500 feet of the rear face

of the dam and the crest must be faced with cutstone. There must be at least two sluices for supply to irrigation as sufficient supply must be let down even when water is low in the reservoir. Taking thickness of the cutstone to be 1 foot and allowing one-third additional thickness for header or bond stones I roughly make out the quantity of rough

stone required as 124,000 c. ft. The cost of this quantity of rough stone at Rs. 2-8-0 per c. ft. of two sluices may, I think, be Rs. 1,22,500 more than the cost of 50,000 c. ft. of cutstone that may be required if all the surplus be let out by sluices and of seven sluices. Besides, the gaps in the right side of the river will have to be bunded up to a higher level and this would increase the excess to Rs. 16,600. I therefore take that it would be decided to pass all the surplus through sluices.

The works then required for the formation of the reservoir with F.T.L. at 710.00 are:—

(a) A masonry dam 900 ft. long and 115 ft. high in the bed of river and its extension into the left margin of the river by 420 ft. and into the right by 280 ft. Assuming the mean sectional area of the extension into the margins to be half of that in the bed of river, the dam for purposes of calculation may be taken to be $\frac{900 + 420 + 280}{2}$ or 1,250 ft. long and 115 ft. high throughout.

(b) Seven sluices each about 10' x 10' with gates similar to that of Periyar head sluice at the head of the tunnel on the hills with floor at 660.00, i.e., 50 ft. below F.T.L. of the reservoir.

(c) Cutstone casing of the tunnel in front and rear of the sluice gates and facing with the same material the rear face of dam over which the water through the sluices will flow down estimated to be on the whole 50,000 c. ft. with an average thickness 1.33 ft. including allowance for bondstone.

(d) Binding up the three gaps in the right side of the river to level 720.00 From the trial pits made it does not appear enough earth will be available for the purpose. Good deal of gravel will have to be used. It is therefore proposed to give only a slope of 2 to 1 for the bund and make the top width 12 ft. Quantity of work required as made out from the cross section taken is about 8,611 units.

The section of the Periyar dam being taken for guidance sectional area of dam 115 ft. high will, it appears, be about 4,600 sq. ft. Allowing for extra masonry in front and over the dam at the site of sluices and for wastage the mean sectional area may be taken to be 5,000 sq. ft. The rate for rough stone masonry and concrete work in Periyar dam appears to have been between Rs. 30 and 33 per 100 c.ft. As this work is not so far up the hills and in so out of the way place as Periyar dam the work may, I think, be done here for Rs. 25. As heavy and hard cutstones must be used and the work must be of first class quality and as probably they will have to be carried up from the plains I allow a rate of Rs. 2-8-0 per c. ft. As there will be considerable lead and lift and the stuff to be used mostly hardly gravel, a rate of Rs. 18 per unit is proposed for the bunds across the gaps.

The cost of the works may therefore be—Masonry dam length 1,250 x sectional area 5,000 or 6,250,000 c. ft. at Rs. 25 per 100 c. ft.	Rs. 15,62,500
Removing boulders, blasting and benching rock for preparation of foundation for dam and baling	50,000
Seven sluice gates with apparatus for lifting, etc., complete, and with iron grating screw in front to prevent drift wood or other substance from entering the sluices, at Rs. 12,500 each	87,500

(Correct value of sluice gates, etc., may be available in Superintending Engineer's office. The figure I have given is only a guess).

50,000 c. ft. of cutstone at Rs. 2/8 per c. ft.	Rs. 1,25,000
Total	18,25,000
Special tools and plant 5 per cent.	91,250
Contingencies and petty supervision	91,250
Total for dam	20,07,500
8,611 units of earth and gravel work for bund in gaps at Rs. 18 per unit	1,54,998
Removing jungle boulders rooting out trees and preparing base for formation of bund	15,000
Total	1,70,000
Tools and plant 2½ per cent.	17,000
Contingencies and petty supervision 7½ per cent	1,70,000
Total	1,77,000
Total for reservoir with F.T.L. at 710.00	219,15,000
or say	22,00,000
At 25 per cent. for establishment and tools and plant. The grand total amounts to	27,50,000

If the reservoir be made to hold water to level 720.00 the cost of dam (taken to vary as the square of the height) may be Rs. (115)² x 20,07,500 or Rs. 23,88,925 or say Rs. 23,89,000. Cost of bund across gaps with top at level 730.00.

18,671 units of earth and gravel work at Rs. 18 per unit	Rs. 3,36,078
Tools and plant 2½ per cent.	8,402
Contingencies and petty supervision 7½	84,023
Total	10

Total for bund	2,73,985
or say	2,74,000
Total for reservoir with F.T.L. at 720.00	23,89,000
or say	27,00,000

Adding 2½ per cent. for establishment and tools and plant, the grand total amounts to 27,50,000

It is probable that when all informations are correctly obtained and detail estimates are made, the cost of the reservoir may be less and more than the figures above arrived at as cutstone may be found available on the hill itself and its quantity much reduced by placing the sluices at some suitable point in the left end of the dam instead of its middle part as estimated and as the contents of the bunds to be made at the gaps may also be less when the jungle is cleared and the most suitable lines are fixed upon.

As it may not be worth while to make a reservoir with F.T.L. lower than 710.00 and there may be no use of making one with F.T.L. higher than 720.00 owing to want of sufficient quantity of water to fill it, I have attempted to make an approximate estimate for reservoir for the two levels 710.00 and 720.00.

7. In para. 6 of the note of the Chief Engineer for Irrigation printed with G.O. No. 53 I, dated 19th January 1898 already referred to more than once in this report. It is stated that the possible increase of revenue will be Rs. 68,313. From this will have to be deducted the amount of forest revenue derived from the area of forest land that will be submerged by the formation of the reservoir. The area that will be submerged at level 710.00 is 3,360 acres, of which 720 acres belong to Singampatti zamin and 2,640 to Government and at 720.00, 4,040 acres, of which 1,000 acres belong to the former, and 3,040 to the latter. An inspection bungalow at Mundanturai and extensive plots of ground in its neighbourhood where the jungle is cleared and many valuable trees are reared in Government forest and Srivimthiyancil to which thousands of people resort on the new moonday in August every year and some building attached thereto in Singampatti zamin forest will also get submerged. It is not known what will be the value of property that may thus be lost and what the annual loss of revenue will be. For about 8,000 acres taken up for Periyar lake in Travancore forest an annual rent of Rs. 40,000, i.e., a rate of Rs. 5 per acre, is paid to that State (vide page 33 of the History of Periyar project compiled by Mr. A. T. Mackenzie, M.C.E.). As this amount was fixed not on a calculation of loss of revenue incurred by that State, but on the utility of the lake to the British Government it may not be necessary to assume such a high rate as Rs. 5 an acre for Papanasani forest. Yet the loss of forest property and revenue may bring down the anticipated increase of revenue to about Rs. 60,000. This is no adequate return for an outlay of Rs. 27½ or 33½ lacs that is necessary. But if nothing is done and the present state of things continues there is the risk of the present amount of revenue becoming reduced in the approaching settlement, as the Srivaikuntam ryots will not accept compounded assessment on lands on which there is not a fair expectation of two crops as observed by the Chief Engineer for Irrigation in his note above quoted; and it appears to me that the Tambraparni irrigation has already accumulated enough of funds and acquired a right for an outlay of a very large amount on the improvement of its water-supply without any return being looked for. The reservoir project must be taken as intended to benefit not Srivaikuntam ancient system alone but the whole of Tambraparni irrigation in general, because there are times not unfrequent when water scarcity is seriously felt for portions of land under almost all the upper channels. As there are seven anicuts to be crossed before water can reach Srivaikuntam anicut it will indeed be very difficult to pass the reservoir water to Srivaikuntam in times of scarcity without a portion of it being picked up by the upper channels. But as all the surplus of the upper channels goes into the river it need not be feared that Srivaikuntam

ancient will not be benefited if the reservoir be made as big as proposed and not smaller. So far back as 1880, Colonel Mullins, then Chief Engineer for Irrigation, has said in para. 4 of his notes printed with G.O. No. 741 I, dated 18th November 1880:—

From a statement submitted by the Superintending Engineer it will be seen that the extent of this irrigation (irrigation under all the seven upper anicuts in Tambraparni river) is acres 47,316, and the assessment Rs. 6,40,740, the average rate per acre being 13-54. There is no irrigation of the same extent elsewhere in the Presidency yielding so high a revenue and its efficient management is of great importance.

Irrigation under the several anicuts in Tambraparni comes under the three classes.—

Class No. I. Srivaikuntam ancient system (the 8th and last).

Class No. II. Marudur ancient system (the 7th).

Class No. III. All the remaining six upper ancient systems.

From information available in the statements of revenue derived from all irrigation works printed with G.O. No. 20 I, dated 12th January 1895, the following statement is prepared to show how the rate of net revenue due to irrigation under Tambraparni compares with that due to irrigation of the same class in other parts of the Presidency:—

Name of work.	Year.	AREA ACTUALLY IRRIGATED OR CHARGED AS IRRIGATED.			Net revenue due to irriga- tion.	Rate of revenue per acre.	Remarks.
		First crop.	Second crop.	Total.			
CLASS I—Works.							
Srivaikuntam ancient	1895-96	ACS. 21,392	ACS. 19,178	ACS. 4,570	RS. 180,235	RS. 4-44	Stands 1st in point of rate of revenue.
Sangam		71,567	3,393	74,960	295,991	3-95	Do. 2nd do.
Total of all works in the Presidency excluding Cauvery and Raskh- ulya.		13,15,251	1,09,267	14,24,518	18,62,051	3-42	
CLASS II—Works.							
Marudur ancient		17,126	16,346	33,872	1,86,989	5-52	Stands 3rd in point of rate of revenue.
Thadapalli channel	..	14,164	465	14,629	1,02,174	6-98	Do. 1st do.
Arkenkots	...	4,070	66	4,136	27,016	6-56	Do. 2nd do.
Kalingaroyan		11,283	10,176	21,459	1,03,818	4-84	Do. 4th do.
Total of all works in the Presidency.		4,27,032	1,03,194	...	17,22,489	3-25	
CLASS III—Works.							
Tinnevely	...	26,646	23,868	70,514	4,20,797	5-97	Stands 1st in point of rate of revenue.
North Arcot	...	12,101	2,283	15,684	59,901	3-97	Do. 2nd do.
Coimbatore		28,480	21,026	47,456	1,45,377	3-07	Do. 3rd do.
Total of all works in the Presidency.		1,02,226	74,753	77,519	6,98,666	3-05	

Class I works.—Srivaikuntam ancient yields the highest rate of revenue and it is Rs. 0-49 more than the rate paid by Sangam ancient which the next highest rate and Rs. 1-02 more than the average rate of all works under the class. The difference between the Srivaikuntam and Sangam rates must be greater than Rs. 0-49 as the ratio between the area of second crop and first crop is 0-90 in the former and less than 0-5 in the latter and as the rate for second crop is less than for the first. If Srivaikuntam had paid Rs. 0-50 less per acre than it did, it yet must be considered as having paid a greater rate than any other work of its class.

Class II works.—Marudur ancient stands third in the rate of revenue. But this is only apparent. The ratio of second crop to first crop cultivation under Thadapalli channel which appears to yield the highest rate of revenue and that under Arkenkots which yields the next highest rate are less than 0-03 and 0-02, respectively, while for Marudur the ratio is more than 0-93. If the water-rate for second crop be half of that for the first Marudur comes out the 1st and if two-third the 2nd. But this comparison between channels so widely differing in the ratio of the first and second crop cultivation is not fair. The comparison between Marudur and Kalingaroyan channel may be fair and it is found that the former pays Rs. 0-68 more per acre than the latter.

Class III works.—Tinnevely stands first and yields Rs. 2 more per acre than any other works of the class though the ratio of the second crop to first crop cultivation is over Rs. 0-92 in it and less than 0-80 in others. I do not therefore see why Srivaikuntam ancient cannot be considered to have accumulated a fund at the rate of annas 8 per year per acre cultivated for the last 20 years, i.e., from the date of the completion of the project, Marudur at the same rate and all the upper anicuts at the rate of Rs. 1-8 from the time of the last settlement or say for the last 25 years. The fund thus considered to be accumulated amounts to $40,570 \times \frac{1}{2} \times 20 + 33,872 \times \frac{1}{2} \times 25 + 70,514 \times \frac{1}{2} \times 25$ or Rs. 34,78,375 or say Rs. 34½ lacs without reckoning any interest. It therefore appears that the construction of the Papanasam reservoir with F.T.L. at 720-00 and estimated to cost Rs. 33½ lacs may well be undertaken without looking for any return. But if some return may be expected, it may be derived from sources indicated below. It has already been said that there may be a possible increase of revenue of Rs. 68,313. But in the note of the Chief Engineer for Irrigation wherein this figure is found, no details as to how the Revenue Officers arrived at the figure are given. I am not therefore sure if those officers may not have anticipated what I am going to say. From the printed list of irrigation works classed as "Imperial" (Now named class II, class III and class IV-A) in the Tinnevely district prepared in accordance with G.O. No. 281 I, dated 5th May 1880, I make out the following statement of class III and class II works in Tambraparni irrigation:—

Name of channels.	DIRECT IRRIGATION.			TANK IRRIGATION.		
	Area.	Revenue.	Rate of revenue per acre.	Area.	Revenue.	Rate per acre.
North and south Kodamala-ganga channels	1,167	10,344	8-71	452	2,608	5-77
Nathiyuni channel	15-42	20,9-8	13-86			
Kannadiyan do.	8-56	1,47,883	77-28	1,498	27,821	14-56
Kodagan do.	2,318	33,011	14-25	2,702	31,105	15-49
Palayan do.	3,392	56,018	16-52	4,352	47,565	10-47
Tinnevely do.	1,742	26,882	15-44	2,541	37,328	10-53
Marudur Melakal and Kilakal	3,693	47,633	12-90	12,667	1,56,501	12-41

From this statement it would appear that the rate of revenue on direct irrigation land under the first three channels is less than that under the fourth, namely, Kannadiyan channel, that under Kodagan channel is less than that under Palayan, the next lower channel and the rate of revenue on tank irrigation is less than on direct under the same channel except in the case of Kodagan channel. Whatever reasons may have existed for such variation of rates in the last settlement I do not think they all can now exist. The maintenance of tank irrigation system is more costly than that of direct irrigation system and I do not think that lands under tanks under any channel except Tenkari and lower tanks under Marudur Melakal suffer any more from scarcity of water than the lands directly supplied by the same channels. I therefore consider that the rate of revenue on tank irrigation may be raised to that on direct irrigation under each channel with the exception above mentioned and that the rate on lands under the first three channels and under Kodagan channel may be raised at least to the rate on lands under Palayan channel. If this were done there may be an increase of revenue of about Rs. 81,000 and this the ryots will gladly pay if the reservoir be constructed and steady supply of water ensured. Thus

on the whole there may be an increase of revenue of Rs. 80,000 *plus* Rs. 60,000 or Rs. 140,000 which is about 4 per cent. of the proposed outlay of Rs. 33,75,000.

I have, etc.,
(Signed) S. GOPALAKRISHNAN,
Executive Engineer.

(True copy.)

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Irrigation.

Read—again the following papers:—

G.O. No. 53 I., dated 19th January 1898.
G.O. No. 634 I., dated 5th June 1902.

Send—also the following paper:—

From the Superintending Engineer, VI Circle, dated 24th November 1902, No. 930 T.N.

No. 329 I.

Note by the Chief Engineer for Irrigation.

In his notes of inspection of the Tinnevely district, dated 5th January 1898, printed in G.O. No. 53 I., dated 19th January 1898, Mr. Hughes gave an account of the steps taken from time to time in investigating the site for a reservoir to store the flood waters of the Tambraparni river and arrived at the conclusion that the best site available for a reservoir dam was that about a mile above the Papanasam falls as already recommended by Colonel Mullins in his note printed in G.O. No. 848 I., dated 31st March 1875. As regards the discharge of the river at this site, Mr. Hughes stated that, as the Nathiyunni anicut was situated only a few miles below Papanasam and as gauge readings had been recorded at the Nathiyunni head sluice since 1877, the only thing required was to ascertain the corresponding depths of water on the anicut crest and in rear of the anicut. For this purpose, he directed the Superintending Engineer, VI Circle, to have gauges fixed at once at either end of the anicut as the observations of a few months would supply the information required to make use of the gauge readings of the head sluice of the past twenty-four years. He observed that the average quantity passing waste to the sea over the Srivaikuntam anicut, the last anicut on the river, during the preceding twenty years amounted to 47,274 millions of cubic feet or sufficient to irrigate 236,000 acres and that this fact indicated the need for large reservoirs. He said that although the catchment area of the Papanasam site was only 160 square miles, the country was so favourable to a large run off and the rainfall over a great part of it so heavy that there was reason to expect that the project would prove well worth execution. The Government concurred in his opinion and directed that arrangements be made for the necessary investigation. An estimate amounting to Rs. 2,300, for preliminary expenses such as clearing jungle, hutting survey establishment, etc., was sanctioned in G.O. No. 507 I., dated 2nd July 1898, and was subsequently raised to Rs. 3,900 in G.O. No. 717 I., dated 28th August 1900. The entertainment of a surveyor and lascars was also sanctioned by Government in G.Os. No. 1749 W., dated 9th July 1898, No. 2456 W., dated 7th September 1900, and No. 321 W., dated 6th February 1901. In April last the ryots of the Tambraparni valley submitted to Government a petition praying for the early execution of the reservoir project. On the Superintending Engineer reporting that the necessary surveys and levels had not been completed, the petitioners were informed in G.O. No. 634 I., dated 5th June 1902, that orders regarding the project would issue after the investigations were over.

The Superintending Engineer now submits with his remarks a report from the Executive Engineer, Tinnevely division, on the result of the investigations with a rough estimate of the cost of a reservoir above the Papanasam falls and of the benefits that can be expected therefrom. The Executive Engineer states that the catchment area of the Papanasam site is only 106 square miles instead of 160 as stated by

Mr. Hughes, and estimates the annual average discharge of the river at this site at about 15,000 millions cubic feet by calculations based on the discharges at the Nathiyanni anicut and on the rainfall recorded at various stations in the Papanasam basin. The Superintending Engineer, however, considers that it would be safer to count on only 11,966 millions cubic feet made up of 5,293 millions of cubic feet in the south-west monsoon months and of 6,673 millions cubic feet during the remaining months. Both the Executive and the Superintending Engineers, however, agree in stating that it will not be possible to store any appreciable quantity of the river-flow during the months from April to September, as the rainfall in the plains during this period is very little and consequently the river channels must depend on the drainage from the hills. The Superintending Engineer states that even the full average discharge of the river during the remaining period of the year cannot be stored, as some portion of it is required for channels immediately below Papanasam and above any important tributary of the Tambraparni. He counts on storing only about 3,000 millions cubic feet which, he says, would only result in safeguarding the second crop under the Srivaikuntam anicut and saving the remission amounting on an average to Rs. 22,743 now annually given. It is not, however, stated clearly in what way it is proposed to utilize the 3,000 to 4,000 millions cubic feet expected to be stored in the reservoir. If, as proposed by the Executive Engineer, the supply is made from the 15th August to 15th October, the reservoir could give with 3,000 millions cubic feet about 570 cubic feet per second for two months. If water is stored by December and carried forward to May, loss by evaporation and absorption in the dry bed of the river should be deducted, in which case the storage would be reduced to, say, 2,000 millions cubic feet. Above the Srivaikuntam anicut there are seven anicuts with an irrigated area of about 40,000 acres. At 60 acres to the cubic foot per second, 666 cubic feet per second would be required for a full supply. How much of the reservoir supply would this area take in an ordinary year—a bad year?

The full supply discharge of the two Srivaikuntam channels is observed to be 1,860 cubic feet per second and the area irrigated by them to be 73,400 acres, which would require, at 60 acres to the cubic foot per second, 1,220 cubic feet per second. If, however, allowance is made for the supply from local tanks, probably less than one-half this quantity would suffice as a continuous supply.

In the case of the Periyar lake with an available capacity of 6,000 to 7,000 millions cubic feet and with apparently a more reliable rainfall and with an area of about 80,000 acres irrigated with the help of local tanks, it has recently been proposed to cut off a considerable area assessed as double crop because of the loss by supply and absorption in the upper reaches of the distributary channels. In the case of the Srivaikuntam anicut, it is not stated in what part of the area irrigated yearly remissions have been rendered necessary, but presumably such lands are at the tail end of channels. With a discharge of about 500 cubic feet per second from the reservoir, how much of it is likely to arrive on the area on which yearly remissions are necessitated?

A Papanasam reservoir may have some small regulative effect on the supply but not of any practical importance. It is considered therefore that before any further investigation is made at Papanasam, the river valley should be further examined for sites for reservoirs on the main river itself and it is doubtful if a capacity of less than 7,000 to 10,000 millions cubic feet will meet the necessities of the case. With a large reservoir there may be possibilities of extension of irrigation under the upper anicuts.

16th December 1902.

(Signed) A. W. SMART, Col., R.E.,
Chief Engineer for Irrigation.

Order—No. S.I., dated 13th January 1903.

Communicated to the Superintending Engineer, VI Circle, for information and necessary action.

(True Extract.)

(Signed) A. W. SMART, Col., R.E.,
Joint Secretary to Government,
Irrigation Branch.

