

- (1) பக்கங்களின் எண்ணிக்கை 46
 (2) புதுக்கித் திருப்பிய நாள் July 88.
 (3) ஆதாரங்குறிப்பவர் சுருக்கொப்பம் bug

தமிழ்நாடு ஆவணக் காப்பகம்.

தமிழ்நாடு அரசு

P.X.D துறை

அரசாணை எண்.	<u>29407</u>	அச்சகம்
மு. கோப்புத் தாள் எண்.	<u>41</u>	பலவகை
நாள் :	<u>5.11.1887</u>	<u>198</u>

மடிக்கவோ கண்டபடி கையாளவோ கூடாது

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GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Military Works.

READ—the following letter from Colonel H. M. VIBART, R.E., Superintending Engineer, V Circle, to the Chief Engineer, Public Works Department, dated Bangalore, 20th October 1887, No. 2946:—

With reference to G.O., of 12th July 1887, No. 1924 W., Public Works, I have the honor to forward an estimate showing approximately the amount of compensation required to be paid for the removal of Agram and Jaksandra villages with the hamlets of Venkatapuram and Maistrypalia attached to the latter. The compensation amounts to the large sum of Rs. 2,96,843. In addition to this a sum of Rs. 15,000 will be necessary to acquire some other lands besides the above. The total estimated cost will therefore aggregate Rs. 3,11,843.

2. As regards the proposal to take a pipe from the higher level tanks with the view of reduction in the estimated annual expenditure connected with Captain Romilly's project A, I beg to point out that the higher level tank water is required for cultivation and could not be indented on for the supply of the troops. With reference to the idea of pumping from the Cauvery, I beg to point out that the Cauvery at the railway bridge is some 600 or 700 feet lower than the station of Bangalore, and that, moreover, the water would have to be brought a distance of about 80 miles through a somewhat difficult country, so that the project indicated is not practically feasible. I propose shortly to visit the Arkavuty river with the view of utilising that river for the supply of Bangalore. The road to Nellamangalam crosses the river at a distance of 12 miles. At this point the catchment basin is about 335 square miles, while lower down, where the road from Bangalore to Magadi crosses it, the drainage amounts to 575 square miles.

3. Unfortunately the river is much lower than Bangalore. Probably at the point on Nellamangalam road, 12 miles from Bangalore, it is some 300 feet lower, and if water is obtained from that river, it will have to be pumped up fully 300 feet. Bangalore is situated on the water-shed between the two rivers of Arkavuty and Penankeny, and these river-beds are about 12 miles distant west and east, and some 2 or 300 feet lower. It will be impossible to get water from either of these rivers without considerable pumping power. I propose shortly to visit these rivers. I enclose a sketch map showing the position of Bangalore with regard to these rivers with a short memorandum.

ENCLOSURES.

STATEMENT showing the approximate amount of compensation estimated for the purpose of taking Agram and Jakandra villages, and the hamlets of Venkatapuram and Maistrypalia attached to the latter, for the improvement of Bangalore water-supply in the Agram Hobli, Bangalore taluk.

Villages.	Particulars of land.	DRY LAND.			WET LAND.			GARDEN.			Total amount of compensation estimated.			Total amount of compensation estimated.		
		Extent.	Rate per acre.	Amount of compensation.	Extent.	Rate per acre.	Amount of compensation.	Extent.	Rate per acre.	Amount of compensation.	Rs.	A. P.	Rs.	Rs.	A. P.	Rs.
Agram.	Assessed land under cultivation	275	100	27,557 8 0	79	150	11,850 0 0	21	200	4,200 0 0	40,912 8 0	23,720 12 0	1,020	4,545	1,65,267	..
	Uncultivated land	102	200	20,425 0 0	28	250	6,950 0 0	..	..	..	29,481 4 0	..	..	..	..	..
	Waste land fit for cultivation	70	100	7,025 0 0	..	..	..	..	..	..	7,025 0 0	..	..	..	..	..
	Village site, unassessed, Gomal land, tank-bed and phoot karab	235	100	23,562 8 0	..	..	..	..	..	..	23,562 8 0	..	..	..	..	..
	Total	..	..	..	..	..	..	..	..	..	1,00,981 4 0	..	..	..	1,65,267	..
Jakandra and the hamlets of Venkatapuram and Maistrypalia attached to it.	Assessed land under cultivation	391	100	39,175 0 0	11	150	1,725 0 0	28	200	5,600 0 0	43,083 12 0	16,813 0 0	1,230	4,940	1,31,576	..
	Uncultivated land	207	200	41,425 0 0	37	250	9,275 0 0	2	300	600 0 0	43,271 4 0	..	..	..	..	..
	Waste land fit for cultivation	11	100	1,100 0 0	..	..	..	..	..	..	1,100 0 0	..	..	..	..	..
	Village site, unassessed, Gomal land, tank-bed, and phoot karab.	73	100	7,300 0 0	..	..	..	..	..	..	7,300 0 0	..	..	..	..	..
	Total	..	..	..	..	..	..	..	..	..	51,678 12 0	16,813 0 0	1,230	4,940	1,31,576	..
Grand Total		..	..	..	..	..	..	..	..	..	1,52,659 4 0	..	..	..	2,96,843	..

N.B.—For the enlargement of Agram tank some other lands attached to the villages of Venkatapuram and Maistrypalia, which are not included in the above, are necessarily required for the purpose of tank-bed and the compensation of which will be nearly Rs. 15,000.

BANGALORE,
20th September 1887.

(Signed) A. H. MACINTYRE,
Deputy Commissioner.

MEMORANDUM.

Bangalore is on very high ground, between the valleys of the Arkavuty and Pensakeny rivers, and it can only be supplied with a copious supply of water from either one or other of these rivers. About 15 miles to the east we find the very large tank of Ooscottah on the valley of the Pensakeny. This tank might be made available, but the water will have to be pumped up a height of 200 feet. To the west we have the Arkavuty on the road to Magadi; the Arkavuty is crossed at a distance of 19 miles from Bangalore, but the bed is some 350 or 400 feet lower than the city.

On the road to Nellamangalam, about 12 miles from Bangalore, the Arkavuty is crossed; here it is only about 220 feet below Bangalore. At this point the catchment basin of the Arkavuty is about 335 square miles, while the catchment basin of the Ooscottah tank is 650 square miles. On the road to Magadi, at a distance of 6 miles, a small drainage of 4 square miles is crossed, which is said to have a good deal of water, but I do not think it at all likely there will be found to be sufficient there. The levels of this drainage I do not know. About half way to Ooscottah and 2 miles to the left of the road is a drainage of about 65 square miles with a terminal tank which was constructed at the time of the last famine. This might be utilised, but the drainage area is not, I think, sufficiently great. General Mullins states that the water of the Ooscottah tank is not considered good by the natives, but I think it would be worth while to have the water analysed, and, if found good, this water might be pumped up to Bangalore. There is a hill close to the tank, height 2,887, and on this hill might be erected a stand-pipe so as to command the barracks at Bangalore, but the stand-pipe would have to be 143 feet in height. I propose to visit shortly Ooscottah tank, the river Arkavuty on the road to Nellamangalam, and the other two smaller drainages mentioned in this memorandum.

BANGALORE,
20th October 1887.

(Signed) H. M. VIBART, Col. R.E.,
Superintending Engineer, V Circle.

ORDER—dated 5th November 1887, No. 2940 W., Public Works.

Ordered to be forwarded to the Government of India.

(Here enter No. 2941 W., dated 5th November 1887.)

(True Extract.)

Captain, R.E.,
Under Secy. to Govt., P.W.D.

To the Superintending Engineer, V Circle.

Exd. J. Moses
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BUILDINGS AND ROADS.
MILITARY WORKS.

Govt. of 1887 Madras.
PUBLIC WORKS.

Dated November, 5th.

Recd.

Encl.

G.O., 5th Nov. 1887, No. 2940.

NOVEMBER.

Bangalore Water-Supply

Copy of a report from the Superintending Engineer, V Circle, in connection with the scheme for the — for troops, ordered to be forwarded to the Government of India.

5TH NOVEMBER 1887, No. 2941 W., PUBLIC WORKS.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Military Works.

LETTER—from

COLONEL J. O. HASTED, R.E.,

Secretary to the Government of Madras,
Public Works Department,

To

THE SECRETARY TO THE GOVERNMENT OF INDIA,
MILITARY DEPARTMENT.

SIR,

Adverting to your letter No. 1182 M.W., dated 11th June 1887, on the subject of the Bangalore water-supply, I am directed to forward copy of the accompanying letter, with enclosures, from the Superintending Engineer, V Circle, affording the information called for by the Government of India in respect to the cost of removal of the four villages which drain into the Agram tank, and offering remarks as to the other suggestions contained in paragraphs 4 and 5 of your letter under acknowledgment.

2. I am to add, that the question of supplying the troops with pure drinking water is still engaging the attention of this Government, as will be seen by their Proceedings, No. 2810 W., dated 20th October 1887, copy of which I am to forward for the information of the Government of India.

I have the honor to be,

Sir,

Your most obedient servant,

Captain, R.E.,
Under Secy. to Govt., P.W.D.

CHEPÁK,
5th November 1887.

Exd. J. Moses.
Spare Copies

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BUILDINGS AND ROADS.
MILITARY WORKS.

Govt. of Madras.

PUBLIC WORKS.

Dated November, 5th.

Recd.

Encl.

5th Nov. 1887, No. 2941 W.

NOVEMBER.

Bangalore Water-Supply

Forwarding to the Government of India copy of a report from the Superintending Engineer, V Circle, in connection with the scheme for the — for troops, and copy of certain Proceedings of the Government on the subject.

18TH JULY 1887, No. 1924 W., PUBLIC WORKS.

g. h. d. 1887

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Military Works.

READ—the following letter from Colonel E. COLLEN, Officiating Secretary to the Government of India, Military Department, to the Secretary to the Government of Madras, Public Works Department, dated Simla, 14th June 1887, No. 1182 M.W.:—

I am directed to acknowledge the receipt of your letter, No. 2293 W., dated 10th September 1886, forwarding a copy of the proceedings of the Madras Government marginally noted, relating to the improvement of the water supply of Bangalore, and stating that the Government of Madras are convinced that the only feasible means of giving the garrison a pure water supply, at a reasonable cost, is to adopt Captain Romilly's project for supplying distilled water for drinking and cooking, and improving the Halsur tank supply and continuing it for all other purposes than drinking and cooking. The estimated cost of the works is Rs. 2,26,860, and the annual cost of maintenance of the distilled water system is estimated at Rs. 84,600, to which has to be added the cost of the impure supply from the Halsur tank, which will apparently be Rs. 27,000 per annum more.

Romilly's project for supplying distilled water for drinking and cooking, and improving the Halsur tank supply and continuing it for all other purposes than drinking and cooking. The estimated cost of the works is Rs. 2,26,860, and the annual cost of maintenance of the distilled water system is estimated at Rs. 84,600, to which has to be added the cost of the impure supply from the Halsur tank, which will apparently be Rs. 27,000 per annum more.

2. With reference to this subject, I am to say that the Government of India, in view of the serious objections to a dual system of water supply, and the great annual expenditure involved in the proposals now put forward, are very unwilling to accept these proposals as the only alternative open for providing a satisfactory water supply for Bangalore; and they hope that further investigation may show that a satisfactory supply may be possible, involving a smaller recurring expenditure. In this hope the Government of India are supported by their responsible advisers on such subjects, a copy of whose note on the subject is herewith forwarded for the information of the Governor in Council.

3. I am therefore to ask that, under the orders of His Excellency, further examination of the country round Bangalore may, if considered necessary, be made.

4. I am, however, to remark that, from the papers submitted, the Agaram scheme seems to offer a reasonable prospect of a satisfactory supply, especially if the four villages, the drainage of which the Agaram tank receives, were removed. The Government of India would be glad if the cost of this as well as of reserving the whole drainage area of the tank were ascertained, as it may be found that Captain Romilly's conviction that the difficulties and expense are prohibitive was a mistaken one. Possibly, the annual expenditure connected with this scheme might be reduced

if a pipe were taken from the higher-level tanks, and the troops supplied by gravitation so long as this supply lasted.

5. If the Agaram scheme is proved to be not practicable, it would be worth while to ascertain the cost of pumping a full supply from the Cauvery.

ENCLOSURE.

Note on Water Supply of Bangalore.

The project on which this department is asked to advise is estimated to cost Rs. 2,26,860. This sum appears to be the cost of "works" alone, and does not include provision for establishment charges or for tools and plant. The addition of these charges would increase the figures probably by about 30 per cent. I note this fact as it has an importance of its own, but throughout the remainder of this note, I will ignore the charges in question for the sake of simplicity.

The project under consideration is one which provides a dual supply. The total quantity of water to be delivered is 60,000 gallons daily. Of this, 9,000 gallons is for drinking and cooking, the remainder is for "inferior" domestic purposes. The "inferior" water is to be supplied from the Halsur tank in much the same manner as it is at present, but the tank itself is to be improved at a cost of Rs. 59,860,* and several improvements (being part of project B) are to be made in the pumping and other arrangements. The "superior" water for drinking and cooking is to be taken from the

* Part of Project C.

1. Channel, masonry works, compensation	Rs. 26,130
2. Improvements to tank	33,730
	59,860

Halsur tank; it is to be distilled by Normandy's apparatus, and then delivered to the troops through iron mains.

The working expenses of the project are estimated in paragraph 35, page 19, of Captain Romilly's report. The gross total is Rs. 84,600. It is not clear whether any provision is made for repairs or not. It may be that the cost of repairs is included in the percentages. No provision is made for superior establishment, nor is the original cost of the old works (about three lakhs) taken into consideration. It is desirable to decide, as far as possible, the working expenses between the two systems of the dual supply. I can only do this approximately. But it would appear that the yearly cost of distilling 9,000 gallons a-day will be—

	Monthly.	RS.	RS.
Share of establishment	...	150	
Fuel for engine, say	...	25	
Fuel for condensers	...	3,600	
Oil, grease and sundries	...	25	
Total, per mensem	...	3,800	
Per annum	...	45,600	
15 % Interest of depreciation in condensers	...	12,027	
15 % Interest of depreciation on share of engine and pumps, say	...	2,000	
10 % Interest of depreciation on other works, say	...	2,000	
	...	16,027	
Total annual charges	...	61,627	

This is (as nearly as I can decide the figures given) the yearly cost of (9,000 × 365 =) 3,285,000 gallons of really good water.

The cost of 1,000 gallons of good water is, therefore, about Rs. 19.

Good drinking-water in London costs about six-pence, I believe, per 1,000 gallons. In Calcutta, I know it costs less than four annas per 1,000 gallons. In Lahore it seems to cost about six annas per 1,000 gallons.

+ Page 36 of Colonel Mullins' report.

It may be said, then, that the proposed system of supply of "superior" water is enormously expensive. It stands to reason that it must be so. The proposal is to allow the pure rainfall to flow over a more or less dirty surface; to permit it to be defiled in a tank, where sewage and other foul matter is admitted, and then to turn it into steam and condense it into good water! Why cannot the pure rainfall be caught when it is pure and needs no distillation and aeration? Why permit the water to be defiled first, and then go to enormous expense to clean it again?

Let us see what is necessary to obtain the small quantity of 9,000 gallons a-day, which is proposed to be distilled. The rainfall is given for eight years on page 29 of Colonel Mullins'

report. The following table is based on the average of those years: it assumes that a catchment surface can be prepared which will—

	Percent of rainfall.
In January, February, March, catch	...
In April, May, June, catch	...
In July, August, September, October, catch	...
In November, catch	...
In December	...

	Rainfall.	Proportion flow off.	Number of gallons which would be discharged from a surface of 400,000 s. ft.	Gallons drawn off at 9,000 gallons daily.	Gallons passed into reservoir from the catchment.	Number of gallons in a reservoir holding 1½ million gallons at the end of each month.
January	0.13	Nil	Nil	270,000	Nil	942,000
February	0.15	Nil	Nil	232,000	Nil	690,000
March	0.53	Nil	Nil	270,000	Nil	411,000
April	0.87	0.5	83,000	270,000	83,000	224,000
May	4.52	0.5	457,000	270,000	457,000	402,000
June	2.15	0.5	228,000	270,000	228,000	360,000
July	4.11	0.75	644,000	270,000	644,000	725,000
August	6.29	0.75	977,000	270,000	977,000	1,423,000
September	4.64	0.75	728,000	270,000	728,000	1,500,000
October	6.21	0.5	977,000	270,000	977,000	1,500,000
November	2.89	0.5	291,000	270,000	270,000	1,500,000
December	0.33	Nil	Nil	270,000	Nil	1,221,000

This table shows that a catchment of 400,000 square feet and a reservoir of 1½ million gallons will supply 9,600 gallons a-day if the catchment discharges as is assumed, and if the reservoir is water-tight. The Ooperhalli scheme failed because the catchment did not fulfil anticipations and the reservoir was not water-tight.

A catchment can be made to discharge nearly the entire rainfall if it be a plastered concrete floor. A reservoir in masonry can be made absolutely water-tight. I take the following rates from the reports:—

Concrete Rs. 12-8 per 100 c. ft., rubble masonry Rs. 14-1 per 100 c. ft. At this rate it ought to be easy to lay a good floor all over the catchment for Rs. 6 per 100 square feet.

Colonel Mullins estimates a clear-water reservoir* to hold 7½ million gallons at Rs. 2,40,000, or, say, Rs. 3 per hundred gallons. Captain Romilly estimates† about Rs. 7 per 100 gallons for a small one to hold only 105,000 gallons. A rate of Rs. 5 per 100 gallons should be more than ample.

Filters appear to cost from Rs. 1 to Rs. 1-4 per square foot. Captain Romilly takes the extraordinary low duty of only 16 gallons per square foot in 24 hours. I will take the same duty and cost at Rs. 1-8 per square foot.

On these rates it would seem to be possible to provide 9,000 gallons of water daily by the following works, costing about Rs. 1,50,000:—

	RS.
Compensation for land, say, 15 acres at 200	3,000
A plastered concrete catchment 400,000 square feet in area at 6 per 100 square feet	24,000
Masonry ducts leading to settling tank	4,000
Open masonry settling tank to hold 500,000 gallons, at, say, Rs. 3 per 100 gallons	15,000
Two filters, each capable of passing 9,000 gallons daily at 16 gallons per square foot, 1,125 square feet at Rs. 1-8, say	2,000
Clear-water reservoir to hold 1½ million gallons at Rs. 5 per 100 gallons	75,000
Mains and stand-posts, &c., say	20,000
Total	143,000

or, say, a total of Rs. 1,50,000. I believe the cost to be very highly estimated, and it is open to question whether a settling tank and filters would be necessary if the catchment were railed and well preserved.

The working expenses of this project would be very small. I assume that it would either be worked by gravitation by selecting a sufficiently high site for the reservoir some distance from Bangalore, or that the reservoir would be placed near the barracks and that the soldiers would pump the water themselves.

Taking the working expenses at	RF.
and interest and depreciation (as in Captain Romilly's estimate) at	2,400
10 per cent. on Rs. 1,50,000	15,000

the total yearly charges would be 17,400 as compared with Rs. 61,627 of the distillation project, and the water would be quite as good. Any project which costs less than about 6 lakhs of rupees would be cheaper than the one proposed.

Again, it is stated in these papers that some of the wells in Bangalore give very good water, but that they cannot be depended upon; that the water is at times brackish, or, if the wells are largely drawn upon, the supply becomes foul, because the large draught taps impure sources. This defilement must be due to local causes. By seeking a locality, some miles perhaps from Bangalore, where these causes do not exist, pure water must be obtainable from wells in abundance. Nine thousand gallons a-day is only one cubic foot per minute. If there is no spring or no well or no group of wells within a reasonable distance, say, 10 miles of Bangalore, which can be relied upon to give one cubic foot per minute, a pipe 2½ inches in diameter with a head of 5 feet per mile would carry that quantity of water. Such a pipe might cost Rs. 4,000 per mile laid. If such a well or spring could be found, the capital cost of works necessary to deliver 9,000 gallons of water per day in Bangalore might be—

Cost of well and land	RS.
Engines and engine house	10,000
10 Miles of 2½-inch pipe	20,000
Service reservoir in Bangalore	40,000
Distribution pipes	5,000
Total	80,000

The working expenses might perhaps amount to	RS.
Interest and depreciation (as before) 15 per cent. on 20,000 = 3,000	A-year.
Interest and depreciation (as before) 10 per cent. on 60,000 = 6,000	9,000

Total charges Rs. 12,000 a-year for 9,000 gallons a-day. I believe I have here exaggerated both the capital cost and the annual charges. But it is evident that, both in this project and in that sketched by me previously, there is room for large excess over my very rough estimates before the cost of the water would amount to that which is contemplated in the scheme for distillation.

The Military Department refer this matter to this department with the question: "Does the Department of Public Works recommend the adoption of the distillation project?" I would reply—"Most certainly not. It is ruinously and unreasonably expensive."

The Military Department further ask: "What does the Department of Public Works advise?" I would reply—"Do not fear to go rather further a field for the water. It is not unreasonable to think that it would be cheaper to pump from the Cauvery river itself rather than to distil water. Find pure water somewhere, it must exist, and then see what it would cost to deliver. If you are satisfied with the supply from the Halsur tank for 'inferior' purposes, by all means accept that portion of this project which contemplates an improvement in the delivery of that water for inferior purposes, and look only for 9,000 gallons a-day for 'superior' purposes. But, if you are not satisfied with that supply, do not hesitate to go further away for your supply of 60,000 gallons a-day. If this quantity of pure water can be found any where, in tank, river, or well, within about 20 miles of Bangalore, it can probably be delivered by iron mains and pumps within the annual sum of Rs. 85,000 a-year, which it is contemplated will be the gross annual charges of the dual project which is recommended by the Government of Madras."

ORDER—dated 18th July 1887, No. 1924 W., Public Works.

Communicated to the Superintending Engineer, V Circle, who will ascertain and report the cost of removing the four villages which drain into the Agaram tank, and of reserving the whole drainage area of the tanks. Also, what reduction in the estimated

annual expenditure connected with Captain Romilly's Project A could be effected by taking a pipe from the higher-level tanks.

2. The Superintending Engineer will also, if possible, prepare a rough estimate of pumping a full supply of water from the Cauvery.

(True Extract.)

(Signed) J. O. HASTED, Colonel, R.E.,
Secretary to Govt., P.W.D.

To the Superintending Engineer, V Circle.
" Military Department.
" Public "

Exd. E. Fernandez.
Spare Copies

BUILDINGS AND ROADS.
MILITARY WORKS.

Gobt. of (1887) Madras.
PUBLIC WORKS.

Dated July, 18th.

Recd.

Encl.

G.O., 18th July 1887, No. 1924 W.

JULY.

Bangalore Water Supply

Orders of the Government of India on the proposals for improving the —, communicated to the Superintending Engineer, V Circle, with instructions.

10TH SEPTEMBER 1886, Nos. 2292, 2293 W., PUBLIC WORKS.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Civil Works.

READ again—

G.O., dated 5th October 1883, Nos. 2794-95 W.
" " 13th June 1884, Nos. 1473-74 W.
" " 25th July 1884, No. 1814 W.

READ—also the following papers:—

G.O., dated 23rd February 1885, No. 427 W., Public Works.

Read—the following letter from Colonel H. L. PRENDERGAST, R.E., Superintending Engineer, V Circle, to the Chief Engineer, Public Works Department, dated Madras, 19th January 1885, No. 3900:—

I have the honor to forward Captain Romilly's report on the supply of water for the European troops at Bangalore, as called for in G.O., No. 1473 W., dated the 13th June 1884.

Captain Romilly has taken up thoroughly the investigation of the different schemes, and gives the cost of them in an abstract statement in appendix Y. There are added, at foot of the table, the annual maintenance charges for the three projects A, B and C.

2. The object in view is to have really good water supplied to the barracks; and, in my opinion, this object can only be attained by distillation. By this process the water obtained from any source available is supposed to become perfectly pure; and it will be most convenient to make use of the Halsur tank water, with condensers at the rock, new cisterns at the rock for drinking water, to be conveyed by new mains to the barracks, and with arrangements for pumping water direct from the Dhobies' Wells to the service cisterns at the barracks, to be used for other purposes than drinking.

This scheme is described in paragraphs 23 to 35 of Captain Romilly's report.

The first cost of providing distilled water, Rs. 1,67,000, is a good deal less than that of pumping filtered water from Agaram tank, Rs. 2,90,000; but there will be a much higher annual expenditure, which, with interest and depreciation of stock, is estimated at Rs. 84,600.

3. The objections urged in the Military Department are entered in appendix R, and consist in condemning the use of the water in the Halsur tank, in deprecating the conveyance of ablution water through the same pipes as the drinking water, and in showing the danger of depending on a single condensing apparatus, with no source to fall back upon in case of accident.

These objections appear to me to be fully met by the proposals to have a separate main-pipe for the pure drinking water, to use the water of the Halsur tank only after condensation, and to have a double condensing apparatus, so that there will be no failure in the delivery of pure water, even if the machinery in use were to be disabled temporarily.

4. The engine now at work at the Dhobies' Wells is an expensive one in fuel. It is in good order, and is saleable. The rock engine is old and liable to break down.

Hence it is desirable to get rid of the two old engines, and to provide a pair of new engines, each of 12-horse power, to be placed at the Dhobies' Wells, and to pump the water to the cisterns at the barracks.

To obviate the risk of a failure of water in the wells, it is proposed that there should be filter beds of sufficient capacity to allow of the tank water being filtered and pumped up to the service cisterns at the barracks.

The present small pure water cistern is not large enough to allow of sufficient water being pumped up; and it is proposed to utilize this cistern as an additional filter to let out water by gravitation to a new pure water cistern at the wells.

5. The condensing station is intended to be upon the Halsur rock; and it is expected that the Engine house on the rock will, with slight alterations, hold the condensing machinery; a plan of the building has in the mean time been sent to London, and the Normandy Company have been asked if there is sufficient accommodation.

A condenser producing nominally 9,000 gallons, but working up to 12,000 gallons, will in six days provide water sufficient for eight days' consumption; and it is proposed that there should be two complete condensers so as to provide against an accident happening to one.

Captain Romilly shows in paragraph 31 that it will be advantageous not to pump the condensed water over a stand-pipe at the rock but to place cisterns on the rock for the condensed water to gravitate to stand-cocks at the barracks. A lower pair of cisterns will each hold a day's supply for the Royal Horse Artillery, the Royal Artillery and the Cavalry, while an upper pair of cisterns will have command sufficient to give each a day's supply to the Infantry barracks.

The main pipes from the cisterns at different levels will be kept distinct for the delivery of water to the stand-cocks at the Agaram and at the Parade barracks. As a further precaution for maintaining the purity of the water, the estimate provides for iron water-carts, to take the place of the leathern buckets that are now in ordinary use for carrying water about the barracks.

6. The scheme would be more complete if the improvements to the Halsur tank were combined with it in part of the project C. The condition of the tank would be much improved by completely diverting the town drainage, filtering the northern drainage, and bringing in a fresh supply of water from a better gathering ground.

The additional cost through would be as given in paragraph 53:—

	RS.
New channel masonry works, compensation	26,130
Improvements to tank	33,730
Add for contingencies	2,990
Total	62,850

and as the condensing system is not affected by the natural quality of the water, the improvement of the Halsur tank will not be for the benefit of the British troops.

The advantages of a better supply of water would be felt chiefly by the civil population of Bangalore; but I fear the municipality would not consent to pay even a half share of the expenditure.

Order—dated 23rd February 1885, No. 427 W., Public Works.

The above papers will, in the first instance, be referred to the Sanitary Commissioner, Madras, for an expression of his opinions, and will then be forwarded for the remarks of His Excellency the Commander-in-Chief, who will be requested to return them to the Secretary to Government, Public Works Department, with a view to examination in detail and final orders by Government.

(True Extract.)

(Signed) J. SHAW-STEWART, Colonel, R.E.,
Secretary to Government, P.W.D.

From the Resident in Mysore, dated 14th March 1885, No. 2456/1280.

From Deputy Surgeon-General G. BIDIE, M.B., C.I.E., Sanitary Commissioner for Madras, to the Secretary to Government, Public Works Department, dated Madras, 15th April 1885, No. 414.

In returning the correspondence* regarding the Bangalore water-supply, referred

- * 1. Report by Captain F. J. Romilly, R.E. under G.O., No. 427, of 23rd February 1885, I have the honor to submit the following remarks to the Right Honorable the Governor in Council.
2. Letter from the Superintending Engineer, V Circle, No. 3900, dated 19th January 1885.
3. Note by Under Secretary to Government, Public Works Department, dated 19th February 1885.

2. In dealing with this question it appears to me that, in restricting inquiries to the requirements of the troops, a somewhat narrow view has been taken of the necessities of the station. A large civil population has been allowed to settle down in the centre of the cantonment, and to outgrow the available water-supply and pollute its sources. These conditions are no doubt greatly to be regretted, but from a sanitary point of view they cannot be ignored. If the bazaar population be constantly exposed to epidemic and other disease from insanitary conditions, all our precautions to protect the health of the troops will be rendered more or less nugatory. I would therefore suggest that steps be taken to move the municipality of Bangalore to adopt some contemporaneous measure to secure for the inhabitants generally, independent of the troops, a sufficient supply of fairly good water. It appears to me that this might be obtained by adopting Colonel Mullins' scheme, with the additions

proposed by Captain Romilly† for excluding the whole of the foul sewage of the town from the Halsur tank, and for bringing into it the drainage of a tract of

open cultivated ground to the eastward of Bangalore. The supply thus obtained would not perhaps be unimpeachable, but it would be greatly superior to the existing one. The cost of these improvements is estimated at close on Rs. 30,000, which would not certainly be a heavy tax on a population of 81,810; and I have hopes that if the matter were placed fairly before the townspeople, they would not grudge so moderate an outlay for such an important purpose.

3. Of the schemes suggested by Colonel Mullins and worked out by Captain Romilly for securing an improved water-supply for the troops, it appears to me that the proposal to use condensed water is, all things considered, the best.

4. The Agaram tank, which is mentioned as a possible source, receives the drainage of four villages, and although the sewage of two of these could be diverted, that of the remaining two could not be excluded. The proximity of native villages to the reservoir would also be objectionable, as it is almost impossible, under such circumstances, to prevent bathing, washing of clothing and cattle, and other objectionable practices. Captain Romilly puts the whole case very clearly when he says "there can be no doubt that the Agaram tank water is liable to dangerous contamination, and if adopted as the future reservoir for the troops, it is urged that the source of supply must not be accepted as, or expected to be, pure." Looking also at the chemical analyses of the water, they are not, so far as such results give warning of danger, of a satisfactory nature.

5. As regards the scheme for improving the Halsur tank and utilising the existing system with certain additions and modifications, there can be no doubt that, although calculated to effect a great improvement in the quality of the water, it is not such as can be recommended where the health of a large body of European troops is concerned, as they are much more sensitive to the effects of water of inferior quality than natives appear to be.

6. As stated by Colonel Mullins, "it is nearly certain that water of perfectly satisfactory quality could be obtained at Bangalore only by distillations." It is proposed, therefore, to use Normandy's condensing apparatus, and to have, in case of a break-down, two sets, each capable of producing 9,000 gallons in 24 hours. The water for distillation is, according to Captain Romilly's modification of the scheme, to

be drawn from the Halsur tank, and supplied to the troops for drinking and cooking purposes through a distinct series of cisterns, pipes and stand-cocks, at the rate of 3 gallons per head daily. Water for other purposes is to be drawn from the Dhobies' Wells, which yield a tolerably pure supply, and distributed through a separate system of pipes. These arrangements seem to meet the wants of the case. As pointed out by His Excellency the Commander-in-Chief, it is no doubt undesirable to have two qualities of water, the one potable and the other doubtful, supplied to barracks; but it is to be hoped that, by a careful arrangement of stand-cocks and other precautions, the anticipated risks may be nullified. I have therefore no hesitation in recommending the adoption of the scheme for the supply of water by Normandy's apparatus.

From Brigadier-General R. C. STEWART, Quartermaster-General, to the Secretary to Government, Public Works Department, dated Ootacamund, 2nd May 1885, No. 970 B.

In returning the documents received with your No. 10 E., of 17th April 1885, on the subject of the water-supply for Bangalore, which were forwarded for the remarks of the Commander-in-Chief, I am desired to say that, after full consideration of the three schemes which are adverted to in the above papers, Sir Frederick Roberts prefers project B, or that for retaining the present system, and providing for a separate service of water for drinking and culinary purposes by condensation.

2. The difficulty of inducing people to make invariable use of pure water when another and less wholesome supply is equally at hand, renders objectionable any system which comprises two sources, but the difficulty of securing water of sufficient quantity and of adequate purity at Bangalore is so great that His Excellency thinks it best to accept project B, provided that at the same time the conservation of the Halsur tank will be taken in hand by Government and the catchment area increased.

3. The cost of these improvements, as stated by Dr. Bidie, would be about Rs. 30,000, and taking into consideration the benefit that would accrue therefrom to the civil population of Bangalore, it would, in the Commander-in-Chief's opinion, be reasonable to expect the municipality to bear the cost of them, or at all events of a portion of them. Should the municipality not be prepared to accept the obligation, then it is hoped that Government will bear the whole expense, for unless these improvements be carried out, the water of the Halsur tank can never be satisfactory.

From A. H. T. MARTINDALE, Esq., Assistant to the Resident in Mysore, to the Secretary to the Government of Madras, Public Works Department, dated Bangalore, 23rd May 1885, No. 477/236.

In continuation of this office letter, No. 2456/1280, dated 14th March 1885, I am directed to forward copy of letter, No. 286, dated 13th May 1885, number and date as per margin, from the

President, Municipal Commission, Civil and Military Station of Bangalore, asking to be furnished with the plans of the recently selected gathering grounds in connection with the late Captain Romilly's scheme for the improvement of the Halsur tank.

2. I am to request that the plans in question may be forwarded to this office if they are available.

From Colonel J. SHAW-STEWART, R.E., Secretary to the Government of Madras, Public Works Department, to the Resident in Mysore, dated 2nd June 1885, No. 173 E.

With reference to your letter, No. 477/236, of 23rd ultimo, I have the honor to forward, for communication to the President of the Bangalore Municipality, the plans prepared by Captain Romilly for adding to the gathering grounds of the Halsur tank and improving the quality of its supply.

2. At the same time I am directed to forward copies of letters from the Quartermaster-General and the Sanitary Commissioner for Madras, in which are recorded the opinions of His Excellency the Commander-in-Chief and of the Sanitary Commissioner on the alternative schemes for improving the water-supply to the British troops at Bangalore.

3. You will observe therefrom that, whilst supporting the project for the distillation of the drinking water to be drawn, as at present, from the Halsur tank for the use of the garrison, both the Military and Sanitary authorities strongly advocate the contemporaneous adoption of the measures proposed in Captain Romilly's project C for adding to the supply available for the civil population of the cantonment, excluding foul sewage from the tank, and improving its conservancy.

4. The estimates for these improvements amount to Rs. 59,860 (not to Rs. 30,000 only as stated by Dr. Bidie), and I am to inquire whether, in view of the decided benefits that will be conferred thereby on the general public of Bangalore, the municipality are prepared to contribute towards the cost of same, and if so, to what extent.

From Major J. H. NEWILL, Assistant to the Resident in Mysore, to the Secretary to the Government of Madras, Public Works Department, dated Bangalore, 6th November 1885, No. 2172/70.

With reference to correspondence ending with your No. 173 E., dated June 2nd, 1885, I have the honor, under instructions from the Officiating Resident, to forward a copy of further papers, as noted on the margin, relative to adding to the gathering grounds of the Halsur tanks and to improving the quality of the water-supply.

1. Note, dated 6th July 1885, on the Halsur tanks, by Captain C. H. M. Kensington, R.E.
2. Letter, No. 943/44, dated 15th July 1885, to the President, Municipal Commission, Civil and Military Station.
3. Letter, No. 838, dated 27th July 1885, from the President, Municipal Commission, Civil and Military Station.
4. Letter, No. 1193/53, dated 3rd August 1885, to the President, Municipal Commission, Civil and Military Station.
5. Demi-official letter, dated 27th August 1885, from Mr. McLaughlin.
6. Letter, No. 1468/70, dated 3rd September 1885, to the President, Municipal Commission.
7. Notification by the President, No. 12, dated 11th September 1885.
8. Letter, No. 1173, dated 25th September 1885, from the President, Municipal Commission, with enclosures.

2. The municipal commissioners having agreed to deepening the Lower tank, and raising the waste weir at a cost of Rs. 10,000 and to the purchase of the Jevanhully tank, the work of excavation was begun early in August and was actively carried on till the heavy fall of rain in the latter part of September stopped it. In all some 34,000 cubic yards of earth have, at a cost of Rs. 5,546-11-4, been removed from the bed of the Lower tank to form an island and an embankment on the eastern side, which are now being laid out as ornamental grounds; 1,450 lineal yards of hedge have been planted; 8,000 square yards of embankment have been sectioned and turfed; two culverts have been lengthened, and some minor works have been completed. The constant rain of the last six weeks has so raised the level of the water in the Lower tank that it is impossible at present to undertake work on the weir. The necessary notification has been given for acquiring the Jevanhully tank. This, when it comes into the possession of the municipality, will constitute a valuable reservoir. The result of what has been done is to lessen, in the Lower tank, the area exposed to evaporation, and to increase the capacity. As the level in the Lower tank sinks, the Upper tank will be drawn upon to supply what is wanting, and so long as the water in the Jevanhully tank admits of so doing, the Upper tank will be similarly replenished from it.

3. With his letter, No. 3150, dated September 22nd, which forms an enclosure to No. 1173, dated September 25th, 1885, from the President of the Civil and Military Station to my address, Colonel Burton, the Executive Engineer of the Presidency

Division, who is also a municipal commissioner for Bangalore, and who has taken a great interest in the work of improving the Halsur tank, has forwarded estimates involving a total expenditure of Rs. 21,500. Of this sum, Rs. 5,546-11-4 had, as shown above, been spent up to the date of his letter from Municipal funds. In his letter, No. 838, dated July 27th, 1885, to my address, the President of the Civil and Military Station has communicated the expectation of the municipal commissioners that the Madras Government will bear its share in the undertaking. As the commissioners have contributed so generously, I trust that their action may now be liberally supported by His Excellency the Governor in Council, and I would express the hope that a similar sum of Rs. 10,000 may be put at our disposal to help in the completion of the work. Independently of that amount already subscribed by the commissioners, there will devolve on them the further cost of compensation for the Jevanhully tank and for raising the waste weir of the Lower Halsur tank. Hence the necessity for a large measure of assistance from outside.

4. The most important feature of Captain Romilly's scheme for improving the quality of the water in the Halsur tanks was to abandon the present catchment area on the west, which is mainly covered by the cantonment bazaar, and to substitute, as the gathering ground, a tract of high and sloping land to the east which belongs almost, if not entirely, to the Mysore Government. Mr. Girdlestone visited this locality some weeks ago, in company with Colonel LeMessurier, R.E., Colonel Burton, R.E., Major Bowen, R.E., Mr. McLaughlin, C.E., and Major Maltby. The last-named officer is the President of the Municipal Commission, Civil and Military Station of Bangalore. The general opinion was that the proposed area for catchment is larger, and that its soil is more holding in its nature than are the area and the soil of the reservoir constructed by Colonel Sankey on the Tumkur road for the use of Bangalore; that for the contour channels sharper gradients than those recommended by Captain Romilly are desirable so as to ensure the prompt and efficient passage into the Halsur tanks of even slight rainfall; that if the land were taken up its cleanliness would have to be secured, as in the case of the English War Officers' Fortification Act, by reserving to the municipal commissioners the right of clearing trees, of preventing the erection of new buildings or a change in existing levels, and of forbidding the construction of unauthorized water channels. Conservancy powers would also have to be obtained over villages now in the area. At present there is sewage forming on fields within the area. Were this practice deemed prejudicial (there was a difference of opinion on this subject amongst those who accompanied Mr. Girdlestone to the spot), the municipality's sale of sewage to this tract would need to be discontinued and disallowed.

5. There does not seem to the Officiating Resident any likelihood that the municipal commissioners would contribute towards the cost of the proposed new catchment area; and in the event of opposition, Mr. Girdlestone would not, under existing circumstances, feel justified in using his influence to overcome their objections. As at present advised, he himself is not prepared to acquiesce in the belief that the proposed scheme would result in water for the garrison much more pure than that now supplied. The municipal commissioners entertain grave doubts as to the value of contour channels for supplying reservoirs; and at any rate they have for the moment before their eyes the failure of Colonel Sankey's scheme on the Tumkur road, which depended to a large extent on this source of supply. They also urge that the water-supply, as it now exists, is acceptable to the townspeople and not unhealthy in its effects; and consequently that as their first care should be for the townspeople, they would not be justified in sharing an expenditure the necessity of which has not been proved to their satisfaction. From this it follows that if the Madras Government still regards this part of Captain Romilly's proposals as imperative, it will rest with itself to provide the funds required for its accomplishment. It seems desirable that if the scheme is undertaken, the supply from the western side should not be cut off till the success of the new undertaking has been fully established.

6. I am to take this opportunity of intimating that much attention has been paid of late to the question of purifying and maintaining pure in its passage to the Halsur tanks the water which runs thither from the western side. Within the gathering ground on the west there is much cultivated land. This it is practically impossible,

owing to the prohibitive cost of compensation, to throw out of cultivation. But scavenging is systematically carried out, and patrolling frequent in all places of public resort. It having been found that on the occasion of heavy rain in the cantonment bazaar the main drain overflowed into the main sewer, the dividing wall between them has been raised so as to prevent this evil. The nuisance caused by the pollution of ground in and about the tanneries and potteries has been stopped. New sites, beyond the limits of the catchment area, for small-pox and cholera camps, are being sought. The question of allowing the Hindu burial-ground to be still used has been referred for the opinions of the Officer Commanding the Division and of the chief Medical authorities in Bangalore. If their opinions are unfavorable, the Officiating Resident will use his influence to put an end to such use. For the protection of the Halsur tanks eight watchmen have been appointed at a cost to the municipality of Rs. 56 a month. Should there be any other practical safeguards which the Madras Government may wish to suggest in the interests of the troops, Mr. Girdlestone will gladly, on receiving details from you, give consideration to them.

From the Resident in Mysore, dated 17th November 1885, No. 2293/70.

From Colonel J. SHAW-STEWART, R.E., Secretary to the Government of Madras, Public Works Department, to the Resident in Mysore, dated 8th January 1886, No. 68 W.

In reply to your Assistant's letter, No. 2172-70, dated 6th November 1885, I am directed to state that, after full and careful consideration, and taking into account the recommendations made by Sir Frederick Roberts and the Sanitary Commissioner, the Government of Madras feel convinced that the most appropriate method of securing a pure water-supply for the troops and civil population of Bangalore is to adopt the proposals made by the late Captain Romilly as set forth in his project B, with the addition of the first seven of the estimates which compose project C.

2. The cost of project B is estimated at Rs. 1,67,000; and that portion of project C that it is proposed to carry out, at Rs. 59,860; or a total expenditure of Rs. 2,26,860. In this connection I am to say that the Government of Madras note that the municipal commissioners of Bangalore are unwilling to contribute any sum towards the cost of taking up a new catchment area to the east of the Halsur tank. But it is hoped that they will raise no objection to this much-needed improvement being carried out by Government. The two items to which the consent of the municipal commission is requisite are—

(1) Diversion of the town drainage, and

(7) New supply-channel and compensation,

and I am to solicit that the matter may be laid before the municipal commissioners as early as practicable, and that you will move the commissioners to accord their consent to the scheme.

3. In view of the heavy expenditure that will be incurred should it be finally decided to carry out the works above mentioned, the Government of Madras regret that they are unable to contribute towards the estimate of Rs. 21,500 for work in connection with the tank which the municipal commissioners have taken in hand; but the Government will be prepared to pay a moiety of the sum expended by the commission on works which will render any of the items from 1 to 7 of project C unnecessary.

4. Adverting to the concluding portion of paragraph 5 of your letter under reply, I am authorized to give the assurance that the Halsur tank supply from the western side shall not be cut off until the success of the new gathering ground to the east shall have been fully established.

5. The enclosures received with your letter are herewith returned, and in conclusion I am directed to solicit that the early consent of the Government of Mysore and of the municipal commissioners to the scheme for taking up a new catchment area to the east of the Halsur tank may be obtained and communicated, in view to the proposal being submitted for the final sanction of the Government of India.

G.O., dated 1st June 1886, No. 1386 W., Public Works.

Read—the following letter from Major E. A. FRASER, Assistant to the Resident in Mysore, to the Secretary to the Government of Madras, Public Works Department, dated Bangalore, 15th April 1886, No. 1022/705:—

With reference to letter, No. 829 C., dated 1st March 1886, from your office, requesting an early reply to letter, No. 68 W., of the 8th January 1886, regarding the proposed improvements to the Bangalore water-supply, I am directed to forward, for information, a copy of the correspondence noted on the margin which has passed on the subject.

ENCLOSURES.

From Major E. P. MALTBY, President, Municipal Commission, Civil and Military Station, Bangalore, to the Assistant to the Resident in Mysore, dated Bangalore, 9th March 1886, No. 2194.

I have the honor to acknowledge the receipt of your letter, No. 396/70, dated 23rd ultimo forwarding copies of letter, No. 2172/70, dated 6th November 1885, from the Assistant to the Resident, to the Secretary to the Government of Madras, Public Works Department, and letter, No. 68 W., dated 8th January 1886, to the Resident in Mysore.

2. In reply, I have to state that as the Government of Madras is willing to bear all the expense of bringing water into the Halsur tank by a new channel on the east, and as that Government gives an assurance that the bazaar drainage which now enters the tank from the west "shall not be cut off until the success of the new gathering ground to the east shall have been fully established," the municipal commissioners now raise no objection to the proposed improvement to the Halsur tank.

3. The commissioners were afraid that the present supply (which, indifferent as it is, is still better than none) would be cut off *before* it was *proved* that water could be brought in in sufficient quantity from the east.

4. Having now the assurance of the Madras Government that such shall not be done, they will be very glad to see the work put in hand.

From J. H. NEWILL, Esq., Assistant to the Resident in Mysore, to the Chief Secretary to the Dewan of Mysore, dated Bangalore, 7th April 1886, No. 902/705.

I am directed to forward a copy of the correspondence noted on the margin regarding improvements to the Halsur tank, and to express the hope of the Officiating Resident that the Government of His Highness the Maharaja will give the subject its most careful consideration and favor him with an early reply.

Read—the following letter from Major E. A. FRASER, Assistant to the Resident in Mysore, to the Secretary to the Government of Madras, Public Works Department, dated Bangalore, 22nd May 1886, No. 1430/705:—

In continuation of letter, No. 1022/705, dated 15th April 1886, from this office, regarding the proposed improvements to the Halsur tank, I am directed to forward a copy of letter, No. 1159/60, dated 28th idem, from the Chief Secretary to the Dewan of Mysore stating that every facility will be afforded by His Highness' Government in the matter of acquiring land for a new catchment area to the east of the tank.

2. I am to request that you will favor the Officiating Resident with an expression of your opinion on the considerations urged by the Durbar in paragraph 3 of its letter above quoted, with regard to certain rights proposed to be reserved to the municipal commissioners of the civil and military station for the purpose of securing the cleanliness of the Halsur tank.

ENCLOSURE.

From M.R.Ry. R. VIJAYENDRA RAO, Chief Secretary to the Dewan of Mysore, to the Assistant to the Resident in Mysore, dated Ootacamund, 28th April 1886, No. 1159/60.

I am directed to acknowledge the receipt of your letter, No. 902/705, of the 7th instant, on the subject of the Halsur tank improvements, and inviting the consideration of His Highness the Maharaja's Government thereto.

2. It would appear from the correspondence that the Government of Mysore has no direct concern with the project under reference, beyond that connected with the acquisition by the British Government of the land to be taken up for the proposed channel to the east of the Halsur tank, which channel will, for the greater part of its course, run through the territory of His Highness, and in regard to this I am desired by the Dewan to say that every facility will be afforded by His Highness' Government for the transfer of the land on reasonable terms.

3. I am to invite attention, however, to paragraph 4 of your letter, No. 2172/70, of 6th November 1885, to the Secretary to the Government of Madras, Public Works Department, where it is proposed to reserve to the cantonment municipal commissioners the rights of clearing trees over the catchment area drained by the channel, of preventing the erection of new buildings or "a change of existing levels," and of forbidding the construction of unauthorized water-channels. Further, conservancy powers over the villages in this area are to be vested in the commissioners and apparently the manuring of fields is to be prohibited. This proposal involving, as it does, the abrogation of immemorial occupancy rights may, the Dewan apprehends, complicate the question considerably; and I am to request the favor of a reconsideration of the necessity for conferring on the cantonment municipality powers to this extent over lands outside their jurisdiction. His Highness' Government fully recognizes the desirability of improving the water-supply of the Bangalore cantonment, and will gladly facilitate the furtherance of any scheme to that effect, but they desire to point out that interference with the rights of land-holders outside the municipal limits should, if possible, be avoided. Extensive powers, such as those indicated above, would probably necessitate the throwing out of cultivation of a large area of land, and the payment of compensation far in excess of what was contemplated by the projectors of this contour channel.

Read—the following letter from Major E. A. FRASER, Assistant to the Resident in Mysore, to the Secretary to the Government of Madras, Public Works Department, dated Bangalore, 21st May 1886, No. 1418/3495:—

I am directed to forward, for your information, a copy of the Officiating Resident's Minute on the water-supply of Bangalore.

ENCLOSURE.

Minute by the Officiating Resident on the Water-supply of Bangalore.

The object of various measures to which the attention of this Residency has been given during the past fourteen months has been to increase the water-supply of Bangalore and to improve the quality of the water.

2. To this end the bed of the Shoolay tank was deepened and the weir and the embankment which surrounds it were raised in the spring of 1885, the result being that an additional depth of two and a half feet was secured over the whole reservoir. The cost of the work was Rs. 7,200. There still remains the work of enlarging the catchment area of this tank and that at Hakitiman-halli, where more water is much required. The outlay on this account is estimated at Rs. 4,000, of which Rs. 1,000 have been entered in the present year's budget, and will be sanctioned, for a feeder on the side of Trinity Church.

3. During August and September 1885 about 35,000 cubic yards of earth were dug out from the bed of the Lower Halsur tank, on the northern and eastern sides, at a cost of about Rs. 5,600, and were formed into an island and an embankment on the eastern side, which are being laid out as ornamental grounds. In the conduct of all this work the help received from Colonel Burton, R.E.,

was very valuable. The total sum voted by the municipality of the civil and military station for the improvement of this tank is Rs 10,000. Since the end of last September the progress of excavation, and the raising of the waste weir, which was a part of the general scheme, have been stopped, owing to the high level of water in the reservoir caused by the autumnal rain. It is very desirable that both works should be taken in hand again whenever circumstances admit. Here, as elsewhere, it is of great importance to increase the capacity of the reservoir. For want of a higher waste weir much water ran off and was lost last October.

4. In connection with this particular supply, the municipal commissioners have exercised a wise forethought in acquiring the Jevanhully tank. The cost of this has amounted to Rs. 6,675. The tank will serve as a valuable feeder to the Upper Halsur tank.

5. The result of what has been done at Halsur is to lessen in the Lower tank the area exposed to evaporation, and to increase the capacity. As the level in the Lower tank sinks, the Upper tank is drawn upon at once to supply the deficiency, and so long as there is water in the Jevanhully tank, the Upper tank will similarly be replenished from it. The chief loss of water, in an extensive but comparatively shallow reservoir, such as the Lower Halsur tank, is due to evaporation, not to consumption. The device of preventing evaporation by means of aquatic foliage has not proved satisfactory in India. Hence the necessity for meeting the difficulty by restriction of area and corresponding excavation.

6. The Madras Government has a separate project under consideration, whereby, at a cost of about 2½ lakhs of rupees, it would fill the Lower Halsur tank entirely from a new catchment area on the east side of the tank. The undertaking is prompted by the wish to afford the European soldiers, who are entirely dependent on the Halsur reservoir, purer water than it is believed can, with the best conditions, be secured under the present system. As the Madras Government is ready to bear all the expense, and as it has given an assurance that the rain drainage from the cantonment bazaar, &c., which now enters the tank from the west, shall not be cut off till the success of the new gathering ground to the east shall have been fully established, the municipal commissioners of the civil and military station have raised no objection to the proposal. They are averse to sharing the cost, not only because it would be difficult to find the necessary funds, but also because they do not feel justified in making such a marked change, so long as the water-supply, as at present it exists, is acceptable to the townspeople and not unhealthy in its effects. The scheme is now before the Mysore Government, whose consent has been sought to the alienation of the land involved by it.

7. Much has been done of late to purify, and to maintain pure in its passage to the Halsur tanks, the water which runs thither from the western side. Within the gathering ground there is much cultivated land. This it is practically impossible, owing to the prohibitive cost of compensation, to throw out of cultivation. But scavenging is systematically carried out, and patrolling frequent in all places of public resort. For the protection of the tanks eight watchmen have been appointed at a cost to the municipality of Rs. 56 a month. It having been found that on the occasion of heavy rain in the cantonment bazaar the main drain overflowed into the main sewer, the dividing wall between them has been raised, so as to prevent this evil, and has satisfactorily withstood the test of the late sharp storms. The nuisance caused by the pollution of ground in and about the tanneries and potteries has been much diminished. New sites, beyond the limits of the catchment area, have been chosen for small-pox and cholera camps, with special regard to the accommodation of the homeless poor in time of scarcity or famine; for experience has proved that the inhabitants of the town are best treated for infectious and contagious diseases in their own houses. A new site has also been chosen for the Hindu burial-ground, which it is hoped that the Durbar will concede. In such case the present one will be closed with as little delay as possible.

8. The supply of water to Miller's tanks, which is the third of the three great systems on which the civil and military station depends, has been facilitated by the construction of a diversion sluice in Cunningham road to serve tank No. 3. The channel with which such diversion is connected is one of the principal feeders of the Sampangi tank, which lies for the most part outside the limits of assigned tract. Consequently, as the Durbar has direct interest in the matter, it has been suggested that it should be left to the Public Works Department Secretary of the Mysore Government and to the President of the Civil and Military Station to agree when the diversion sluice should be used, and that in case of difference, the Resident should settle the question. This arrangement I hope that the Durbar will acquiesce in.

9. Advantage would be gained, I believe, by deepening all three Miller's tanks, provided that the lower soil is tenacious enough to hold water, and provided that there is no risk of setting free malarious influences if the present bottom be disturbed. Such has not been the result of the excavations at Shoolay and Halsur. I also think favorably of a scheme advocated by Mr. J. W. Hayes, municipal commissioner, for the construction of another reservoir below, but in close vicinity to the Shoolay tank. The configuration of the ground is such that the undertaking is not likely to be very expensive. Mr. Hayes puts the cost at Rs. 15,000, irrespective of compensation for house-property. Population in this neighbourhood is numerous and apparently on the increase. Hence the desirability of intercepting and holding water which, as actually happened

last year, may otherwise run to waste. In the present year I am afraid there is no prospect of funds being available for this work. I am also strongly impressed with the necessity of taking water nearer to the houses of the inhabitants as soon as money can be spared. At present the distance to which poor persons have to go for water, specially those who live in the cantonment bazaar, is considerable. This improvement may perhaps be best effected by pumping from existing reservoirs through pipes into cisterns or open basins at convenient centres. In connection with it the establishment of drinking fountains and drinking troughs at places of general resort seems desirable.

10. Not long ago it was represented to me that the water level in the wells of the civil and military station has been steadily getting lower for some years past. The fall has been variously attributed to the increased growth of casuarinas, which have a great tendency to absorb moisture, to a diminution in the rainfall, and to other climatic influences. The subject is, I think, worthy of investigation. At present the information at disposal is too limited to warrant the assumption that the water level in general has sunk. Till this fact has been established it is premature to speculate on the causes which may be at work.

11. The construction of the low level sluice from Sankey's reservoir for the benefit of the city of Bangalore does not in my opinion imperil the interests of the civil and military station. Colonel Sankey's main object of continuously supplying the High Ground and neighbourhood with water having failed, and there being no present means or likelihood of achieving that object, it would be an act of selfishness to oppose the utilization of such water as can serve the city under circumstances when the high-level sluice cannot be worked. Apart from this consideration the city has a claim by reason of the catchment area of the Dharmabudi tank having been circumscribed by the formation of Sankey's reservoir. The distribution of the water can always be determined by the Resident and the Dewan in consultation. It was by mutual agreement that Miller's tanks were thus replenished last autumn in a season of exceptional drought. As no difficulty was then experienced, there is reason for anticipating as satisfactory results in cases of future necessity. There seems no likelihood of raising the level in Sankey's reservoir, except at inordinate expense, and with risk of taking from the supply of other tanks in the neighbourhood.

12. The importance of not allowing present sources of water-supply beyond the limits of the Assigned Tract to be interfered with for purposes of irrigation or otherwise has been recognised, and assurances have been given on the part of the Durbar that it will not allow such interference, and that practically now it stops such interference in all cases which are brought to its notice.

13. There has not been leisure, on the part either of myself or of the engineer officers who have favored me with their help and advice in the above-mentioned matters of more immediate importance, to go deeply into the larger consideration of making Bangalore independent of its present system of tanks and wells. Even the preliminary inquiries involved in such schemes as that of leading water from Nundidroog and of pumping from the Cauvery would necessitate the employment of specially qualified professional men at no slight expense. That the cost of either scheme would be very great is beyond doubt. Such cost could only be met by a water-rate on the population which would be unobjectionable, if it did not exceed the present cost of fetching water, but which otherwise might press on a community that believes municipal taxation to be already quite high enough. Geologists have hitherto declared against the practicability of Artesian boring. It may be that this process, when more perfected, may solve the difficulty. Such a measure would be less likely to be hampered by questions of compensation; it would be without the risk of intermediate interruption which is attendant on the other two schemes, and it might be comparatively inexpensive. The deep borings which are now being made at various points on the Kolar gold fields may show what volume of water is to be hoped for at specified levels under known conditions of intervening rock or other material, and may yield information on other important points. Meanwhile, I think that the municipalities of Bangalore will be wise in restricting themselves, as regards improvement, to the lines which they have been pursuing of late.

12th May 1886.

(Signed) C. E. R. GIRDLESTONE.

Note by the Secretary to Government, Public Works Department.

In February 1885 the three projects prepared by the late Captain Romilly, R.E., for improving the water-supply of Bangalore were referred to the Sanitary Commissioner for an expression of his opinion, and, in his No. 414, dated 15th April 1885, Dr. Bidie approved project B, which provided for drawing the supply from Halsur tank and distilling the water by means of condensing engines. His Excellency the Commander-in-Chief also expressed his preference for project B, "provided that, at

the same time, the conservation of the Halsur tank will be taken in hand by Government and the catchment area increased."

In order to carry out the foregoing proviso it was found necessary to adopt the first seven items of project C, in addition to project B; and the Resident in Mysore was informed, in January 1886, that the Government of Madras were convinced that that was the most appropriate method of securing a pure water-supply for Bangalore.

Of the first seven items of project C, two required the previous assent of the Government of Mysore, which was accordingly solicited.

The items were—

- (1) Diversion of the town drainage.
- (2) New supply channel and compensation.

With regard to (1) it was proposed to divert the town drainage from the west of the Halsur tank, and to draw the supply in future from a new catchment area to the east of the tank.

The area of the proposed new catchment basin was 2.4 square miles, or 1536

Further information regarding the items referred to will be found in paragraphs 41—43 of Captain Romilly's report, copy of which is attached.

acres; and the compensation provided for in the estimate was Rs. 2,680 for the contour channel, and Rs. 2,635 for 52.7 acres of land thrown out of cultivation under the Kadarampolem tank.

In requesting the approval of the Bangalore Municipal Commissioners and the Government of Mysore to the two items above referred to, the Government of Madras gave the assurance that the supply from the catchment on the west should not be cut off until the success of the new gathering ground to the east had been fully established; and, on this assurance and on the understanding that the British Government paid all expenses, the Municipal Commissioners, in March last, stated that they had no objection to the proposed improvements.

In a communication, dated 28th April 1886, to the Resident in Mysore, the Government of Mysore state that every facility will be afforded for the transfer, on reasonable terms, of the land required for the new catchment area; but invite attention to a letter from the Resident, dated 6th November last, in which it was stated that, in the event of the new catchment area being taken up, its cleanliness would have to be secured, as in the case of the English War Officer's Fortification Act, by reserving to the Municipal Commissioners the right of clearing trees, of preventing the erection of new buildings or a change in existing levels, and of forbidding the construction of unauthorised water channels. The Resident further expressed his opinion that conservancy powers would have to be obtained over villages situated within the catchment area, and that, if it were deemed prejudicial, sewage forming on fields within the area should be stopped.

The Mysore Government now represent that the prohibition of manuring of fields would involve the abrogation of immemorial occupancy rights, and might, it is feared, complicate the whole question considerably; they request that the necessity for conferring on the cantonment municipality powers to the extent indicated above over lands outside their jurisdiction may be reconsidered; and add that, while the Mysore Government will gladly facilitate any scheme for improving the water-supply of Bangalore, interference with the rights of land-holders outside the municipal limits should, if possible, be avoided. Extensive powers, such as those indicated above, would probably necessitate the throwing out of cultivation of a large area of land, and the payment of compensation far in excess of what was originally contemplated.

The question now to be decided is whether the proposed new gathering ground, lying to the east of the Halsur tank, may be added to the drainage area of the tank without taking any special precautions for securing its thorough conservancy. The only alternative appears to be to acquire possession of the land which forms the proposed new gathering ground, and to throw it permanently out of cultivation; but it is to be observed that this alternative course would involve very heavy additional expenditure.

31st May 1886.

(Signed) J. SHAW-STEWART, Colonel, R.E.,
Secretary to Govt., P.W.D.

Order—dated 1st June 1886, No. 1386 W., Public Works.

These papers, with the note thereon which has been drawn up in this department, will, in the first instance, be referred to Surgeon-General Bidie, who, with advertence to his letter, dated 15th April 1885, No. 414 (written as Sanitary Commissioner), will be requested to favor the Government with his opinion on the point which has lately been raised.

2. The papers will then be forwarded to the Quartermaster-General,* who will be requested to obtain the opinion of His

* Vide his No. 970 B., dated 2nd May 1885.

Excellency the Commander-in-Chief, and to return the papers to the Secretary to

Government in the Public Works Department.

(True Extract.)

(Signed) J. SHAW-STEWART, Colonel, R.E.,
Secretary to Govt., P.W.D.

From G. BIDIE, Esq., M.B., C.I.E., Acting Surgeon-General with the Government of Madras, to the Chief Secretary to Government, dated Ootacamund, 23rd June 1886, No. O/191.

In returning the papers referred to me under G.O., No. 924 C, of 8th June 1886, I have the honor to submit the following remarks on certain points connected with the proposals for the improvement of the water-supply of Bangalore.

2. The chief point on which my opinion is invited is, "whether the proposed new gathering ground, lying to the east of the Halsur tank, may be added to the drainage area of the tank without taking any special precautions for securing its thorough conservancy."

3. From a sanitary point of view it is no doubt desirable that the gathering ground should be thoroughly conserved, but as that end could only be attained by throwing the whole of the land out of cultivation, I am not prepared to advocate such a measure, inasmuch as the water prior to delivery to the troops is to be purified by storage in a reservoir and distillation.

4. I have not inspected the proposed new gathering ground, which is said to embrace an area of 2.4 square miles; but from Colonel Mullins' report (paragraph 34) learn that the soil is of a "light sandy character," for the most part under dry cultivation, and extensively manured with more or less filthy material collected from the barracks, the station, and the bazaars. Such land will undoubtedly contaminate the surface wash more or less, the amount of impurity depending to a considerable extent on the weight of the showers and the season at which they fall. A heavy shower, occurring shortly after tillage and the application of manure, would carry off a considerable amount of organic matter; but on the crops attaining some size, the surface water would be comparatively clean, as growing vegetation rapidly disposes of nitrogenous matter in the soil, and any of it on the surface not got rid of in this way would speedily be converted into nitrates (inorganic matter).

5. As a precautionary measure, however, I would suggest that arrangements be made for the exclusion from the tank of foul water resulting from heavy showers falling immediately after the manuring of the gathering grounds.

6. If this be done, the only other precautions that seem necessary are—

- (a) The prohibition of any extension of the present cultivated land within the gathering grounds.
- (b) The institution of some arrangement with the Mysore Government for the surface conservancy of the villages that exist on the protected area, and for the prevention of the erection of any more buildings except in substitution of those already existing.
- (c) That offensive trades—such as tanning—be forbidden on the gathering ground.

7. As already stated, I make these suggestions clearly on the understanding that the water is to be purified prior to use by a Normandy's condensing apparatus; and have only to add, that the supply obtained from the proposed new gathering ground ought to be much purer than that now deposited in the Halsur tank from the densely populated and filthy town of Bangalore.

No. 318 D.

Forwarded, with advertence to G.O., No. 1386 W., dated 1st June 1886, to the Quartermaster-General, for favor of His Excellency the Commander-in-Chief's opinion.

2. Copy of a minute, dated 12th May 1886, on the water-supply of Bangalore, by Mr. Girdlestone, is enclosed for information.

Ootacamund,
30th June 1886.

(Signed) J. SHAW-STEWART, Colonel, R.E.,
Secretary to Govt., P.W.D.

From Colonel E. FAUNCE, Officiating Quartermaster-General, to the Secretary to Government, Public Works Department, dated Ootacamund, 24th August 1886, No. 2797 B.

In returning the papers received with G.O., No. 318 D., dated 30th June 1886, relative to the improvement of the water-supply at Bangalore, I have the honor, by order, to state that, although the Commander-in-Chief would prefer the alternative measure of thoroughly conserving the new gathering ground to the east of the Halsur tank, by throwing the whole of the land permanently out of cultivation (similar arrangements being made as regards the old gathering ground of the north feeder) yet, as the cost of these measures would apparently be prohibitive, and great difficulty would arise in acquiring the necessary land, His Excellency accepts the scheme as proposed, viz., that the town drainage having been diverted, a new gathering ground lying to the east of the tank be added to the drainage area of the Halsur tank, the precautionary measures in connection with the entire gathering grounds suggested by Dr. Bidie (in paragraphs 5 and 6 of his letter, No. O/191, dated 23rd June 1886) being fully adopted.

2. I am to request that, if convenient, a printed copy of the correspondence now returned may be forwarded for record in this office.

ORDER—dated 10th September 1886, No. 2292 W., Public Works.

Frequent outbreaks of enteric fever among the troops at Bangalore having led to strong representations respecting the quality of the water and the sufficiency of the water-supply available for the use of the troops and of the cantonment bazaar at that station, this Government, after careful consideration of the subject, arrived, in October 1883, * at the conclusion that the best

* G.O., No. 2794 W., dated 5th October 1883. means of providing the troops and town with wholesome water would be to extend and complete the scheme known as the Ooparhalli project, which had been originated, in 1868, by Major-General Sankey, R.E., C.B., when Chief Engineer of Mysore.

2. With that object, Colonel J. Mullins, R.E., was placed on special duty to investigate the subject; and, on the 31st March 1884, that officer submitted a report in which the whole subject of the water-supply of Bangalore was exhaustively treated. The results of Colonel Mullins' inquiries were summed up by the Chief Engineer in his note printed with proceedings, No. 1473 W., dated 13th June 1884, as follows:—

- (1) The Ooparhalli project is incapable of supplying the station or troops.
- (2) The Halsur tanks are not capable of being made a satisfactory source of supply for the troops.

- (3) Wells may be sunk which would yield a sufficient supply for the troops for drinking and cooking purposes, but the quality of the water must remain doubtful.
- (4) The Agaram tank offers a new source of supply of suitable water, having an ample and sufficiently clear catchment basin.
- (5) Water of unexceptional quality is probably obtainable at Bangalore only by distillation.

3. In their order, No. 1473 W., dated 13th June 1884, the Government recorded their opinion that the Agaram tank scheme offered the most promising solution of the question of the water-supply to the Bangalore garrison, and directed the late Captain Romilly, R.E., to elaborate the scheme, and to prepare the requisite plans and estimates. In the following month,* orders were issued to Captain Romilly to include in his investigations the alternative scheme suggested by Colonel Mullins for condensing a supply of water from the dhobies' wells, sufficient to meet the requirements of the troops for drinking and cooking purposes, leaving the water required for other purposes to be pumped from the Halsur tank. Captain Romilly was further ordered to investigate the question of taking in an area of additional gathering ground to the eastward of the Halsur tank, and to include in his estimate for the Agaram tank scheme all compensation for land rendered necessary thereby.

4. With his letter, No. 3900, dated 19th January 1885, the Superintending Engineer, V Circle, submitted Captain Romilly's report, accompanied by three alternative estimates. The first, A, provided for the supply of water to the barracks from the Agaram tank, and amounted to Rs. 2,90,000; the annual cost of maintenance being Rs. 44,385. The second, B, provided for drawing the supply from the Halsur tank and distilling the water by means of condensing engines, and amounted to Rs. 1,67,000; the annual cost of maintenance being Rs. 84,600. The third, C, provided for certain improvements to the existing source of supply, and the augmentation of the supply by taking up a new gathering ground. The cost was Rs. 1,33,000, and the annual maintenance charges, Rs. 27,000.

5. This report having been referred to the Sanitary Commissioner, and to His Excellency the Commander-in-Chief, for opinion, the former officer condemned project A, and concurred in Captain Romilly's views that the Agaram tank-water was liable to dangerous contamination; and, if adopted as the future reservoir for the troops, the source of supply could not be accepted as pure. Dr. Bidie approved project B as the only means of insuring a supply of pure water for the use of the troops. His Excellency the Commander-in-Chief also expressed his preference for project B, "provided that, at the same time, the conservation of the Halsur tank will be taken in hand by Government, and the catchment area increased." His Excellency was of opinion that, as the civil population of Mysore would benefit by the improvements, the municipality should bear a portion of the cost; but he expressed a hope that, if the municipality were not prepared to do so, the Government would carry out the improvements and bear the whole expense.

6. In June 1885, the Resident in Mysore was addressed on the subject. The plans and estimates prepared by Captain Romilly were forwarded with the remark that, whilst supporting the project for the distillation of the drinking-water drawn from the tank for the use of the garrison, both the military and sanitary authorities strongly advocated the contemporaneous adoption of Captain Romilly's proposals for adding to the supply available for the civil population; for excluding foul sewage from the tank; and for improving its conservancy. These improvements comprised the first seven items of Captain Romilly's project C, estimated to cost Rs. 59,860; and the Resident was asked whether the Bangalore municipality were prepared to contribute towards the cost, and, if so, to what extent.

7. In his reply, dated 15th November 1885, the Resident intimated that the municipality had already incurred considerable expense on works undertaken by themselves in improving the Halsur tank; and, with respect to Captain Romilly's proposal to

substitute a tract of high and sloping ground to the east of the tank for the existing catchment area on the west. Mr. Girdlestone did not think the Commissioners would bear any portion of the outlay involved, inasmuch as the necessity for the change had not been demonstrated to their satisfaction. The Resident intimated clearly that, if the Madras Government still considered the change imperative, it would rest with this Government to provide funds to the full amount required for its accomplishment. On an assurance from this Government that the supply from the catchment on the west shall not be cut off, until the success of the new gathering ground to the east has been fully established, the municipality have given their assent to the proposal to divert the town drainage from the tank. The Government of His Highness the Maharaja also have intimated their willingness to afford every facility for the transfer, on reasonable terms, of the land required for the new catchment area. While doing this, the Mysore Government pointed out that complications would arise, and the cost of compensation would be greatly enhanced, if attempts were made to thoroughly conserve the new gathering ground, and throw it permanently out of cultivation. With reference to this point, the Government have received the opinion of Surgeon-General Bidie (who, as Sanitary Commissioner, previously reported on the water-supply question) that, if certain precautionary measures be taken, the prohibition of cultivation in the new catchment area need not be insisted upon; and His Excellency the Commander-in-Chief, in view of the great outlay which would be involved if this Government determined to acquire the whole of the gathering ground, has accepted the position.

8. His Excellency the Governor in Council considers that the question has now arrived at a stage when the Government of India may be addressed. That Government will accordingly be asked to sanction Captain Romilly's project B, with the addition of the first seven items of project C, involving a total estimated outlay from Imperial funds of Rs. 2,26,860.

9. The measures suggested by the Surgeon-General, in paragraphs 5 and 6 of his letter of 23rd June 1886, will receive consideration hereafter, should the Government of India sanction the proposals now to be submitted.

10. The following letter will be addressed to the Government of India:—

(Here enter No. 2293 W., dated 10th September 1886.

(True Extract.)

(Signed) J. O. HASTED, Colonel, R.E.,
Secretary to Govt., P.W.D.

To the Military Department.

- " Superintending Engineer, V Circle.
- " Examiner, Public Works Accounts.
- " Public Department.

LETTER—to the Secretary to the Government of India, Public Works Department, dated Fort St. George, 10th September 1886, No. 2293 W.

I am directed to forward, for the consideration of the Government of India, copies of the proceedings of this Government marginally noted, relative to the proposals for improving the water-supply of the troops at Bangalore.

No. 2794 W., dated 5th October 1883.	
" 2795 W., " 5th " "	
" 1473 W., " 13th June 1884.	
" 1474 W., " 13th " "	
" 1814 W., " 26th July " "	
" 2292 W., " 10th Sept. 1886.	

with Captain Romilly's report annexed.

Government of India is required to a total estimated outlay, from Imperial Military Funds, of Rs. 2,26,860.

3. It will further be seen from the correspondence, that the question of improving the water-supply of Bangalore has been the subject of exhaustive inquiry by this Government, who are convinced that the only feasible means of giving the garrison a

pure water-supply, at a reasonable cost, is by adopting Captain Romilly's project B, estimated to cost Rs. 1,67,000, with the addition of the first seven items of project C, estimated to cost Rs. 59,860. The annual cost of maintenance of project B is estimated at Rs. 84,600.

4. The Army Sanitary Commission in England have frequently noticed the high rate of mortality from enteric fever among the troops at Bangalore, and have urged a consideration of the question of improving the water-supply; and I am to forward, for the information of the Government of India, copies of the two last reports of that body, printed with the proceedings of this Government, in the Military Department, marginally noted.

4. I am therefore to express the hope of His Excellency the Governor in Council that the Government of India will take this subject into early consideration, and sanction the proposed expenditure of Rs. 2,26,860. Also, that the Government of India will be pleased to make a substantial grant for inclusion in the budget for 1887-88, in view to the early commencement of the work.

(Signed) J. O. HASTED, Colonel, R.E.,
Secretary to Govt., P.W.D.

Exd. E. Fernandez.
Spare Copies

BUILDINGS AND ROADS.
CIVIL WORKS.

Govt. of (1886) Madras.
PUBLIC WORKS.

Dated September, 10th.

Recd.

Encl.

G.O., 10th Sept. 1886, Nos. 2292,
2293 W.

SEPTEMBER.

Bangalore Water-Supply

Proposals for improving the — for troops,
submitted for the sanction of the Govern-
ment of India.

No. 2946.

SUPERINTENDING ENGINEER'S OFFICE,

Bangalore V Circle, Madras,

20th October 1887.

From

Colonel A. M. Tibart R.E.

SUPERINTENDING ENGINEER, V CIRCLE,

To

The Chief Engineer,
P.W. Department.

Sir,

Enclosures. 3

With reference to G.O. of 12th July 1887
No. 1924 W Public Works, I have the honor to
forward an estimate showing approximately
the amount of compensation required to be paid
for the removal of Agrani and Jaksandra
villages with the hamlets of Venkatapuram
and Mestry Polya attached to the latter.
The compensation amounts to the large sum
of 2,96,343 Rupees. In addition to this a sum
of 15,000 Rupees will be necessary to acquire some
other lands besides the above. The total estimated
cost will therefore aggregate Rs. 3,11,343.

As regards the proposal to take a pipe
from the higher level tanks with the view of
reduction in the estimated annual expenditure
connected with Captain Dornelly's Project A.

I beg to point out that the higher level tank water is required for the cultivation and could not be indented on - for the supply of the troops -

With reference to the idea of pumping from the Cauvery - I beg to point out that the Cauvery is some 600 or 700 ft. lower than the station of Bangalore and that moreover the water would have to be brought a distance of about 80 miles - through a somewhat difficult country - so that the project indicated is not practically feasible.

I propose shortly to visit the Arkavathy River with the view of utilizing that river for the supply of Bangalore. The road to Neltamangalam crosses the river at a distance of 12 miles. At this point the Catchment Basin is about 335 Square miles - while lower down where the road from Bangalore to Magady crosses it, the Drainage amounts to 575 Square miles.

Unfortunately the river is much lower than Bangalore - Probably at the point on Kellamangalam road 12 miles from Bangalore - it is some 300 ft. lower and if water is obtained from that river

river it will have to be pumped up fully
300ft. Bangalore is situated on the water
shed between the 2 rivers of Arkavathy and
Penukerry and these river beds are about
12 miles distant West and East and some 2 or 300ft.
lower. It will be impossible to get water
from either of these rivers without considerable
pumping power. I propose shortly to visit
these rivers - I enclose a sketch map showing the
position of Bangalore with regard to these
rivers with a short memorandum.

I have the honor to be
Sir

Your most Obedient Servant

9.0.2810 W 2/20-10-87
19.24 W 18-7-87
22.92-3 W 10-9-86

PWC No 8448 N

No 2946

From

The Superintendent of
5 Circle

To The Chief Engineer
P.W. Dept.

Dated 20th 3 October
Recd 22 1887

Encl: 3. 22+3
(Plan)

Syram & Jack.
Sandra Villages
near Bangalore

Forwarded as
Simultaneous
approximately the
amount of Compens-
ation required the
paid for the removal
of —

Memorandum.

9948/19

Bangalore is on very high ground between the valleys of the Arkavathy and Penaukeny Rivers and it can only be supplied with a copious supply of water from either one or other of these rivers. About 15 miles to the East we find the very large Tank of Cascottah on the valley of the Penaukeny. This tank might be made available but the water will have to be pumped up a height of 200 ft. To the West we have the Arkavathy on the road to Magadi. the Arkavathy is crossed at a distance of 19 miles from Bangalore but the bed is some ^{350 ft} 400 ft lower than the City.

On the road to Kellamangalam about 12 miles from Bangalore the Arkavathy is crossed. here it is only about 220 ft below Bangalore. At this point the catchment basin of the Arkavathy is about 335 square miles while the Catchment basin of the Cascottah Tank is 650 sq miles. On the road to Magadi at a distance of

of 6 miles a small drainage of 4 $\frac{1}{2}$ miles is crossed - which is said to have a good deal of water - but I do not think it at all likely there will be found to be sufficient there.

The levels of this drainage I do not know. About half way to Ooscottah and 2 miles to the left of the road is a drainage of about 65 $\frac{1}{2}$ miles - with a terminal tank which was constructed at the time of the last famine. This might be utilized but the drainage area is not I think sufficiently great. General Mullins states that the water of the Ooscottah Tank is not considered good by the natives - but I think it would be worth while to have the water analyzed and if found good - this water might be pumped up to Bangalore. There is a hill close to the Tank - height 2887 and on this hill might be erected a Stand Pipe so as to command the Barracks at Bangalore - but the stand pipe would have to be 143 ft in height. I propose to visit shortly Ooscottah Tank,

the

the River Arkavathy on the road to Neltamangalam and the other two smaller drainages mentioned in this Memo.

Camp Bangalore
20th October 1887

Henry Purvis J. R. E.

Supltg. Engineer, V Circle

131 R
mily works

PUBLIC WORKS DEPARTMENT.

8948/81

No 2940 W

PROCEEDINGS OF THE MADRAS GOVERNMENT.

Under date the 5th Novr/87.

Read the following

From the Superintending Engineer V Circle A.E. No 2946
dated 20 October 1887

Ordered to be forwarded

Supy Engineer V Circle S to the Government of India.

17/11

A.E. No 2941 W d/s 20/11/87

ppH
5 Nov

The Secretary to the
Govt of India
Military Department

See

Adverting to your
letter No 1182 M. W. dated 11th

Jan

E.1
PH 8448/87

June 1887 on the subject
of the Bangalore water
supply. I am directed to
forward copy of the
accompanying letter, with
enclosures, from the
Superintending Engineer
to be made, affording the
information called for
by the Government of
India in respect to
the cost of removal of
the four villages which
drain into the Agrani
tank, and offering
remarks as to the
other suggestions contained

in paras 4 & 5 of your
letter under acknowl-
edgment. *9940/1*

I am to add that
the question of supplying
the troops with pure
drinking water is still
engaging the attention
of this Government, as
will be seen by the

Proceedings No. 2810 W
dated 20th October 1887,
copy of which I am to
forward for the
information of the
Government of India.

Desat
note after
4201-2940 W
2810 W/V W
tracing
17/11

MUR
26.10.87

R.S.

Jan
24/11/87

220081
23

None

circ. 4-11-87 R. S. 11-87

circ. 4-11-87 R. S. 11-87

848.

Govt. of Madras.

PUBLIC WORKS.

Dated

W. 24/11/11

7/11

Reads fine

Recd

Encl

29. 5. 1887. 2940

2941

Bangalore water

Supply

30

30 collections

Copy of report
from the Supply
Circle in connection
with the Scheme for
the ——— for troops
proceeds to be furnished
to the Surveyor

Bangalore water
supply

Forwarding to the Surveyor
Copy of a report from the
Supply Circle in connection with
the Scheme for the — for troops,
proceeds to be furnished
to the Surveyor