Local & Munl. (1895) Department.

PRINTED.

G.O., No. 469 M

DATED 19th March 1895.

5371

[Despatch Abstract.]

Water-supply and Drainage.

Agreeing with Chief Engineer in considering that in Karur a water-supply is of more importance than a drainage scheme, and requesting the Sanitary Engineer to draw up a scheme of water-supply for the town.

BACK PAPERS.

G.O.	No.	Department.	Date.	G.O.	No.	Department.	Date.

FURTHER PAPERS.

G.O.	No.	Department.	Date.	G.O.	No.	Department.	Date.

Proof - Please return original with this proof to get diagram lithographed

19TH MARCH 1894, No. 469 M., LOCAL AND MUNICIPAL.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers :—

From J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government, to the Chief Secretary to Government, dated Fort St. George, 28th November 1893, No. 2567.

Agreeably to the programme of work of this department for 1893, approved in G.O., dated 12th December 1892, No. 2035 M., Local and Municipal, I have the honour to forward herewith plans, estimate and a report on a scheme for the improvement of the drainage of Karúr.

2. Eighteen sheets of longitudinal sections showing size, gradient and levels of street drains are being bound in book-form, but I presume it will not be necessary to forward these to Government.

ENCLOSURE.

Report on a scheme for the improvement of the drainage of Karúr.

The town of Karúr lies on the left bank of the Amarávati river. It is on elevated ground which from a central point within the town slopes down on all sides. It is therefore evident that if the drainage of the whole town is to be collected at one point, an intercepting sewer completely encircling the town is required.

2. Except in one or two streets, there are no masonry drains in the town.

3. The streets have a good fall, averaging about 1 in 100.

4. The town supply of water is derived from pits or channels in the bed of the Amarávati and from wells within the town itself. The river water is said to be good and is freely used (*vide* abstract of sanitary reports of municipalities, page 76 ; the annual report of the Sanitary Commissioner for Madras for 1892). There is therefore no immediate necessity for an improved piped supply of water ; and as long as the supply remains unpiped, it will be very limited, probably not more than 2 or 3 gallons per head per diem.

5. A good surface fall and a limited supply of water are good reasons for preferring a surface drainage scheme.

6. In the present scheme the surface drains are designed to carry off a rainfall of half an inch per hour. The maximum rainfall at Karúr within the past 16 years was 35 inches in 1880, and of this some 11 inches fell in October. The provision of half an inch per hour is ample.

7. The gradient of the drains must necessarily depend upon the surface fall of the streets, which, as already stated, averages about 1 in 100, and the average velocity in the drains when running full would be about 3 feet per second.

8. The drains proposed are semi-oval in shape with their top breadth equal to the depth (*vide* plan No. 3). They will be constructed of brick in chunam. The two side walls will be capped with table-moulded bricks in cement or cement concrete slabs, and the inside of the drains will be plastered in cement.

From Surgeon-Lieutenant-Colonel W. G. KING, M.B., C.M., D.P.H., Acting Sanitary Commissioner for Madras, to the Chief Secretary to Government, dated Fort St. George, 21st May 1894, No. 1019–S.

With reference to your endorsement No. 254 (herewith returned), dated 2nd April 1894, Local and Municipal, I have the honour to submit herewith a memorandum upon the proposed Karúr drainage scheme.

2. The plans and estimates which accompanied the above reference are herewith returned.

Enclosure.

The Scheme.

I. (*Paragraph* 1).—Although there is a slope on all sides, it is far from equal, and the expenditure necessary for surrounding the town with an intercepting sewer should therefore be reconsidered. Holding in memory the fact that, as the scheme stands, the large area to the west of Karúr channel has been omitted—an area which is now rapidly increasing as to new houses and prosperity, and where all future extension of the town must occur—it is worth while considering whether the simple plan of surrounding the main portion of the town is the best to follow, *in the interests of economy*. I believe intercepting sewers No. 1 and No. 2 could safely be dispensed with. The chief purpose of sewer No. 2 is the receipt of sewage from very small portions of the town bordering the river. Inspection of these areas shows that they consist almost exclusively of mud-thatched pariah huts, placed with the utmost irregularity, so that nothing short of rebuilding the whole would allow of drainage being carried out; and, then, the question as to who is to pay for impervious surfaces in these poor private dwellings would still be a matter of doubt. Intercepting sewer No. 1 also means heavy expenditure, for the very few houses between the station and north Agraharam street.

It is practicable to drain the chief and well populated parts of the town towards the valley in which the Karúr channel lies, and by trusting to a single intercepting sewer laid here that important part of the town to the west now ignored can also be efficiently drained. This intercepting sewer could discharge upon land with a suitable level in the direction of the discharge of the channel on the west of the town, or on the opposite side of the railway line. A collecting well, as in the original design, might be necessary; but it is possible land could be commanded direct by the outfall sewer. Given a limited sum of money, I believe this modification of the scheme would afford the best sanitary results in practice, although the scheme of the Sanitary Engineer's department is theoretically complete *for the portion of the town* attended to.

II. (*Paragraphs* 6 *and* 7).—I consider $\frac{1}{2}$ inch of rainfall per hour an unnecessarily large amount to receive in the instance of this town. In consideration of the excellent surface fall available, storm water might practically be ignored except as to small amounts for courtyards, and, thus, further economy as to size of surface drains could be secured. Notwithstanding the receipt on an area of, roughly, 105 acres of $\frac{1}{2}$ inch rainfall per hour or about 132·72 cubic feet per minute, it is noted not a single overflow has been provided, although good facilities for these exist, and are desirable. The outfall sewer is capable of discharging 115·4 cubic feet per minute only. Overflow must therefore be expected at the third manhole from the junction with sewer No. 1 unless storm water overflows are provided, whilst both sewers Nos. 1 and 2 will back up for a considerable distance beyond this point. In case the collecting well is adopted, during storms, and at times when lifting machinery is not working, silting and storage of sewage will occur in both sewers.

III. (*Paragraph* 15).—The principle here advocated of building the intercepting sewer after the surface drains have been formed should be avoided both from an engineering and sanitary point of view. Construction should commence from the main sewers to the periphery.

Estimate and Plans.

IV. *Sewage Farm.*—Whether the Rs. 2,000 includes compensation or not for ground is not stated. Likewise, neither the nature of the soil and its suitability for sewage farming, nor whether it is to be underdrained is stated. No value for land acquired nor for the realignment of streets or houses is mentioned. None of these are trivial points, and should have been quoted. It would not be advisable to take up a site for the sewage farm liable to flood.

No specification, or reference to the standard plans, is afforded as to the form of the manholes, nature of joints of stoneware pipes, or name of the maker.

In my opinion the silt traps are bad in form; no idea is given as to the position of these.

All plans, I think, should be prepared so that if the designer were to proceed on leave on the day following submission, there should be no doubt as to what his intentions were, and this is the rule followed in all engineering undertakings, and would be advisable here also.

The statement as to "flushing arrangements" is indefinite, but it is to be supposed in the absence of a public water-supply that pumping from a convenient well or stream is intended into the iron reservoir, exhibited in the plan, in communication with the automatic syphon. The object of an automatic flush, when it is requisite to pump the water by manual labour, is not very evident. The attendance of a cooly once daily, in any case, is necessary, and it would not be too much to expect this cooly to repeat this in the evening, so as to secure the pulling up of a plug from an inexpensive cistern. But granting something neater than this rough mode is requisite, I cannot see the object of the chamber for the automatic syphon *plus* the storage for *the full amount of water*. Economy would be secured without loss of efficiency by arranging that a reservoir be made to contain half the total water, so that on its being filled completely it would allow of overflow by a *large* pipe to the syphon compartment which could thus discharge, allowing for a gradual filling and a second automatic discharge, that might be regulated by a *small* pipe (*vide* margin). The arrangement would, I think, be more economical than that shown in the plans. The loss of head for starting flushing is of no moment in practice—a full bore flush only is what is required.

Automatic syphons are of such various descriptions, and their efficiency differs so greatly, that the maker's name should have been specified. By most makers it is

9. The town is divided into seven areas for the purpose of drainage. The drainage of each area will be concentrated at a point at the base of the cone which forms the town site. For the collection of the sewage proper from these various areas there will be two sewers starting in opposite directions from the west end of the town. The two sewers, which are denominated No. 1 and No. 2, converge near the toll-gate at the south entrance to the railway compound. A combined sewer then passes along the road to Námakkal to the proposed sewage farm, which will be to the north of the railway line. There are here two sites for the sewage farm; the choice must depend upon financial considerations. The land marked B is sufficiently low to be commanded by the sewer. If this land is selected, the sewer will terminate in a small cistern from which the sewage will be conveyed in an open carrier as shown by dotted red line on the general plan. The only objection to this site, and that not a very important one, is that it is liable to be flooded. The fact that the sewage will be delivered on the land by gravitation is a sufficient recommendation for its adoption. The other site marked A on plan is a short distance inland from the sewer. It is the lowest site above flood level within a reasonable distance of the town. But sewage will be required to be lifted on to the ground. No pumping machinery will be required as long as the present water-supply continues. With the present supply two picottahs will be able to lift the sewage of the whole town. The question of the sites may be left open at present for reasons that will be explained later on in this report.

10. In calculating the sizes of the intercepting sewers a provision has been made for a flow of 15 gallons per head per diem, half of which will be discharged in 6 hours. Fifteen gallons is the accepted minimum piped supply of water for towns in this Presidency. The population of Karúr was, in 1881, 9,205, and in 1891 it was 10,750. The intercepting sewers are designed for a population of 15,000.

11. Sewer No. 1 will eventually receive the sewage from a population of about 10,000 which gives a discharge of 33 cubic feet per minute. A 9-inch pipe with a fall of 1 in 300 flowing half full and having a velocity of $2\frac{1}{2}$ feet per second will discharge 33 cubic feet per minute.

12. Sewer No. 2 will ultimately receive the sewage from a population of 5,000 which will give a discharge of 17 cubic feet. The theoretical diameter of sewer for this discharge would be 6 inches. But for other reasons it is considered inadvisable to have an intercepting sewer of a less size than 9 inches. To give a flow of 17 cubic feet per minute the depth in a 9-inch pipe will be 3·7 inches, and this will give a velocity of 2·28 feet per minute. With the usual flushing arrangements the sewers will not give any trouble.

13. It has been stated that the question of the sites may be left open for the present. The reason for this is that there is no likelihood of the scheme being carried out in its entirety within, say, the next 10 or 15 years. The circumstances which lead to the preparation of the scheme are as follow:—

Sometime ago the Karúr Municipality wished to construct drains in some of the important streets. They were informed that to lay disconnected bits of drains without any reference to one another was not advisable, and it was recommended that a scheme should be prepared first and any streets may then be drained in conformity with the scheme. There is therefore no undertaking on the part of the municipality to see the scheme carried out if one was prepared. The municipality may not be able to carry out the scheme as a whole without substantial aid from Government.

14. The rate at which the tax on buildings in Karúr is assessed is $6\frac{1}{4}$ per cent. If building tax be raised to the maximum of $7\frac{1}{2}$ per cent. and if profession tax be levied, it is believed that the municipality will obtain an additional income of about Rs. 2,000 which, on the assumption that Government will grant a loan, is sufficient to pay the interest and sinking fund on say Rs. 30,000. For this sum only half of the surface drains in the scheme could be constructed. Government may, however, be able to give a grant in addition, and if this amounted to Rs. 29,000, all the surface drains could be completed. If, however, the Government can neither give loan nor contribution, the municipality should spend the Rs. 2,000 yearly in constructing new

drains according to this scheme, taking up such streets first as require most attention; a substantial improvement in the drainage of the town would thus be effected in the course of a few years.

15. The construction of the intercepting sewers may be deferred until a sufficient number of street drains have been constructed to keep up a sufficient flow in the sewers. In the meantime the sewage can be utilised on a long strip of land which is about 1,000 feet broad and lies between the town and the river, or diverted into the irrigation channels that run on the west of the town. The cost of the complete scheme is Rs. 95,853 distributed as follows:—

Surface Drains.

	Rs.
Block A	11,320
„ B	3,451
„ C	4,429
„ D	2,768
„ E	6,079
„ F	4,303
„ G	18,914
Intercepting Sewer No. 1	9,465
„ No. 2	11,242
12-inch outfall sewer	6,849
Silt traps	1,000
Flushing arrangements	2,000
Sewage farm	2,000
Well	200
Contingencies	11,833
Total	95,853

Note.—Total for surface drains with contingencies is Rs. 69,000.

(Signed) J. A. JONES,
Sanitary Engineer to Government.

No. 867.

Referred to the Public Works Department for remarks.

FORT ST. GEORGE,
5*th December* 1893.

(Signed) A. T. PRINGLE,
Assistant Secretary.

To the Public Works Department.

No. 878-C.

The Sanitary Engineer's proposals with regard to the drainage of the town of Karúr in the Coimbatore district are approved in the Public Works Department.

(Signed) J. PENNYCUICK, Colonel, R.E.,
Secretary to Government, P.W.D.

To the Local and Municipal Department.

No. 254.

Referred to the Sanitary Commissioner for remarks.

(By Order.)

FORT ST. GEORGE,
3*rd April* 1894.

(Signed) L. DAVIDSON,
Ag. Assistant Secretary.

To the Sanitary Commissioner.

this defect; arrangements could easily be made so that the sewage from the drain could be used for irrigating and manuring land in the neighbourhood. *A drainage scheme is much required for this town and one is to be prepared.*"

G.O., dated 27th January 1893, *No.* 115 *M., Local and Municipal.*

Drainage.—"No change since last inspection, and most of the sewage sinks into the soil of the ground. The 'Komaty drain' was in the same defective condition and no proper arrangements had been made for the disposal of its contents. *A drainage scheme for the town is much needed and one is to be prepared.*"

G.O., dated 16th November 1893, *No.* 1584 *M., Local and Municipal.*

Drainage.—"The matter is at present engaging the attention of the Sanitary Engineer. The sewage is to be conducted to the north-east of the town; there is a suitable site for a sewage farm to the west of the Vangal road beyond the Pallars' village. The present drains are very unsatisfactory, and in many places the air is poisoned by the emanations from stagnant sewage. *A good drainage system will, no doubt, improve the quality of the well water of the town.* The Komaty drain appears to have been well constructed, but unfortunately the sewage is discharged directly into the river, and some people draw water below the point of discharge."

2. The above extracts go to prove that the Sanitary Commissioner's department has been for years perfectly cognizant of the fact that a drainage scheme for Karúr was under preparation, that they attached more importance to a drainage scheme than to a water-supply scheme, and that they reiterated remarks to the above effect in every inspection report since 1891.

3. As has been stated in the report on the drainage scheme, the original object of the scheme was that it should enable the municipality of Karúr to construct street drains in such localities where they were most needed on some concerted plan so as to form part of a general scheme for the town. But during the period that elapsed between the time that the question of a drainage scheme was first considered and its final submission to Government such emphatic opinions were pronounced by Doctors Laing and Dymott as to the necessity of a comprehensive drainage scheme that this department thought it desirable to suggest methods for carrying out the works within a limited number of years. There was, however, no wish on the part of this department to insist that the scheme should be taken up as a whole, for, in the concluding portion of paragraph 14 of the drainage report, it has been suggested that if means do not permit of the scheme being undertaken as a whole, the municipality should spend Rs. 2,000 yearly in constructing new drains according to the scheme.

4. Dr. King admits that Car Street, Main Bazaar Street and Komati Street need drains apart from the question of the introduction of a water-supply. With Rs. 2,000 annually it will take five years to drain the above three streets; at the expiration of five years there will probably be other streets that require draining. The undersigned adheres to the opinion expressed in the report on the drainage scheme that if means cannot be found to undertake the drainage scheme as a whole, the municipality should spend Rs. 2,000 annually in constructing street drains, taking up those first that require most attention.

5. A water-supply project for Karúr will cost not less than a lakh of rupees. The interest and sinking fund on a lakh of rupees will be Rs. 6,000 annually. The cost of pumping and maintenance of works will be about Rs. 4,000 annually. The project will thus cost the municipality about Rs. 10,000 annually, or if Government contribute a moiety of the capital cost, the annual charge will be Rs. 7,000.

6. A water-tax will bring to the municipality a revenue of Rs. 2,500, and this added to the Rs. 2,000 estimated as the probable yield from enhancement of house-tax and the imposition of profession tax, the total sum available for the water-supply project would be Rs. 4,500 which, looking to the figures given in the previous paragraph, is quite inadequate.

7. The other remarks of the Sanitary Commissioner will now be dealt with in their order:—

I. The area to the west of the town is shown on the map (sheet No. 1). This area is not included in the scheme as it is beyond the thickly populated area of the town, but the question of draining it in future has been duly considered. The levels of this area are marked on the plan—*vide* sheet No. 1—and an inspection of these levels will show that the levels admit of this area being drained into the proposed sewers.

The Sanitary Commissioner's recommendation that sewer No. 2 be omitted must be condemned. The sewer is intended to intercept the sewage of an area that drains into the river which is the principal source of drinking water. Looking to this fact, and also that the area holds a population of 4,000 which is not insignificant enough to be ignored, the proposal of the Sanitary Commissioner to do away with the intercepting sewer does not appear to be advisable.

Sewer No. 1 is the sewer which passes through the valley in which the Karúr irrigation channel lies. It is not understood what Dr. King means by first saying that this sewer should be omitted and then recommending that an intercepting sewer should be laid in the valley through which the irrigation channel flows.

II. The undersigned cannot agree with Dr. King in thinking that a provision for quarter of an inch of rainfall would be sufficient. In England, where the rainfall is more equable than in tropical climates, it is considered necessary to provide for a rainfall of $\frac{1}{2}$ to 1 inch per hour. In India most of the rain falls in about three months of the year, and the rate of fall is frequently in excess of half an inch per hour. The reason advanced for curtailing the provision for rainfall, namely, that the town has a good surface fall, does not hold good in the case of a surface drainage scheme, though it would be so in an underground drainage scheme. In an underground drainage scheme proper arrangements can be made for excluding rain water from the sewers. It is impossible to exclude storm water from surface drains, and when a surface drain is not sufficiently large for storm water, it overflows, and the tendency is, it has been found, to scour out the sides of the road; on the cessation of rain the mud thus scoured out subsides into the bottom of the drain.

There will be no economy in limiting the rainfall to quarter of an inch. Most of the drains are 6 inches in size. It is inadvisable to have street drains of any smaller size. There will be a small saving in the large sizes of the drains, but this economy can only be effected at the sacrifice of efficiency.

Storm overflows on the intercepting sewer were fully contemplated when working out the scheme. Their omission on the plan is an inadvertence.

III. The proposal to defer the construction of the intercepting sewers was with reference to the execution of the scheme piecemeal. If only Rs. 2,000 are available yearly for expenditure on the scheme, it would take 15 years to complete the sewers alone. Until the street drains are completed the intercepting sewers would be inactive. The money should decidedly be laid out in the construction of street drains first. The great point is to remove the sewage from the streets; at present it soaks into ground at the door of the houses. If street drains are constructed first, it would remove the sewage from the immediate vicinity of the houses and could be discharged into the adjoining fields or cess-pits.

IV. Rupees 2,000 include cost of land. The land is suitable for sewage farming. There is no necessity or reason for underdraining the land. It is not proposed to realign streets. The realignment of a single street may probably cost as much as the whole scheme. All that would be necessary is to remove some very prominent projections in the shape of verandahs or pyals. What these will be can only be ascertained during the actual construction of the drains. There is no reason why a land liable to floods should not be converted into sewage farms. Of the two sites proposed, only one is liable to be flooded occasionally. Both the lands are now cultivated. If liability to floods is not a bar to its cultivation, it would not be a bar for a sewage farm, as when the land is flooded the sewers would be discharging at the overflows.

8. The manholes will be of the standard type proposed for Negapatam, the drainage scheme for which town has been approved by the Chief Engineer, Public Works Department. Messrs. Burn and Co.'s stoneware pipes have been estimated for. They will be jointed with cement with an inner ring of tarred yarn.

9. The silt traps are economical and their efficiency has been practically tested. Their positions are marked on the sections of streets.

10. The iron tank holds water sufficient to charge the syphon twice. A flush is most needed when the sewers run at their lowest. This is usually between 12 and 3 P.M., or between 9 P.M. and 3 A.M. These are inconvenient hours for a cooly to work, it is therefore considered best to store the full supply required in the iron tank, and so regulate the tap that the syphons will act about the time a flush is most needed. It is proposed to manufacture the syphon locally.

11. Dr. King has reproduced in his memorandum an illustration which he describes as a free air inlet arrangement. The exact function of this arrangement is to expel air from the syphon chamber as it is being gradually filled up. A simple opening in the side of the chamber near its top will serve the purpose of an air outlet efficiently. In fact, the arrangement shown by Dr. King is not applicable to the syphon proposed for Karúr. It can only be adopted when the syphon chamber is placed under a street, in which case it is not desirable to have an opening immediately over the top of the chamber as this would admit dust.

Fort St. George,
25*th June* 1894.

(Signed) R. E. ELLIS,
Ag. Sanitary Engineer to Government.

No. 633.

Referred to the Public Works Department for favour of remarks.

Fort St. George,
4*th August* 1894.

(Signed) W. FRANCIS,
Ag. Assistant Secretary.

To the Public Works Department, with plans.

Note by the Chief Engineer, Public Works Department.

I consider that Mr. Ellis has fully met the Sanitary Commissioner's objections to the proposed scheme for the drainage of Karúr with the following qualifications:—

(*a*) I am of opinion that for Karúr, as for any other town in India, a sufficient water-supply is of more importance than a drainage scheme, and that, if the town cannot have both, the former should have the preference. At the same time it is conclusively shown that Dr. King or his predecessors concurred in the necessity for the latter.

(*b*) Mr. Ellis explains, or rather explains away, the proposal to defer the construction of the intercepting sewers, but in point of fact, if only Rs. 2,000 yearly were available for expenditure on the scheme, it would not be worth while to begin it at all; if it is to be undertaken funds should be provided sufficient to complete it in at most two years and in that case the intercepting sewers should be the first and not the last part to be carried out.

I regret that, by an oversight on my part, these papers have been mislaid and their disposal thus postponed.

(Signed) J. PENNYCUICK, Colonel, R. E.,
Chief Engineer, P.W.D.

11*th February* 1895.

No. 564-C.

Transferred to the Local and Municipal Department with advertence to its endorsement No. 633, dated 4th August 1894, and the referred papers returned.

(Signed) J. PENNYCUICK, Colonel, R. E.,
Secretary to Government, P.W.D.

13*th February* 1895.

To the Local and Municipal Department, with papers.

Order—dated 19th March 1895, No. 469 M., Local and Municipal.

The Government agrees with the Chief Engineer in considering that in Karúr a sufficient water-supply is of more importance than a drainage scheme. The Sanitary Engineer will accordingly be requested to draw up a scheme of water-supply as soon as his other engagements will permit him to do so.

(True Extract.)

for *Chief Secretary.*

To the Chairman, Municipal Council, Karúr.
" Collector of Coimbatore.
" Sanitary Commissioner.
" Sanitary Engineer.
" Public Works Department.
Editors' Table.

Exd. S. J. Pereira.

Govt. of {1895} Madras.

L CAL AND MUNICIPAL.

Issued

Read. *Encl.*

G.O., 19th March 1895, No. 469 M.

MARCH.

Water-supply and Drainage.

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19 March 5 469

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

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2. Eighteen sheets of longitudinal sections showing size, gradient and levels of street drains are being bound in book-form, but I presume it will not be necessary to forward these to Government.

ENCLOSURE.

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2. Except in one or two streets, there are no masonry drains in the town.

3. The streets have a good fall, averaging about 1 in 100.

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5. A good surface fall and a limited supply of water are good reasons for preferring a surface drainage scheme.

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8. The drains proposed are semi-oval in shape with their top breadth equal to the depth (*vide* plan No. 3). They will be constructed of brick in chunam. The two side walls will be capped with table-moulded bricks in cement or cement concrete slabs, and the inside of the drains will be plastered in cement.

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10. In calculating the sizes of the intercepting sewers a provision has been made for a flow of 15 gallons per head per diem, half of which will be discharged in 6 hours. Fifteen gallons is the accepted minimum piped supply of water for towns in this Presidency. The population of Karúr was, in 1881, 9,205, and in 1891 it was 10,750. The intercepting sewers are designed for a population of 15,000.

11. Sewer No. 1 will eventually receive the sewage from a population of about 10,000 which gives a discharge of 33 cubic feet per minute. A 9-inch pipe with a fall of 1 in 300 flowing half full and having a velocity of $2\frac{1}{2}$ feet per second will discharge 33 cubic feet per minute.

12. Sewer No. 2 will ultimately receive the sewage from a population of 5,000 which will give a discharge of 17 cubic feet. The theoretical diameter of sewer for this discharge would be 6 inches. But for other reasons it is considered inadvisable to have an intercepting sewer of a less size than 9 inches. To give a flow of 17 cubic feet per minute the depth in a 9-inch pipe will be 3·7 inches, and this will give a velocity of 2·28 feet per minute. With the usual flushing arrangements the sewers will not give any trouble.

13. It has been stated that the question of the sites may be left open for the present. The reason for this is that there is no likelihood of the scheme being carried out in its entirety within, say, the next 10 or 15 years. The circumstances which lead to the preparation of the scheme are as follow:—

Sometime ago the Karúr Municipality wished to construct drains in some of the important streets. They were informed that to lay disconnected bits of drains without any reference to one another was not advisable, and it was recommended that a scheme should be prepared first and any streets may then be drained in conformity with the scheme. There is therefore no undertaking on the part of the municipality to see the scheme carried out if one was prepared. The municipality may not be able to carry out the scheme as a whole without substantial aid from Government.

14. The rate at which the tax on buildings in Karúr is assessed is $6\frac{1}{4}$ per cent. If building tax be raised to the maximum of $7\frac{1}{2}$ per cent. and if profession tax be levied, it is believed that the municipality will obtain an additional income of about Rs. 2,000 which, on the assumption that Government will grant a loan, is sufficient to pay the interest and sinking fund on say Rs. 30,000. For this sum only half of the surface drains in the scheme could be constructed. Government may, however, be able to give a grant in addition, and if this amounted to Rs. 29,000, all the surface drains could be completed. If, however, the Government can neither give loan nor contribution, the municipality should spend the Rs. 2,000 yearly in constructing new

drains according to this scheme, taking up such streets first as require most attention; a substantial improvement in the drainage of the town would thus be effected in the course of a few years.

15. The construction of the intercepting sewers may be deferred until a sufficient number of street drains have been constructed to keep up a sufficient flow in the sewers. In the meantime the sewage can be utilised on a long strip of land which is about 1,000 feet broad and lies between the town and the river, or diverted into the irrigation channels that run on the west of the town. The cost of the complete scheme is Rs. 95,853 distributed as follows:—

Surface Drains.

	Rs.
Block A	11,320
„ B	3,451
„ C	4,429
„ D	2,768
„ E	6,079
„ F	4,303
„ G	18,914
Intercepting Sewer No. 1	9,465
„ No. 2	11,242
12-inch outfall sewer	6,849
Silt traps	1,000
Flushing arrangements	2,000
Sewage farm	2,000
Well	200
Contingencies	11,833
Total	95,853

Note.—Total for surface drains with contingencies is Rs. 69,000.

(Signed) J. A. JONES,
Sanitary Engineer to Government.

No. 867.

Referred to the Public Works Department for remarks.

FORT ST. GEORGE,
5th December 1893.

(Signed) A. T. PRINGLE,
Assistant Secretary.

To the Public Works Department.

No. 878-C.

The Sanitary Engineer's proposals with regard to the drainage of the town of Karúr in the Coimbatore district are approved in the Public Works Department.

(Signed) J. PENNYCUICK, Colonel, R.E.,
Secretary to Government, P.W.D.

To the Local and Municipal Department.

No. 254.

Referred to the Sanitary Commissioner for remarks.

(By Order.)

FORT ST. GEORGE,
3rd April 1894.

(Signed) L. DAVIDSON,
Ag. Assistant Secretary.

To the Sanitary Commissioner.

From Surgeon-Lieutenant-Colonel W. G. KING, M.B., C.M., D.P.H., Acting Sanitary Commissioner for Madras, to the Chief Secretary to Government, dated Fort St. George, 21st May 1894, No. 1019–S.

With reference to your endorsement No. 254 (herewith returned), dated 2nd April 1894, Local and Municipal, I have the honour to submit herewith a memorandum upon the proposed Karúr drainage scheme.

2. The plans and estimates which accompanied the above reference are herewith returned.

ENCLOSURE.

The Scheme.

I. (*Paragraph* 1).—Although there is a slope on all sides, it is far from equal, and the expenditure necessary for surrounding the town with an intercepting sewer should therefore be reconsidered. Holding in memory the fact that, as the scheme stands, the large area to the west of Karúr channel has been omitted—an area which is now rapidly increasing as to new houses and prosperity, and where all future extension of the town must occur—it is worth while considering whether the simple plan of surrounding the main portion of the town is the best to follow, *in the interests of economy*. I believe intercepting sewers No. 1 and No. 2 could safely be dispensed with. The chief purpose of sewer No. 2 is the receipt of sewage from very small portions of the town bordering the river. Inspection of these areas shows that they consist almost exclusively of mud-thatched pariah huts, placed with the utmost irregularity, so that nothing short of rebuilding the whole would allow of drainage being carried out; and, then, the question as to who is to pay for impervious surfaces in these poor private dwellings would still be a matter of doubt. Intercepting sewer No. 1 also means heavy expenditure, for the very few houses between the station and north Agraharam street.

It is practicable to drain the chief and well populated parts of the town towards the valley in which the Karúr channel lies, and by trusting to a single intercepting sewer laid here that important part of the town to the west now ignored can also be efficiently drained This intercepting sewer could discharge upon land with a suitable level in the direction of the discharge of the channel on the west of the town, or on the opposite side of the railway line. A collecting well, as in the original design, might be necessary; but it is possible land could be commanded direct by the outfall sewer. Given a limited sum of money, I believe this modification of the scheme would afford the best sanitary results in practice, although the scheme of the Sanitary Engineer's department is theoretically complete *for the portion of the town* attended to.

II. (*Paragraphs* 6 *and* 7).—I consider $\frac{1}{2}$ inch of rainfall per hour an unnecessarily large amount to receive in the instance of this town. In consideration of the excellent surface fall available, storm water might practically be ignored except as to small amounts for courtyards, and, thus, further economy as to size of surface drains could be secured. Notwithstanding the receipt on an area of, roughly, 105 acres of $\frac{1}{2}$ inch rainfall per hour or about 132·72 cubic feet per minute, it is noted not a single overflow has been provided, although good facilities for these exist, and are desirable. The outfall sewer is capable of discharging 115·4 cubic feet per minute only. Overflow must therefore be expected at the third manhole from the junction with sewer No. 1 unless storm water overflows are provided, whilst both sewers Nos. 1 and 2 will back up for a considerable distance beyond this point. In case the collecting well is adopted, during storms, and at times when lifting machinery is not working, silting and storage of sewage will occur in both sewers.

III. (*Paragraph* 15).—The principle here advocated of building the intercepting sewer after the surface drains have been formed should be avoided both from an engineering and sanitary point of view. Construction should commence from the main sewers to the periphery.

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Estimate and Plans.

IV. *Sewage Farm.*—Whether the Rs. 2,000 includes compensation or not for ground is not stated. Likewise, neither the nature of the soil and its suitability for sewage farming, nor whether it is to be underdrained is stated. No value for land acquired nor for the realignment of streets or houses is mentioned. None of these are trivial points, and should have been quoted. It would not be advisable to take up a site for the sewage farm liable to flood.

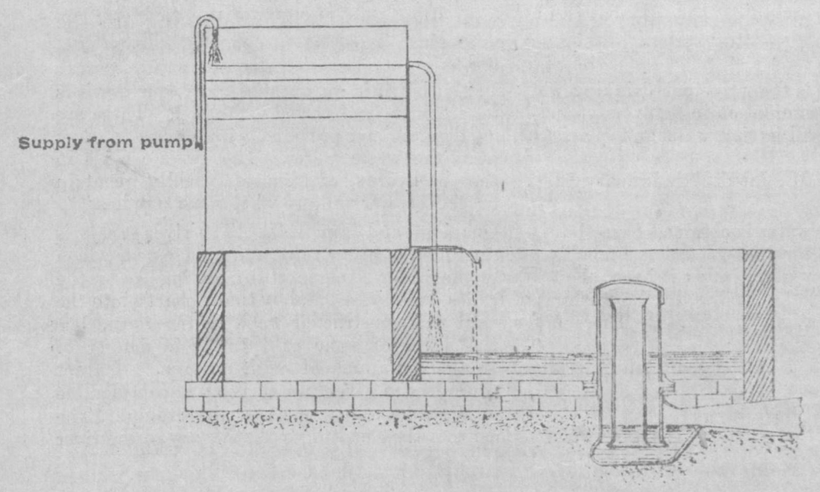
No specification, or reference to the standard plans, is afforded as to the form of the manholes, nature of joints of stoneware pipes, or name of the maker.

In my opinion the silt traps are bad in form; no idea is given as to the position of these.

All plans, I think, should be prepared so that if the designer were to proceed on leave on the day following submission, there should be no doubt as to what his intentions were, and this is the rule followed in all engineering undertakings, and would be advisable here also.

The statement as to "flushing arrangements" is indefinite, but it is to be supposed in the absence of a public water-supply that pumping from a convenient well or stream is intended into the iron reservoir, exhibited in the plan, in communication with the automatic syphon. The object of an automatic flush, when it is requisite to pump the water by manual labour, is not very evident. The attendance of a cooly once daily, in any case, is necessary, and it would not be too much to expect this cooly to repeat this in the evening, so as to secure the pulling up of a plug from an inexpensive cistern. But granting something neater than this rough mode is requisite, I cannot see the object of the chamber for the automatic syphon *plus* the storage for *the full amount of water*. Economy would be secured without loss of efficiency by arranging that a reservoir be made to contain half the total water, so that on its being filled completely it would allow of overflow by a *large* pipe to the syphon compartment which could thus discharge, allowing for a gradual filling and a second automatic discharge, that might be regulated by a *small* pipe (*vide* margin). The arrangement would, I think, be more economical than that shown in the plans. The loss of head for starting flushing is of no moment in practice—a full bore flush only is what is required.

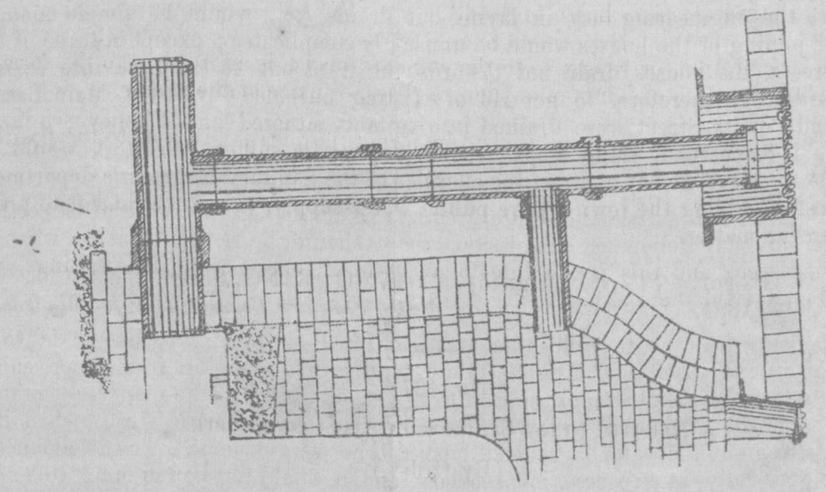
Wrought iron water tank
800 gallons, costs about Rs. 95



Automatic syphons are of such various descriptions, and their efficiency differs so greatly, that the maker's name should have been specified. By most makers it is

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laid down as a *sine qua non* that a free air inlet should be arranged for in the syphon chamber to allow of venting the syphon readily, it being, in fact, stated that without this the syphon will not work. Possibly, the form selected by the Sanitary Engineering department will work without this precaution; but the usual arrangement adopted in consequence of this belief is as follows:—



Irrespective of the syphon question, this being the head of the sewer it would be better that it be ventilated. The plan leaves it to imagination how the syphon flush chamber is to be entered for cleansing, regulating flow, &c.

Necessity for the Scheme.

V. (*Paragraph* 4).—The Sanitary Engineer's department relies upon statements in abstracts of sanitary reports, page 76, annual report for 1892, as to necessity of drainage. These "abstracts" are from reports by Chairmen of Municipalities, and, although the Sanitary Commissioner may modify or expunge certain statements and is responsible, it must be remembered they are not "original." The following are the views expressed by my predecessors:—

"The river is the principal drinking water-supply, but it is an unsatisfactory source as it is subjected to contamination in many ways and bodies are burnt and buried in its bed. There are 17 public wells, all having walls and platforms, but they are not provided with drains to carry away the waste water. The private wells in the backyards of houses usually contain brackish water and are wholesome supplies." *

* G.O., No. 115 M., dated 27th January 1893.

"Drinking water is obtained from the river Amarávati and from wells. The river supply is not satisfactory, for the water has probably been polluted at every town and village near which the river has flowed and after its arrival at Karúr the water is made still more impure by the burning and burial of bodies, by the washing of bodies and clothes, and by the discharge into the river of town sewage. . . . . There are several well-constructed wells in the town, but the water of some of them is in danger of being contaminated with sewage. Except towards the river, water is at a considerable depth from the surface of the ground. The people living to the north of New Street complained that they had to go all the way to the river for drinking water." †

† G.O., No. 1584 M., dated 16th November 1893.

Indeed, the mere fact of consumption being reckoned by the Sanitary Engineer's department at only three gallons per head seems to me a sufficient reason for the urgency for a water-supply being established. The restriction of the use of water below requirements for sanitary purposes shows the difficulty with which water is obtained. As a fact, great inconvenience is felt as to the distance of this new supply. The Chairman, for example, informed me that he lives so far from the river that he

has to content himself with "brackish well water." The river water is highly contaminated with fœcal matter. Cholera mortality in Karúr amounted, during the last epidemic, to 9·1 per mille. I believe, therefore, that the reason given by the Sanitary Engineer's department as to the urgency of drainage when compared with a water-supply is not tenable. Any scheme of drainage of Karúr would be attended with much difficulty as to obtaining good sanitary results, if applied to the whole town. Although the engineering task in laying out drains, &c., would be simple enough, the after joining of the houses would be unusually complicated; except in three of the main streets, the houses drain not towards the front but to the back into *lengthy* court-yards. If, therefore, to get rid of existing nuisance Car Street, Main Bazaar Street and Comity Street were drained into suitably situated land, I believe, so far as drainage is concerned, these steps would *temporarily* suffice, whilst it would be advisable for Government to direct the energies of the Sanitary Engineer's department to the task of giving the town a pure public water-supply, which ought not to prove an expensive matter.

FORT ST. GEORGE,
19*th May* 1894.

(Signed) W. G. KING, Surgn.-Lieut.-Col.,
Acting Sanitary Commissioner for Madras.

No. 427.

Referred to the Sanitary Engineer for remarks.

(By Order.)

FORT ST. GEORGE,
4*th June* 1894.

(Signed) L. DAVIDSON,
Ag. Assistant Secretary.

To the Sanitary Engineer.

From R. E. ELLIS, Esq., ASSOC. M. INST. C.E., Acting Sanitary Engineer to Government, to the Chief Secretary to Government, dated Fort St. George, 25th June 1894, No. 1411.

With reference to your endorsement No. 427, dated 4th June 1894, I have the honour to submit herewith a memorandum on the Acting Sanitary Commissioner's remarks on the Karúr drainage scheme.

2. The papers which accompanied the reference above quoted are herewith returned.

ENCLOSURE.

Memorandum on the Acting Sanitary Commissioner's remarks on the Karur Drainage Scheme.

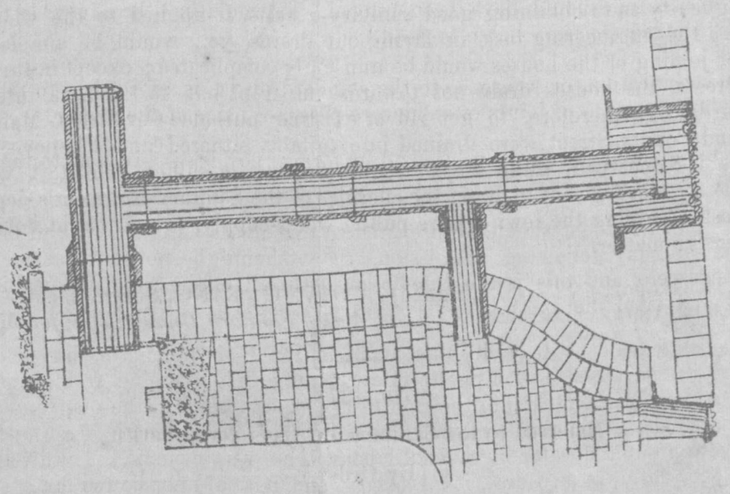
The principal point in the Acting Sanitary Commissioner's memorandum that requires a reply is the urgency or otherwise of a drainage scheme for Karúr. Doctor King quotes certain remarks of his predecessors in support of his contention that Karúr stands more in need of a water-supply than drainage. Dr. King would have represented facts more correctly if he had quoted also the remarks of his predecessors on the drainage of Karúr side by side with their remarks on its water-supply. The undersigned begs to invite the attention of Government to the following remarks of Doctors Laing and Dymott extracted from the very Government Orders quoted by Dr. King:—

G.O., dated 13*th February* 1892, *No.* 291 *M., Local and Municipal.*

Drainage.—"There is no system of drainage and most of the sewage sinks into the soil of the town. Three streets have been provided with drains which discharge into the Amarávati river and Panchamadevi channel. The 'Komaty drain' is in the same condition, and as no arrangements have been made for the disposal of its contents, they form an elongated cess-pool at its end. Some measures should be taken to remedy

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Acting Sanitary Commissioner for Madras.

No. 427.

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(By Order.)

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4*th June* 1894.

(Signed) L. DAVIDSON,
Ag. Assistant Secretary.

To the Sanitary Engineer.

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2. The papers which accompanied the reference above quoted are herewith returned.

ENCLOSURE.

Memorandum on the Acting Sanitary Commissioner's remarks on the Karur Drainage Scheme.

The principal point in the Acting Sanitary Commissioner's memorandum that requires a reply is the urgency or otherwise of a drainage scheme for Karúr. Doctor King quotes certain remarks of his predecessors in support of his contention that Karúr stands more in need of a water-supply than drainage. Dr. King would have represented facts more correctly if he had quoted also the remarks of his predecessors on the drainage of Karúr side by side with their remarks on its water-supply. The undersigned begs to invite the attention of Government to the following remarks of Doctors Laing and Dymott extracted from the very Government Orders quoted by Dr. King:—

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this defect; arrangements could easily be made so that the sewage from the drain could be used for irrigating and manuring land in the neighbourhood. *A drainage scheme is much required for this town and one is to be prepared.*"

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G.O., dated 16th November 1893, *No.* 1584 *M., Local and Municipal.*

Drainage.—"The matter is at present engaging the attention of the Sanitary Engineer. The sewage is to be conducted to the north-east of the town; there is a suitable site for a sewage farm to the west of the Vangal road beyond the Pallars' village. The present drains are very unsatisfactory, and in many places the air is poisoned by the emanations from stagnant sewage. *A good drainage system will, no doubt, improve the quality of the well water of the town.* The Komaty drain appears to have been well constructed, but unfortunately the sewage is discharged directly into the river, and some people draw water below the point of discharge."

2. The above extracts go to prove that the Sanitary Commissioner's department has been for years perfectly cognizant of the fact that a drainage scheme for Karúr was under preparation, that they attached more importance to a drainage scheme than to a water-supply scheme, and that they reiterated remarks to the above effect in every inspection report since 1891.

3. As has been stated in the report on the drainage scheme, the original object of the scheme was that it should enable the municipality of Karúr to construct street drains in such localities where they were most needed on some concerted plan so as to form part of a general scheme for the town. But during the period that elapsed between the time that the question of a drainage scheme was first considered and its final submission to Government such emphatic opinions were pronounced by Doctors Laing and Dymott as to the necessity of a comprehensive drainage scheme that this department thought it desirable to suggest methods for carrying out the works within a limited number of years. There was, however, no wish on the part of this department to insist that the scheme should be taken up as a whole, for, in the concluding portion of paragraph 14 of the drainage report, it has been suggested that if means do not permit of the scheme being undertaken as a whole, the municipality should spend Rs. 2,000 yearly in constructing new drains according to the scheme.

4. Dr. King admits that Car Street, Main Bazaar Street and Komati Street need drains apart from the question of the introduction of a water-supply. With Rs. 2,000 annually it will take five years to drain the above three streets; at the expiration of five years there will probably be other streets that require draining. The undersigned adheres to the opinion expressed in the report on the drainage scheme that if means cannot be found to undertake the drainage scheme as a whole, the municipality should spend Rs. 2,000 annually in constructing street drains, taking up those first that require most attention.

5. A water-supply project for Karúr will cost not less than a lakh of rupees. The interest and sinking fund on a lakh of rupees will be Rs. 6,000 annually. The cost of pumping and maintenance of works will be about Rs. 4,000 annually. The project will thus cost the municipality about Rs. 10,000 annually, or if Government contribute a moiety of the capital cost, the annual charge will be Rs. 7,000.

6. A water-tax will bring to the municipality a revenue of Rs. 2,500, and this added to the Rs. 2,000 estimated as the probable yield from enhancement of house-tax and the imposition of profession tax, the total sum available for the water-supply project would be Rs. 4,500 which, looking to the figures given in the previous paragraph, is quite inadequate.

7. The other remarks of the Sanitary Commissioner will now be dealt with in their order:—

I. The area to the west of the town is shown on the map (sheet No. 1). This area is not included in the scheme as it is beyond the thickly populated area of the town, but the question of draining it in future has been duly considered. The levels of this area are marked on the plan—*vide* sheet No. 1—and an inspection of these levels will show that the levels admit of this area being drained into the proposed sewers.

The Sanitary Commissioner's recommendation that sewer No. 2 be omitted must be condemned. The sewer is intended to intercept the sewage of an area that drains into the river which is the principal source of drinking water. Looking to this fact, and also that the area holds a population of 4,000 which is not insignificant enough to be ignored, the proposal of the Sanitary Commissioner to do away with the intercepting sewer does not appear to be advisable.

Sewer No. 1 is the sewer which passes through the valley in which the Karúr irrigation channel lies. It is not understood what Dr. King means by first saying that this sewer should be omitted and then recommending that an intercepting sewer should be laid in the valley through which the irrigation channel flows.

II. The undersigned cannot agree with Dr. King in thinking that a provision for quarter of an inch of rainfall would be sufficient. In England, where the rainfall is more equable than in tropical climates, it is considered necessary to provide for a rainfall of $\frac{1}{2}$ to 1 inch per hour. In India most of the rain falls in about three months of the year, and the rate of fall is frequently in excess of half an inch per hour. The reason advanced for curtailing the provision for rainfall, namely, that the town has a good surface fall, does not hold good in the case of a surface drainage scheme, though it would be so in an underground drainage scheme. In an underground drainage scheme proper arrangements can be made for excluding rain water from the sewers. It is impossible to exclude storm water from surface drains, and when a surface drain is not sufficiently large for storm water, it overflows, and the tendency is, it has been found, to scour out the sides of the road; on the cessation of rain the mud thus scoured out subsides into the bottom of the drain.

There will be no economy in limiting the rainfall to quarter of an inch. Most of the drains are 6 inches in size. It is inadvisable to have street drains of any smaller size. There will be a small saving in the large sizes of the drains, but this economy can only be effected at the sacrifice of efficiency.

Storm overflows on the intercepting sewer were fully contemplated when working out the scheme. Their omission on the plan is an inadvertence.

III. The proposal to defer the construction of the intercepting sewers was with reference to the execution of the scheme piecemeal. If only Rs. 2,000 are available yearly for expenditure on the scheme, it would take 15 years to complete the sewers alone. Until the street drains are completed the intercepting sewers would be inactive. The money should decidedly be laid out in the construction of street drains first. The great point is to remove the sewage from the streets; at present it soaks into ground at the door of the houses. If street drains are constructed first, it would remove the sewage from the immediate vicinity of the houses and could be discharged into the adjoining fields or cess-pits.

IV. Rupees 2,000 include cost of land. The land is suitable for sewage farming. There is no necessity or reason for underdraining the land. It is not proposed to realign streets. The realignment of a single street may probably cost as much as the whole scheme. All that would be necessary is to remove some very prominent projections in the shape of verandahs or pyals. What these will be can only be ascertained during the actual construction of the drains. There is no reason why a land liable to floods should not be converted into sewage farms. Of the two sites proposed, only one is liable to be flooded occasionally. Both the lands are now cultivated. If liability to floods is not a bar to its cultivation, it would not be a bar for a sewage farm, as when the land is flooded the sewers would be discharging at the overflows.

8. The manholes will be of the standard type proposed for Negapatam, the drainage scheme for which town has been approved by the Chief Engineer, Public Works Department. Messrs. Burn and Co.'s stoneware pipes have been estimated for. They will be jointed with cement with an inner ring of tarred yarn.

this defect; arrangements could easily be made so that the sewage from the drain could be used for irrigating and manuring land in the neighbourhood. *A drainage scheme is much required for this town and one is to be prepared.*"

G.O., dated 27th January 1893, *No.* 115 *M., Local and Municipal.*

Drainage.—"No change since last inspection, and most of the sewage sinks into the soil of the ground. The 'Komaty drain' was in the same defective condition and no proper arrangements had been made for the disposal of its contents. *A drainage scheme for the town is much needed and one is to be prepared.*"

G.O., dated 16th November 1893, *No.* 1584 *M., Local and Municipal.*

Drainage.—"The matter is at present engaging the attention of the Sanitary Engineer. The sewage is to be conducted to the north-east of the town; there is a suitable site for a sewage farm to the west of the Vangal road beyond the Pallars' village. The present drains are very unsatisfactory, and in many places the air is poisoned by the emanations from stagnant sewage. *A good drainage system will, no doubt, improve the quality of the well water of the town.* The Komaty drain appears to have been well constructed, but unfortunately the sewage is discharged directly into the river, and some people draw water below the point of discharge."

2. The above extracts go to prove that the Sanitary Commissioner's department has been for years perfectly cognizant of the fact that a drainage scheme for Karúr was under preparation, that they attached more importance to a drainage scheme than to a water-supply scheme, and that they reiterated remarks to the above effect in every inspection report since 1891.

3. As has been stated in the report on the drainage scheme, the original object of the scheme was that it should enable the municipality of Karúr to construct street drains in such localities where they were most needed on some concerted plan so as to form part of a general scheme for the town. But during the period that elapsed between the time that the question of a drainage scheme was first considered and its final submission to Government such emphatic opinions were pronounced by Doctors Laing and Dymott as to the necessity of a comprehensive drainage scheme that this department thought it desirable to suggest methods for carrying out the works within a limited number of years. There was, however, no wish on the part of this department to insist that the scheme should be taken up as a whole, for, in the concluding portion of paragraph 14 of the drainage report, it has been suggested that if means do not permit of the scheme being undertaken as a whole, the municipality should spend Rs. 2,000 yearly in constructing new drains according to the scheme.

4. Dr. King admits that Car Street, Main Bazaar Street and Komati Street need drains apart from the question of the introduction of a water-supply. With Rs. 2,000 annually it will take five years to drain the above three streets; at the expiration of five years there will probably be other streets that require draining. The undersigned adheres to the opinion expressed in the report on the drainage scheme that if means cannot be found to undertake the drainage scheme as a whole, the municipality should spend Rs. 2,000 annually in constructing street drains, taking up those first that require most attention.

5. A water-supply project for Karúr will cost not less than a lakh of rupees. The interest and sinking fund on a lakh of rupees will be Rs. 6,000 annually. The cost of pumping and maintenance of works will be about Rs. 4,000 annually. The project will thus cost the municipality about Rs. 10,000 annually, or if Government contribute a moiety of the capital cost, the annual charge will be Rs. 7,000.

6. A water-tax will bring to the municipality a revenue of Rs. 2,500, and this added to the Rs. 2,000 estimated as the probable yield from enhancement of house-tax and the imposition of profession tax, the total sum available for the water-supply project would be Rs. 4,500 which, looking to the figures given in the previous paragraph, is quite inadequate.

7. The other remarks of the Sanitary Commissioner will now be dealt with in their order:—

I. The area to the west of the town is shown on the map (sheet No. 1). This area is not included in the scheme as it is beyond the thickly populated area of the town, but the question of draining it in future has been duly considered. The levels of this area are marked on the plan—*vide* sheet No. 1—and an inspection of these levels will show that the levels admit of this area being drained into the proposed sewers.

The Sanitary Commissioner's recommendation that sewer No. 2 be omitted must be condemned. The sewer is intended to intercept the sewage of an area that drains into the river which is the principal source of drinking water. Looking to this fact, and also that the area holds a population of 4,000 which is not insignificant enough to be ignored, the proposal of the Sanitary Commissioner to do away with the intercepting sewer does not appear to be advisable.

Sewer No. 1 is the sewer which passes through the valley in which the Karúr irrigation channel lies. It is not understood what Dr. King means by first saying that this sewer should be omitted and then recommending that an intercepting sewer should be laid in the valley through which the irrigation channel flows.

II. The undersigned cannot agree with Dr. King in thinking that a provision for quarter of an inch of rainfall would be sufficient. In England, where the rainfall is more equable than in tropical climates, it is considered necessary to provide for a rainfall of $\frac{1}{2}$ to 1 inch per hour. In India most of the rain falls in about three months of the year, and the rate of fall is frequently in excess of half an inch per hour. The reason advanced for curtailing the provision for rainfall, namely, that the town has a good surface fall, does not hold good in the case of a surface drainage scheme, though it would be so in an underground drainage scheme. In an underground drainage scheme proper arrangements can be made for excluding rain water from the sewers. It is impossible to exclude storm water from surface drains, and when a surface drain is not sufficiently large for storm water, it overflows, and the tendency is, it has been found, to scour out the sides of the road; on the cessation of rain the mud thus scoured out subsides into the bottom of the drain.

There will be no economy in limiting the rainfall to quarter of an inch. Most of the drains are 6 inches in size. It is inadvisable to have street drains of any smaller size. There will be a small saving in the large sizes of the drains, but this economy can only be effected at the sacrifice of efficiency.

Storm overflows on the intercepting sewer were fully contemplated when working out the scheme. Their omission on the plan is an inadvertence.

III. The proposal to defer the construction of the intercepting sewers was with reference to the execution of the scheme piecemeal. If only Rs. 2,000 are available yearly for expenditure on the scheme, it would take 15 years to complete the sewers alone. Until the street drains are completed the intercepting sewers would be inactive. The money should decidedly be laid out in the construction of street drains first. The great point is to remove the sewage from the streets; at present it soaks into ground at the door of the houses. If street drains are constructed first, it would remove the sewage from the immediate vicinity of the houses and could be discharged into the adjoining fields or cess-pits.

IV. Rupees 2,000 include cost of land. The land is suitable for sewage farming. There is no necessity or reason for underdraining the land. It is not proposed to realign streets. The realignment of a single street may probably cost as much as the whole scheme. All that would be necessary is to remove some very prominent projections in the shape of verandahs or pyals. What these will be can only be ascertained during the actual construction of the drains. There is no reason why a land liable to floods should not be converted into sewage farms. Of the two sites proposed, only one is liable to be flooded occasionally. Both the lands are now cultivated. If liability to floods is not a bar to its cultivation, it would not be a bar for a sewage farm, as when the land is flooded the sewers would be discharging at the overflows.

8. The manholes will be of the standard type proposed for Negapatam, the drainage scheme for which town has been approved by the Chief Engineer, Public Works Department. Messrs. Burn and Co.'s stoneware pipes have been estimated for. They will be jointed with cement with an inner ring of tarred yarn.

9. The silt traps are economical and their efficiency has been practically tested. Their positions are marked on the sections of streets.

10. The iron tank holds water sufficient to charge the syphon twice. A flush is most needed when the sewers run at their lowest. This is usually between 12 and 3 P.M., or between 9 P.M. and 3 A.M. These are inconvenient hours for a cooly to work, it is therefore considered best to store the full supply required in the iron tank, and so regulate the tap that the syphons will act about the time a flush is most needed. It is proposed to manufacture the syphon locally.

11. Dr. King has reproduced in his memorandum an illustration which he describes as a free air inlet arrangement. The exact function of this arrangement is to expel air from the syphon chamber as it is being gradually filled up. A simple opening in the side of the chamber near its top will serve the purpose of an air outlet efficiently. In fact, the arrangement shown by Dr. King is not applicable to the syphon proposed for Karúr. It can only be adopted when the syphon chamber is placed under a street, in which case it is not desirable to have an opening immediately over the top of the chamber as this would admit dust.

FORT ST. GEORGE,
25*th June* 1894.

(Signed) R. E. ELLIS,
Ag. Sanitary Engineer to Government.

S. E. 6 22-8-93—1,000.

GOVERNMENT OF MADRAS.

No. 2567

OFFICE OF SANITARY ENGINEER,

Fort St. George, 28th November 1893.

From

J. A. JONES, ESQ., MEM. INST. C.E., F.R.S.E.,

SANITARY ENGINEER TO GOVERNMENT,

To

The Chief Secretary to Government.
Local & Municipal Department

SIR,

Agreeably to the programme of work of this Department for 1893 approved in G. O. dated 12th December 1892, No. 2035 M, Local & Municipal, I have the honor to forward herewith plans, estimate & a report on a sche for the improvement of the drainag of Karur.

2. Eighteen sheets of longi-tudinal sections showing size, gradient & levels of street drains are being bound in book form, bu I presume it will not be necessar to forward these to Government.

I

I have the honor to be,
Sir,
Your most obedt. Servt.

Sanitary Engineer to Govt.

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28

Report on a scheme for the improvement of the Drainage of Karur.

The town of Karur lies on the left bank of the Amravati river. It is on elevated ground which from a central point within the town slopes down on all sides. It is therefore evident that if the drainage of the whole town is to be collected at one point an intercepting sewer completely encircling the town is required.

2. Except in one or two streets there are no masonry drains in the town.

3. The streets have a good fall averaging about 1 in 100.

4. The town supply of water is derived from pits or channels in the bed of the Amravati and from wells within the town itself. The river water is said to be good and is freely used (vide Abstract of Sanitary Reports of Municipalities, page 76 - The annual

Report

Report of the Sanitary Commissioner for Madras for 1892). There is therefore no immediate necessity for an improved piped supply of water; and as long as the supply remains unpiped, it will be very limited probably not more than 2 or 3 gallons per head per diem.

5. A good surface fall and a limited supply of water are good reasons for preferring a surface drainage scheme.

6. In the present scheme the surface drains are designed to carry off a rainfall of ½ an inch per hour. The maximum rainfall at Karur within the past 16 years was 3.5 inches in 1880, and of this some 11 inches fell in October. The provision of ½ an inch per hour is ample.

7. The gradient of the drains must necessarily depend upon the surface fall of the streets which, as already stated, averages about 1 in 100, and the average velocity in the drains when running full would be about 3 feet per second.

8. The drains proposed are semioval in shape with their top breadth equal to the depth, (vide plan No. 3). They will be constructed of brick in chunam. The two side walls will be capped with table moulded bricks in cement on cement concrete slabs, and the inside of the drains will be plastered in cement.

9. The town is divided into seven areas for the purpose of drainage. The drainage of each area will be concentrated at a point at the base of the cone which forms the town site. For the collection of the sewage proper from these various areas there will be two sewers starting in opposite directions from the west end of the town. The two sewers which are denominated No. 1 & No. 2 converge near the toll gate at the South entrance to the Railway Compound. A combined sewer then passes along the road to Kankal to the proposed sewage farm, which will be to the north of the Railway line. There are here two sites for

Report of the Sanitary Commissioner for Madras for 1892). There is therefore no immediate necessity for an improved piped supply of water; and as long as the supply remains unpiped, it will be very limited probably not more than 2 or 3 gallons per head per diem.

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for the sewage farm; the choice must depend upon financial considerations. The land marked B is sufficiently low to be commanded by the sewer. If this land is selected, the sewer will terminate in a small cistern from which the sewage will be conveyed in an open carrier as shown by dotted red line on the general plan. The only objection to this site, and that not a very important one, is that it is liable to be flooded. The fact that the sewage will be delivered on the land by gravitation is a sufficient recommendation for its adoption. The other site marked A on plan is a short distance inland from the sewer. It is the lowest site above flood level within a reasonable distance of the town. But sewage will be required to be lifted on to the ground. No pumping machinery will be required as long as the present water supply continues. With the present supply two picottahs will be able to lift the sewage of the whole town.

The question of the sites may be left open at present for reasons that will be explained later on in this report.

10. In calculating the sizes of the intercepting sewers a provision has been made for a flow of 15 gallons per head per diem, half of which will be discharged in 6 hours. Fifteen gallons is the accepted minimum piped supply of water for towns in this Presidency. The population of Karur was in 1881 9,205 and in 1891 it was 10,750. The intercepting sewers are designed for a population of 15,000.

11. Sewer No. 1 will eventually receive the sewage from a population of about 10,000 which gives a discharge of 33 lcft. per minute. A 9" pipe with a fall of 1 in 300 flowing half full and having a velocity of 2½ feet per second will discharge 33 lcft. per minute.

In 30 years time

12. Sewer No. 2 will ultimately receive the sewage from a population of 5,000 which will give a discharge of 17 lcft. The theoretical diameter of sewer for this discharge would be 6". But for

the

other reasons it is considered inadvisable to have an intercepting sewer of a less size than 9". To give a flow of 1·7 cft. per minute the depth in a 9" pipe will be 3·7 inches, and this will give a velocity of 2·28 feet per minute. With the usual flushing arrangements the sewers will not give any trouble.

13. It has been stated that the question of the sites may be left open for the present. The reason for this is that there is no likelihood of the scheme being carried out in its entirety within say the next 10 or 15 years. The circumstances which lead to the preparation of the scheme are as follow:-

Sometime ago the Kayar Municipality wished to construct drains in some of the important streets. They were informed that to lay disconnected bits of drains without any reference to one another was not advisable, and it was recommended that a scheme should be prepared first and any streets may then be drained in conformity with the scheme. There is therefore no undertaking on the part of the Municipality to see the scheme carried out if one was prepared. The Municipality may not be able to carry out the scheme as a whole without substantial aid from Government.

14. The rate at which the tax on buildings in Kayar is assessed is 6¼ per cent. If building tax be raised to the maximum of 7½ per cent and if profession tax be levied, it is believed that the Municipality will obtain an additional income of about Rs 2,000 which, on the assumption that Government will grant a loan, is sufficient to pay the interest & sinking fund on say Rs 30,000. For this sum only half of the surface drains in the scheme could be constructed. Government may however be able to give a grant in addition, and if this amounted to Rs 29,000 all the surface drains could be completed. If however

however the Government can neither give loan nor contribution, the Municipality should spend the Rs 2,000 yearly in constructing new drains according to this scheme, taking up such streets first as require most attention; a substantial improvement in the drainage of the town would thus be effected in the course of a few years.

15. The construction of the intercepting sewers may be deferred until a sufficient number of street drains have been constructed to keep up a sufficient flow in the sewers. In the meantime the sewage can be utilised on a long strip of land which is about 1,000 feet broad and lies between the town & the river, or diverted into the irrigation channels that run on the west of the town. The cost of the complete scheme is Rs 95,853 distributed as follows:-

Surface drains.

	Rs
Block A	11,328
Block B	3,451
Block C	4,430
Block D	2,760
Block E	6,079
Block F	4,303
Block G	18,914
Intercepting Sewer No 1	9,465
do No 2	11,242
12" outfall sewer	6,849
silt traps	1,000
Flushing arrangements	2,000
Sewage farm	2,000
Well	200
Contingencies	11,824
Total	95,853

Note — Total for surface drains with contingencies is Rs 69,000.

Sanitary Engineer to Govt.

No. 6 Letter No. 2567 of 1893

From

The Sanitary Engineer
to Government

To

The Chief Secretary
to Government
Local & Mun^l. Dept.

SANITARY ENGINEER 2 747 TO THE GOVERNMENT OF MADRAS

P.W.E.1 / 10385/93

Report on a scheme for the improvement of the drainage of Karur.

b / 2425 W of 93

P. W. CURRENT No. 10385

~~LOCAL AND MUNICIPAL DEPARTMENT.~~

~~Local & Municipal Dept~~

~~CURRENT No 2425 M~~

7 P.

From

The Sanitary Engineer
to Government,

To

The Chief Secretary
to Government,
Local and Municipal Dept.

Enclo 3 (Enclo 3 contg 4 plans in one roll)

No. 2567

Recd: 6.12.93

Dated 28th November 1893

Received

Enclosures 6 (4 plans)

SUBJECT.

Improvement of the Drainage of Karur.

Submitting plans, estimates and report for the ——.

SANITARY ENGINEER TO THE GOVERNMENT OF MADRAS
In 1747

TO BE RETURNED WITH REPLY.

No 867

Referred to the Public Works department for remarks.

A. J. King Ce

Assistant Secretary

V.R. 7/12/93

Fort St George 5th December 1893

I For examination

To

The Public Works Department.
(with plans and estimates (to be returned).

+ sent separately

No. 878 C

Government of Madras.

PUBLIC WORKS DEPARTMENT.

Endorsement.

~~MEMORANDUM.~~

552 M

Dated Madras, 26th February ~~189~~ 1894.

From the Sanitary Engineer to Government No 2567 d/28th November 1893.

Endorsement thereon in the Local and Municipal Dept. No 867 d/5th Decr 1893.

—

The Sanitary Engineer's proposals with regard to the drainage of the town of Karur in the Coimbatore District are approved in the P. W. Department.

[signature]

Col R.E.

Secretary to Government P.W.D.

To The Local & Municipal Dept with plans and Estimates and the Sanitary Engi.... letter returned.

41—1,000-19-8-93.

P. W. CURRENT No. 10385
LOCAL AND MUNICIPAL DEPARTMENT.

~~Local & Municipal Dept~~
~~CURRENT No 2425 M~~

7 P.

From

The Sanitary Engineer
to Government,

To

The Chief Secretary
to Government,
Local and Municipal Depts.

No 867

Referred to the Public Works department for remarks.

A. J. Pring Co.
Assistant Secretary

Enclos 3 (Enclos 3 contg 4 plans in one roll)

No. 2567

Recd: 6.12.93

V.R. 1/12/93

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5th December 1893 }

Dated 28th November 1893
Received
Enclosures 6 (4 plans)

TO BE RETURNED WITH REPLY.

SUBJECT.

Improvement of the Drainage of Karur.

Submitting plans, estimates and report for the ——.

SANITARY ENGINEER TO THE GOVERNMENT OF MADRAS
In 174

I For examination
6 12 93

To
The Public Works Department.
(with plans and estimates (to be returned).
+ sent separately

(with an Endorsement)

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Government of Madras.

PUBLIC WORKS DEPARTMENT.

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To
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41—1,000-19-8-93.

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[0]

LOCAL AND MUNICIPAL DEPARTMENT.

Local & Municipal Dept
CURRENT No. 552m

Karur Drainage

From

The Public works Dept

No. 254

Referred to the Sanitary Commissioner for remarks.

(By order)

Lionel Davidson
Acting Assistant Secretary

Dated 26 - 2 - 1894.

Received

Enclosures No. 2425m of 93 with encl: 6 (4 plans) returned.

SUBJECT.

Approving proposals of the Sanitary Engineer regarding improvement to the drainage of Karur in the Coimbatore District.

To,

The Sanitary Commissioner.

OFFICE OF SANITARY COMMISSIONER,

Fort St. George, 2nd May 1894.

Local & Municipal Dept
CURRENT No. 1090 m

No. 1019/S.

From

SURGEON LIEUT.-COL. W. G. KING, M.B., C.M., D.P.H.,

by SANITARY COMMISSIONER FOR MADRAS,

To

THE Chief Secretary to Government Local and Municipal Department.

Enclosures 9

SIR,

† herewith returned.

With reference to your endorsement No. 254 dated 2nd April 1894, Local and Municipal, I have the honor to submit herewith a Memorandum upon the proposed Karur drainage scheme.

Memorandum — 1
Encl. No. 878C of 26/2/94 from the P.W. Dept — 8
work & Encls: — 9

2. The plans and † estimates which accompanied the above reference are herewith returned.

I have the honor to be
Sir
Your most obed Servant

W G King.

Surgn: Lt: Col:
Sanitary Commissioner

[0]

LOCAL AND MUNICIPAL DEPARTMENT.

Local & Municipal Dept
CURRENT No. 552M

Karur Drainage

From

The Public Works Dept.

No. 254

Referred to the Sanitary Commissioner for remarks.

(By order)

Lionel Davidson
2.4
Acting Assistant Secretary

Sanitary Engineer to the Government of Madras Dn 1747.

No. 878 C.

Dated 26 - 2 - 1894.

Received

Enclosures C.No. 2425M of 93 with encl. 6 (4 plans) returned.

V.R. 2/4/94

Fort St. George }
2nd April 1894 }

SUBJECT.

Approving proposals of the Sanitary Engineer regarding improvement to the drainage of Karur in the Coimbatore District.

To,

The Sanitary Commissioner.

TO BE RETURNED WITH REPLY.

No. 1019/S.

OFFICE OF SANITARY COMMISSIONER,

Fort St. George 25th May 1894.

Local & Municipal Dept
CURRENT No. 1090 M

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From

SURGEON LIEUT.-COL. W. G. KING, M.B., C.M., D.P.H.,

Ag: SANITARY COMMISSIONER FOR MADRAS,

To

THE Chief Secretary
to Government
Local and Municipal Department

Enclosure 19.

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With reference to your endorsement No. 254 dated 2nd April 1894, Local and Municipal, I have the honor to submit herewith a Memorandum upon the proposed Karur drainage scheme.

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I have the honor to be
Sir
Your most obed. Servant
W G King
Surgn: Lt. Col.
Ag Sanitary Commissioner

4/4

The Scheme.

I (Para 1) Although there is a slope on all sides, it is far from equal, and the expenditure necessary for surrounding the Town with an intercepting sewer, should therefore be reconsidered. Holding in memory the fact that, as the scheme stands, the large area to the West of Manor Channel has been omitted - an area which is now rapidly increasing as to new houses and prosperity, and where all future extension of the Town must occur - it is worth-while considering whether the simple plan of surrounding the main portion of the Town is the best to follow, in the interests of economy. I believe intercepting sewers No 1 and No 2 could safely be dispensed with. The chief purpose of sewer No 2 is the reception of sewage from very small portions of the Town bordering the river. Inspection of these areas shows that they consist almost exclusively of mud thatched parish huts, placed with the utmost irregularity

irregularity, so that nothing short of rebuilding the whole would allow of drainage being carried out, and, then, the question as to who is to pay for impervious purfaces in these poor private dwellings would still be a matter of doubt. Intercepting sewer No 1 also means heavy expenditure, for the very few houses between the station and North Agraharam Street.

(2) It is practicable to drain the chief and well populated parts of the Town towards the valley in which the Karur Channel lies, and by trusting to a single intercepting sewer laid here that important part of the Town to the West now ignored, can also be efficiently drained. This intercepting sewer could discharge upon land with a suitable level in the direction of the discharge of the channel on the West of the Town, or, on the opposite side of the railway line. A collecting well, as in the original design, might be necessary, but it is

possible land could be commanded direct by the outfall sewer. Given a limited sum of money, I believe this modification of the scheme would afford the best sanitary results in practice - although the scheme of the Sanitary Engineer's Department is theoretically complete for the portion of the Town attended to.

II (Paras 6 and 7.) I consider 1/2" of rainfall per hour an unnecessarily large amount to receive, in the instance of this Town. In consideration of the excellent surface fall available, storm water might practically be ignored except as to small amounts for Courtyards, and, thus, further economy as to size of surface drains could be secured. Notwithstanding the receipt on an area of, roughly, 105 acres of 1/2" rainfall per hour or about 132.72 Cubic feet per minute, it is noted not a single overflow has been provided, although good facilities for these exist, and are desirable. The outfall sewer is capable of discharging 115.4 Cubic feet

per

per minute only. Overflow must there-
-fore be expected at the third man-
-hole from the junction with sewer No 1
unless storm water overflows are pro-
-vided, whilst both sewers Nos 1 and 2
will back up for a considerable dis-
-tance beyond this point. In case
the collecting well is adopted, during
storms, and at times when lifting
machinery is not working, silting
and storage of sewage will occur
in both sewers.

III (Para 15) The principle here ad-
-vocated of building the intercepting
sewer after the surface drains
have been formed, should be avoided
both from an Engineering and Sanitary
point of view. Construction should
commence from the main sewers
to the periphery.

Estimate and Plans.

IV. Sewage farm. Whether the
£2000 includes compensation or not
for ground, is not stated. Likewise,
neither the nature of the soil and
its suitability for sewage farming,
nor whether it is to be under-drained.

is

is stated. No value for land acquire-
nor for the realignment of streets or
houses, is mentioned. None of
these are trivial points, and should
have been quoted. It would not
be advisable to take up a site for
the sewage farm liable to flood.

No specification, or reference to
the standard plans, is afforded
as to the form of the manholes, na-
-ture of joints of stoneware pipes, or
name of the maker

In my opinion, the silt traps
are bad in form. no idea is given
as to the position of these.

All plans, I think, should be
prepared so that if the designer
were to proceed on Gas or the day following
submission, there should be no
doubt as to what his intentions
were, and this is the rule followed
in all Engineering undertakings,
and would be advisable here also.

The statement as to "flushing
arrangements" is indefinite, but
it is to be supposed in the ab-
-sence of a public water-supply

that

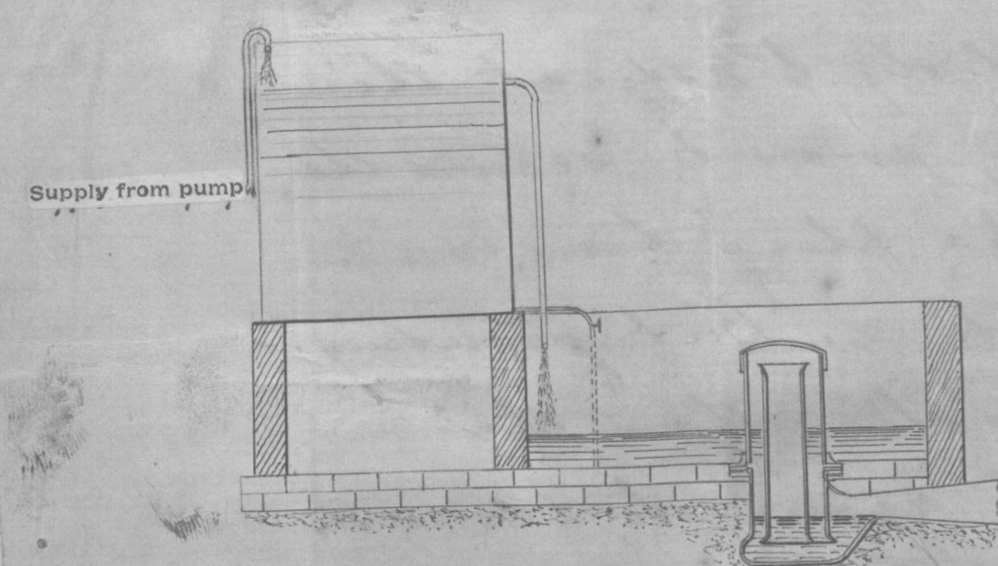
that pumping from a convenient
well or stream is intended into
the iron reservoir exhibited in the
plan, in communication with the
automatic syphon. The object of an
automatic flush, when it is re-
-quisite to pump the water by
manual labour is not very evi-
-dent. The attendance of a cooly
once daily, in any case, is necessary,
and it would not be too much
to expect this cooly to repeat this
in the evening, so as to secure the
pulling up of a plug from an in-
expensive cistern. But granting
something neater than this ~
rough mode is requisite, I cannot
see the object of the chamber for the
automatic syphon, plus the storage
for the full amount of water.
Economy would be secured with-
out loss of efficiency, by arranging
that a reservoir be made to con-
-tain half the total water so that
on its being filled completely it
would allow of overflow [by a large pipe] to the
syphon compartment which could
thus

148

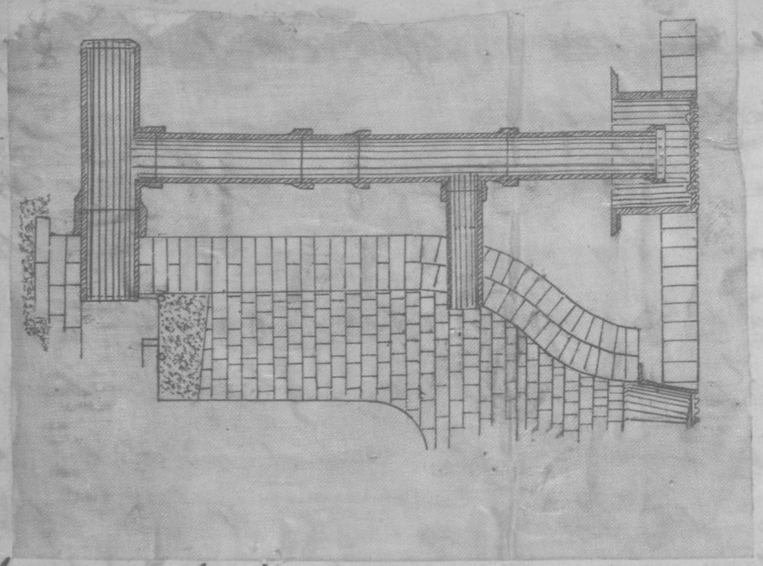
thus discharge, allowing for a gra-
-dual filling and a second ~
automatic discharge, that might be
regulated by a small pipe (vide margin), the ar-
-rangement would, I think, be
more economical than that ~
shown in the plans. The loss of

C1436M

Wrought iron water tank
8800 gallons, costs about Rs. 95



[illegible] shing is of
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[illegible] are of such
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[illegible] syphon cham-
-ber to allow of [illegible] the syphon
readily, it being, in fact, stated
that without this the syphon will
not work. Possibly, the form selected
by the Sanitary Engineering Depart-
-ment will work without this
precaution; but the usual arrang-
-ment adopted in consequence
of this belief is as follows:—



DEPUTY SUPERINTENDENT.
10 July 1894
MADRAS REVENUE SURVEY.

Irrespective of the syphon question, this being the head of the sewer it would be better that it be ventilated. The plan leaves it to imagination how the syphon flush chamber is to be entered for cleansing, regulating flow &c.

Necessity for the scheme.

V (Para 4) The Sanitary Engineer's Department relies upon statements in abstracts of Sanitary reports page 76, Annual Report for 1892, as to necessity of drainage. These "abstracts" are from Reports by Chairmen of Municipalities, and, although the Sanitary Commissioner may modify or expunge certain statements and is responsible, it must be remembered they are not "original". The following are

are the views expressed by my predecessors:-

"The river is the principal "drinking-water supply, but it is "an unsatisfactory source as it is "subjected to contamination in "many ways and bodies are "burnt and buried in its bed. "There are 17 public wells - all "having walls and platforms, "but they are not provided with "drains to carry away the waste "water. The private wells in the "backyards of houses usually "contain brackish water - "and are wholesome supplies."*

* G.O. No. 115 M. dated 27th January 1893.

"Drinking water is obtained "from the river Amaravati - "and from wells. The river sup- "-ply is not satisfactory, for "the water has probably "been polluted at every town "and village near which "the river has flowed and "after its arrival at Karur the "water is made still more im- "-pure by the burning and burial

of

"of bodies, by the washing of bodies
"and clothes and by the discharge
"into the river of town sewage. x x x x.
"There are several well constructed
"wells in the town but the water of
"some of them is in danger of being
"contaminated with sewage. Ex-
"-cept towards the river,
"water is at a considerable depth
"from the surface of the ground.
"The people living to the north
"of New Street complained that they had
"to go all the way to the river for
"drinking water*."

Indeed, the mere fact of Con-
-sumption being reckoned by the
Sanitary Engineer's Department
at only 3 gallons per head, seems to
me a sufficient reason for the
urgency for a water-supply be-
-ing established. The restriction
of the use of water below require-
-ments for sanitary purposes, shows
the difficulty with which
water is obtained. As a fact,
great inconvenience is felt as to
the

* G.O. No. 1584 in dated 16th November 1893.

the distance of this new supply.
The Chairman, for example, informed
me that he lives so far from the
river, that he has to content
himself with "brackish well water".
The river water is highly contamin
-ted with faecal matter. Cholera
mortality in Karur amounted,
during the last epidemic, to 9.6
per mille. I believe, therefore, that the rea
-son given by the Sanitary Engineer
Department as to the urgency of
drainage when compared with a
water-supply, is not tenable.
Any scheme of drainage of Karur
would be attended with much
difficulty as to obtaining good
sanitary results, if applied to
the whole Town. Although the
Engineering task in laying out
drains it would be simple
enough, the after joining of the
houses would be unusually
complicated, except in three, or four main
streets the houses drain not
towards the front, but to the back
into lengthy Courtyards. If, therefore
to

to get rid of existing nuisances. Car Street, main Bazaar Street and Vernity Street were drained into suitably situated land, I believe, so far as drainage is concerned, these steps would be temporarily sufficient, whilst it would be advisable for Government to direct the energies of the Sanitary Engineer's Department to the task of giving the Town a pure public water supply, which ought not to prove an expensive matter.

W. S. King

Surgeon Lieut. Col.
Dy Sanitary Commissioner
for Madras.

Fort St. George
19 May 1894

In 1747

1/1090 in 4/14

Local & Municipal Dep
CURRENT No. 1090 M

Local & Municipal DEPARTMENT.

From
W. G. King M.B., C.M.,
SURGEON LIEUT.-COL. ~~J. A. LAING~~, D.P.H.
Ag SANITARY COMMISSIONER FOR MADRAS,

To
THE Chief Secretary
to Government
Local and Municipal Dept

No. 1019/5

Dated 21st
Despatched 21st May 1894.
Received 22 MAY. 94

ENCLOSURES. 9 L & C. Nos
2425 M of 93 with encls 6 (4 plans)
& 55-2 M of 94 retd

Subject.

Submitting a Memorandum upon the proposed Karur drainage scheme in the Coimbatore District.

[960—8-12-92.]

(with an Endorsement)

9th 9-1-94 — 2035 M 12-12-92
1584 M 16-1-93 — 291 M 13-2-92
1141 M 29-8-93 — 77 M 16-5-90
115 M 27-1-93 — 315 — 3-90
1320 —
1190 — 7-10-89

Print this paper with enclosures from S.E. as directed by A.S. Vide Slip with M.R.

Enclosure No. 1 to letter No. 1411 of 1894

C.S.

TO BE RETURNED WITH REPLY.

No. 427

Referred to the Sanitary Engineer, for remarks.

By order

V.R. 29/5/94

Lionel Davidson 31.5
Fort St. George 4th June 1894 } Ag. Asst. Secretary.

SANITARY ENGINEER TO THE GOVERNMENT OF MADRAS
1747

To The Sanitary Engineer with plans.

& sent separately

S.E./6 2-2-94—1,000.

No. 1411

GOVERNMENT OF MADRAS.
OFFICE OF SANITARY ENGINEER,
Fort St. George, 25th June 1894.

Code Class

INDIAN TELEGRAPHS. Monthly Number.

To (Office) Telephone Message	From (Office)
Words / Day 9 / Hour 11 / Minute 40	Official Instructions
To (Person) Hd. Clerk Chief Secy	From (Person) Supdt. Cash Press

The Survey Dept have sent a reminder regarding the two diagrams relating to C. No. 1436 of C. The proof is still with you.

7-10-94

Reply

Who please is subject 7 G. No. 1436 M. If proof was sent me it has gone to Govt.

7/10

7-10-94
1849

L.N.	Sent to	L.N.
	At Hrs. Mts. by	

Telegr

3—23,00,000.

Local & Municipal
CURRENT No.

Local & Municip

From

W. G.

SURGEON LIEUT.-C

Ag SANITARY COM

To

THE Ch

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Dated

Despatched

Received 2

Subm
-pandum
proposed Karur
scheme in the Coimbatore
District.

To The Sanitary Engineer.
with plans.

[960—8-12-92.]

(with an Endorsement)

S.E./6 2-2-94—1,000.

No. 1411

GOVERNMENT OF MADRAS.

OFFICE OF SANITARY ENGINEER,

Fort St. George, 25th June 1894.

INDIAN TELEGRAPHS. Monthly Number.

To (Office) Telephonic message | From (Office)

Words	Day.	Hour.	Minute.	Official Instructions.
	9	12	45	

To (Person) Hd Clerk Chief Secy

From (Person) Supdt Govt Press

Subject of C. No. 1426 M. is a report on a scheme for the improvement of the drainage of Karur.

9-10-94

L.N. Mts. by | Sent to L.N. At Hrs. Mts. by

Telegraph Master.

No. 331 T—29-9-93—23,00,000.

Local & Municipal Dept

CURRENT No. 1090 M PBK

1584 h 16-1-93 ✓ 291 ... 13-2-92
1141 h 29-8-93 ✓ 77 ... 16-5-90
115 h 27-1-93 ✓ 315 ... 3-90
1320 ... 7-10-89
1190 ... 10-...

Print this paper with instructions from S.E. as directed by A. S. Vide Slip

Local

From

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[960-8-12-92.]

(with ...

25/6/94 ... & print separately

S.E./6 2-2-94-1,000.

No. 1411

GOVERNMENT OF MADRAS.

OFFICE OF SANITARY ENGINEER,

Fort St. George, 25th June 1894.

Local & Municipal Dept

CURRENT No. 1436 M

From

R. E. ELLIS, Esq., ASSOC. M. INST. C.E.,

ACTING SANITARY ENGINEER TO GOVERNMENT,

To

The Chief Secretary to Government,
Local & Municipal Department.

SIR,

With reference to your endorsement No. 427 dated 4th June 1894, I have the honor to submit herewith a memorandum on the Acting Sanitary Commissioner's remarks on the Karur Drainage Scheme.

2. The papers which accompanied the reference above quoted are herewith returned.

I have the honor to be,
Sir,
Your most obdt. Servt.

R. E. Ellis.

Ag. Sany. Engr. to Govt.

[initials]

[initials]

Local & Municipal Dept.
CURRENT No 1091 & PBJC

To

Memorandum on the Acting Sanitary Commissioner's remarks on the Kanew Drainage Scheme.

The principal point in the Acting Sanitary Commissioner's memorandum that requires a reply is the urgency or otherwise of a drainage scheme for Kanew. Dr. King quotes certain remarks of his predecessors in support of his contention that Kanew stands more in need of a water supply than drainage. Dr. King would have represented facts more correctly if he had quoted also the remarks of his predecessors on the drainage of Kanew side by side with their remarks on its water supply. The undersigned begs to invite the attention of Government to the following remarks of Dr. Laing & Dymott extracted from the very Government Orders quoted by Dr. King. G.O., dated

13th

13th February 1892, et. 291 hw, Local and Municipal.

Drainage:- "There is no system of drainage and most of the sewage sinks into the soil of the town. Three streets have been provided with drains which discharge into the Amaravati river and Panchamadivi channel. The "Komaty drain" is in the same condition, and as no arrangements have been made for the disposal of its contents they form an elongated cesspool at its end. Some measures should be taken to remedy this defect; arrangements could easily be made so that the sewage from the drain could be used for irrigating and manuring land in the neighbourhood. A drainage scheme is much required for this town and one is to be prepared."

G.O. dated 27th January 1893, No. 115 hw., L & hw.

Drainage:- "No change since last inspection, and most of the sewage sinks into the soil of the ground. The "Komaty drain" was in the same defective condition and no proper arrangements had been made for the disposal of its contents. A drainage scheme for the town is much needed and one is to be prepared."

G.O. dated 16th November 1893, No. 1584 hw., L & hw.

Drainage: The matter is at present engaging the attention of the Sanitary Engineer. The sewage is to be conducted to the north-east of the town; there is a suitable site for a sewage farm to the west of the Vaugal Road beyond the Pallars' village. The present drains are very unsatisfactory, and in many places the air is poisoned by the emanations from stagnant sewage. A good drainage system will, no doubt improve the quality of the well water of the town. The Komitee drain appears to have been well constructed, but unfortunately the sewage is discharged directly into the river, and some people draw water below the point of discharge."

The above extracts go to prove tha

2. the

13½ Ex 1.

that the Sanitary Commissioner's
department has been for years
perfectly cognizant of the fact that a
drainage scheme for Karur was under
preparation, that they attached more
importance to a drainage scheme than
to a water supply scheme and that
they reiterated remarks to the above
effect in every inspection report since
1891.

3. As has been stated in the
report on the drainage scheme, the
original object of the scheme was that
it should enable the Municipality of
Karur to construct street drains in
such localities where they were most
needed on some concerted plan so as to
form part of a general scheme for the
town. But during the period that
elapsed between the time that the
question of a drainage scheme was
first considered and its final sub-
mission to Government such em-
phatic opinions were pronounced
by Dr. Laing & Dymott as to the
necessity

necessity of a comprehensive drainage
scheme that this department thought
it desirable to suggest methods for
carrying out the works within a
limited number of years. There was,
however, no wish on the part of this
department to insist that the
scheme should be taken up as a
whole; for, in the concluding portion
of para 14 of the drainage report it
has been suggested that if means
do not permit of the scheme being
undertaken as a whole, the Munici-
-cipality should spend Rs 2,000 yearly
in constructing new drains accor-
-ding to the scheme.

4. Dr. King admits that Car
Street, Main Bazaar Street & Komati
Street need drains apart from the
question of the introduction of a
water supply. With Rs 2,000 annually
it will take 5 years to drain the above
three streets; at the expiration of 3
years there will probably be other
streets that require draining

into

the

that the Sanitary Commissioner's
department has been for years
perfectly cognizant of the fact that a
drainage scheme for Karur was under
preparation, that they attached more
importance to a drainage scheme than
to a water supply scheme and that
they reiterated remarks to the above
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such localities where they were most
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form part of a general scheme for the
town. But during the period that
[illegible] per Rs 2,500, and
this added to the Rs 2,000 estimated as
[illegible]
able yield from enhancement
use tax and the imposition
of
by Drs Laing & Dymott as to the
necessity of a comprehensive drainage scheme that this department thought it desirable to suggest methods for carrying out the works within a limited number of years. There was, however, no wish on the part of this department to insist that these schemes should be taken up as a whole, for, in the concluding portion of para 14 of the drainage report it has been suggested that if means do not permit of the scheme being undertaken as a whole, the Municipality should spend Rs 2,000 yearly in constructing new drains according to the scheme.

4. Drs King admits that Car Street, Main Bazaar Street & Komati Street need drains apart from the question of the introduction of a water supply. With Rs 2,000 annually it will take several years before the recommendation that Sewer No 2 be omitted must be condemned. The sewer is intended to intercept the sewage of an area that drains into the

undersigned adheres to the opinion
expressed in the report on the drainage
scheme that if means cannot be
found to undertake the drainage
scheme as a whole, the municipality
should spend Rs 2,000 annually in
constructing street drains taking
up those first that require most
attention.

5. A water supply project for
Karwa will cost not less than a lakh
of rupees. The interest & sinking funds
on a lakh of rupees will be Rs 6,000
annually. The cost of pumping and
maintenance of works will be about
Rs 4,000 annually. The project will thus
cost the municipality about Rs 10,000
annually, or if Government contri-
bute a moiety of the capital cost
the annual charge will be Rs 7,000.

A water tax will bring to the
municipality a revenue of Rs [illegible]
this added to the Rs 2,000 estimated as
available yield from enhancement
of
house tax and the imposition
of
profession tax, the total sum available
for the water supply project would be
Rs 4,500 which, looking to the figures
given in the previous paragraph, is
quite inadequate.

7. The other remarks of the
Sanitary Commissioner will now
be dealt with in their order.

I. The area to the west of the town
is shown on the map (sheet No. 1). This
area is not included in the scheme
as it is beyond the thickly populated
area of the town; but the question of
draining it in future has been duly
considered. The levels of this area are
marked on the plan, vide sheet No. 1,
and an inspection of these levels
will show that the levels admit of
this area being drained into the
proposed sewers.

The Sanitary Commissioner's
recommendation that Sewer No 2 be
omitted must be condemned. The
sewer is intended to intercept the
sewage of an area that drains into
the

the river which is the principal source of drinking water. Looking to this fact and also that the area holds a popu- -lation of 4,000 which is not insignif- -icant enough to be ignored, the proposal of the Sanitary Commissioner to do away with the intercepting sewer does not appear to be advisable.

Sewer No. 1 is the sewer which passes through the valley in which the Karur Irrigation Channel lies. It is not understood what Dr. King means by first saying that this sewer should be omitted and then recommending that an intercepting sewer should be laid in the valley through which the Irrigation Channel flows.

II. The undersigned cannot agree with Dr. King in thinking that a provision for ¼ an inch of rainfall would be sufficient. In England where the rainfall is more equable than in tropical climates it is considered necessary to provide for a rainfall of ½ to 1 inch per hour. In India most of the rain falls in about three months of the year, and the rate of fall is frequently in excess of ½ an inch per hour. The reason advanced for curtailing the provision for rainfall namely that the town has a good surface fall does not hold good in the case of a surface drainage scheme though it would be so in an underground drainage scheme. In an underground drainage scheme proper arrangements can be made for excluding rain water from the sewers. It is impossible to exclude storm water from surface drains and when a surface drain is not sufficiently large for storm water, it overflows and the tendency is, it has been found, to scour out the sides of the road, on the cessation of rain the mud thus scoured out subsides into the bottom of the drain.

There will be no economy in limiting the rainfall to 1/4 of an inch

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inch. Most of the drains are 6 inch in size. It is inadvisable to have street drains of any smaller size. There will be a small saving in the large sizes of the drains, but this economy can only be effected at the sacrifice of efficiency.

Storm overflows on the intercepting sewers were fully contemplated when working out the scheme. Their omission on the plan is an inadvertence.

III. The proposal to defer the construction of the intercepting sewers was with reference to the execution of the scheme piecemeal. If only Rs 2,000 are available yearly for expenditure on the scheme, it would take 15 years to complete the sewers alone. Until the street drains are completed the intercepting sewers would be inactive. The money should decidedly be laid out in the construction of street drains first. The great point is to remove the sewage from the streets; at

it soaks into ground at or door of the houses. If street drains are constructed first, it would remove the sewage from the immediate vicinity of the houses and could be discharged into the adjoining fields or cesspits.

IV. Rupees 2,000 include cost of land. The land is suitable for sewage farming. There is no necessity or reason for under-draining the land. It is not proposed to realign streets. The realignment of a single street may probably cost as much as the whole scheme. All that would be necessary is to remove some very prominent projections in the shape of verandahs or pyals. What these will be can only be ascertained during the actual construction of the drains. There is no reason why a land liable to floods should not be converted into sewage farms. Of the two sites proposed only one is liable to be flooded occasionally. Both the lands are now cultivated.

If

...tivation it would not be a bar
r a sewage farm, as when the land
s flooded the sewers would be dis-
harging at the overflows.

The manholes will be of the
tandard type proposed for Negapatam,
he drainage scheme for which town
has been approved by the Chief
Engineer, P. W. D. Messrs. Burn & Co's
toneware pipes have been esti-
mated for. They will be jointed
with cement with an inner ring of
tarred yarn.

9. The silt traps are economical
and their efficiency has been
practically tested. Their positions
are marked on the sections of Streets.

10. The iron tank holds water
sufficient to charge the syphon twice.
A flush is most needed when the
sewers run at their lowest. This is
usually between 12 & 3 P. M. or
between 9 P. M. and 3 A. M. These
are inconvenient hours for a cooly
to

to work, it is therefore considered
best to store the full supply
required in the iron tanks,
and so regulate the tap that
the syphons will act about the
time a flush is most needed.
It is proposed to manufacture
the syphon locally.

11. Dr. King has repro-
-duced in his memo an illus-
-tration which he describes as
a free air inlet arrangement.
The exact function of this ar-
-rangement is to expel air from
the syphon chamber as it is
being gradually filled up. A
simple opening in the side of
the chamber near its top will
serve the purpose of an air
outlet efficiently. In fact the
arrangement shown by Dr. King
is not applicable to the syphon
proposed for Kanur. It can only
be

be adopted when the syphon chamber is placed under a street, in which case it is not desirable to have an opening immediately over the top of the chamber as this would admit dust.

Office of Sanitary Engineer,
Fort St George, 25 June 1894

Actg. Sanitary Engr. to Govt.

S.E. 13-12-92—500.

Enclosure No. 2 to letter No. 1411 of 1894

1894.

From

Ag:
The Sanitary Engineer
to Government,

To

The Chief Secretary
to Government
Local & Munl Dept.

No. 1411

Dated 25th
Despd. } June 1894.
Recd.

Enc.

Subject.

Karur Drainage Scheme

Memorandum on the Ag:
Sanitary Commissioner's remarks on
the ———

1
1436 M of 94

S.E./4 13-12-92—500.

S.E./4 13-12-92—500.

Local & Municipal Dept.
CURRENT No. 1436 M

Diagrams

1894.

From

The Ag: Sanitary Engineer
to Government,

To

The Chief Secretary
to Government
Local and Munl. Dept.

No. 1411

Dated 25th
Despd. 26th } June 1894.
Recd. 26 JUN 94

Encs. 3

Subject.

Karur Drainage Scheme

Submitting a memorandum
the Acting Sanitary Commissioner's
rks on the subject of —

No. 564 C d/ 13th February 1895 S.W.D

Local & Municipal Dept.
CURRENT No. 512 M

Endorsement in the Local and Municipal Dept
No. 633 dated 4th August 1894

Note by the Chief Engineer P.W.D.:—

I consider that Mr Ellis has fully met the Sanitary Commissioner's objections to the proposed scheme for the drainage of Karur with the following qualifications:—

(a) I am of opinion that for Karur as for any other town in India a sufficient water supply is of more importance than a drainage scheme, and that if the town cannot have both the former should have the preference

At the same time it is
conclusively shewn
that Dr King or his
predecessors concurred
in the necessity for
the latter.
(b) Mr Ellis explains,
or rather explains
away, the proposal
to defer the construction
of the intercepting
sewers; but in point
of fact if only Rs.
2,000 yearly were
available for ex=
penditure on the
scheme, it would
not be worth while
to begin it at all;
if it is to be under=
taken funds should
be provided sufficient
to complete it in at

P. W. DOCUMENT No. 5875

C No. 2425 of 93 + 562 : 1090 of
1436 m of 94

No. 878 C of 26-2-94

Kasur drainage scheme

Enc 2 (1 book of plans)
Recd: 7. 8. 94

11 B

TO BE RETURNED WITH REPLY.

CB

No. 633

Referred to the Public Works Department for remarks and return of the plans.

1/8/94

Ag. Assistant Secretary

V.R.
7/8/94

Fort St. George,
6th August 1894.

To

The Public Works Department
(with plans)

+ sent separately

5-VIII-94

most ~~ten~~ two years and in that case, the intercepting sewers should be the first, and not the last ~~point~~ part to be carried out.

I regret that by an oversight on my part these papers have been mislaid, and their disposal thus postponed.

(Sd) John Pennycuick
Colonel R.E.
Chief Eng. P. W. D.
February 11, 1895

Transferred to the Local and Municipal department with advertence to its endorsement No. 633

dated 4th Aug: 1894
and the referred papers
returned.

Colonel RE
Secretary to Govt. P. W. D

To,
The Local & Municl
Deptt with papers.

878 C4/26-2-94

1895.

Public Works Department.

Local & Municipal Dept.

CURRENT No. 512 M

No. 564 C

Dated 13-2-1895

Despatched

Received

Encls 3 (1 roll of plans)

UNDER SECRETARY 14 FEB 95 PUBLIC WKS DEPT.

SUBJECT.

Transferring note by the Chief Engineer P.W.D. regarding the improvement of the drainage of Karur.

1165 to 16-11-93
1141 to 29-8-93
1115 to 27-1-93
291 to 13-2-92

Cnos 2426/93, 552, 1090 & 1436/94 & 512 M/95.

H.M.
P.S.

Order — d/19-3-95 No. 469 M

17/3/95

The Government agrees with the Chief Engineer in considering that in Karur a sufficient watersupply is of more importance than a drainage scheme. The Sanitary Engineer will accordingly be requested to draw up a scheme of watersupply, as soon as his other engagements will permit him to do so.

V.R. 1/3/95 10.3.95 13/3/95

The town has natural surface drainage, only their sewage can be kept out of the sources of water supply, this drainage would probably be sufficient. The water supply would cost a lakh, according to San. Engr., & would there require the extra act to finance it, so no great delay incurred after all. 10.3.95

To

The Chairman, M.C., Karur.
" Collector of Coimbatore.
" Sanitary Commissioner
" " Engineer with plan & ...
" Public Works Department

Editors' Table — ?

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

Read—the following papers :—

From J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government, to the Chief Secretary to Government, dated Fort St. George, 28th November 1893, No. 2567.

Agreeably to the programme of work of this department for 1893, approved in G.O., dated 12th December 1892, No. 2035 M., Local and Municipal, I have the honour to forward herewith plans, estimate and a report on a scheme for the improvement of the drainage of Karúr.

2. Eighteen sheets of longitudinal sections showing size, gradient and levels of street drains are being bound in book-form, but I presume it will not be necessary to forward these to Government.

Enclosure.

Report on a scheme for the improvement of the drainage of Karúr.

The town of Karúr lies on the left bank of the Amarávati river. It is on elevated ground which from a central point within the town slopes down on all sides. It is therefore evident that if the drainage of the whole town is to be collected at one point, an intercepting sewer completely encircling the town is required.

2. Except in one or two streets, there are no masonry drains in the town.

3. The streets have a good fall, averaging about 1 in 100.

4. The town supply of water is derived from pits or channels in the bed of the Amarávati and from wells within the town itself. The river water is said to be good and is freely used (*vide* abstract of sanitary reports of municipalities, page 76; the annual report of the Sanitary Commissioner for Madras for 1892). There is therefore no immediate necessity for an improved piped supply of water; and as long as the supply remains unpiped, it will be very limited, probably not more than 2 or 3 gallons per head per diem.

5. A good surface fall and a limited supply of water are good reasons for preferring a surface drainage scheme.

6. In the present scheme the surface drains are designed to carry off a rainfall of half an inch per hour. The maximum rainfall at Karúr within the past 16 years was 35 inches in 1880, and of this some 11 inches fell in October. The provision of half an inch per hour is ample.

7. The gradient of the drains must necessarily depend upon the surface fall of the streets, which, as already stated, averages about 1 in 100, and the average velocity in the drains when running full would be about 3 feet per second.

8. The drains proposed are semi-oval in shape with their top breadth equal to the depth (*vide* plan No. 3). They will be constructed of brick in chunam. The two side walls will be capped with table-moulded bricks in cement or cement concrete slabs, and the inside of the drains will be plastered in cement.

9. The town is divided into seven areas for the purpose of drainage. The drainage of each area will be concentrated at a point at the base of the cone which forms the town site. For the collection of the sewage proper from these various areas there will be two sewers starting in opposite directions from the west end of the town. The two sewers, which are denominated No. 1 and No. 2, converge near the toll-gate at the south entrance to the railway compound. A combined sewer then passes along the road to Námakkal to the proposed sewage farm, which will be to the north of the railway line. There are here two sites for the sewage farm; the choice must depend upon financial considerations. The land marked B is sufficiently low to be commanded by the sewer. If this land is selected, the sewer will terminate in a small cistern from which the sewage will be conveyed in an open carrier as shown by dotted red line on the general plan. The only objection to this site, and that not a very important one, is that it is liable to be flooded. The fact that the sewage will be delivered on the land by gravitation is a sufficient recommendation for its adoption. The other site marked A on plan is a short distance inland from the sewer. It is the lowest site above flood level within a reasonable distance of the town. But sewage will be required to be lifted on to the ground. No pumping machinery will be required as long as the present water-supply continues. With the present supply two picottahs will be able to lift the sewage of the whole town. The question of the sites may be left open at present for reasons that will be explained later on in this report.

10. In calculating the sizes of the intercepting sewers a provision has been made for a flow of 15 gallons per head per diem, half of which will be discharged in 6 hours. Fifteen gallons is the accepted minimum piped supply of water for towns in this Presidency. The population of Karúr was, in 1881, 9,205, and in 1891 it was 10,750. The intercepting sewers are designed for a population of 15,000.

11. Sewer No. 1 will eventually receive the sewage from a population of about 10,000 which gives a discharge of 33 cubic feet per minute. A 9-inch pipe with a fall of 1 in 300 flowing half full and having a velocity of $2\frac{1}{2}$ feet per second will discharge 33 cubic feet per minute.

12. Sewer No. 2 will ultimately receive the sewage from a population of 5,000 which will give a discharge of 17 cubic feet. The theoretical diameter of sewer for this discharge would be 6 inches. But for other reasons it is considered inadvisable to have an intercepting sewer of a less size than 9 inches. To give a flow of 17 cubic feet per minute the depth in a 9-inch pipe will be 3·7 inches, and this will give a velocity of 2·28 feet per minute. With the usual flushing arrangements the sewers will not give any trouble.

13. It has been stated that the question of the sites may be left open for the present. The reason for this is that there is no likelihood of the scheme being carried out in its entirety within, say, the next 10 or 15 years. The circumstances which lead to the preparation of the scheme are as follow:—

Sometime ago the Karúr Municipality wished to construct drains in some of the important streets. They were informed that to lay disconnected bits of drains without any reference to one another was not advisable, and it was recommended that a scheme should be prepared first and any streets may then be drained in conformity with the scheme. There is therefore no undertaking on the part of the municipality to see the scheme carried out if one was prepared. The municipality may not be able to carry out the scheme as a whole without substantial aid from Government.

14. The rate at which the tax on buildings in Karúr is assessed is $6\frac{1}{4}$ per cent. If building tax be raised to the maximum of $7\frac{1}{2}$ per cent. and if profession tax be levied, it is believed that the municipality will obtain an additional income of about Rs. 2,000 which, on the assumption that Government will grant a loan, is sufficient to pay the interest and sinking fund on say Rs. 30,000. For this sum only half of the surface drains in the scheme could be constructed. Government may, however, be able to give a grant in addition, and if this amounted to Rs. 29,000, all the surface drains could be completed. If, however, the Government can neither give loan nor contribution, the municipality should spend the Rs. 2,000 yearly in constructing new

drains according to this scheme, taking up such streets first as require most attention; a substantial improvement in the drainage of the town would thus be effected in the course of a few years.

15. The construction of the intercepting sewers may be deferred until a sufficient number of street drains have been constructed to keep up a sufficient flow in the sewers. In the meantime the sewage can be utilised on a long strip of land which is about 1,000 feet broad and lies between the town and the river, or diverted into the irrigation channels that run on the west of the town. The cost of the complete scheme is Rs. 95,853 distributed as follows:—

Surface Drains.

	Rs.
Block A	11,320
„ B	3,451
„ C	4,429
„ D	2,768
„ E	6,079
„ F	4,303
„ G	18,914
Intercepting Sewer No. 1	9,465
„ No. 2	11,242
12-inch outfall sewer	6,849
Silt traps	1,000
Flushing arrangements	2,000
Sewage farm	2,000
Well	200
Contingencies	11,833
Total ..	95,853

Note.—Total for surface drains with contingencies is Rs. 69,000.

(Signed) J. A. JONES,
Sanitary Engineer to Government.

No. 867.

Referred to the Public Works Department for remarks.

Fort St. George,
5th December 1893.

(Signed) A. T. PRINGLE,
Assistant Secretary.

To the Public Works Department.

No. 878-C.

The Sanitary Engineer's proposals with regard to the drainage of the town of Karúr in the Coimbatore district are approved in the Public Works Department.

(Signed) J. PENNYCUICK, Colonel, R.E.,
Secretary to Government, P.W.D.

To the Local and Municipal Department.

No. 254.

Referred to the Sanitary Commissioner for remarks.

(By Order.)

Fort St. George,
3rd April 1894.

(Signed) L. DAVIDSON,
Ag. Assistant Secretary.

To the Sanitary Commissioner.

From Surgeon-Lieutenant-Colonel W. G. KING, M.B., C.M., D.P.H., Acting Sanitary Commissioner for Madras, to the Chief Secretary to Government, dated Fort St. George, 21st May 1894, No. 1019–S.

With reference to your endorsement No. 254 (herewith returned), dated 2nd April 1894, Local and Municipal, I have the honour to submit herewith a memorandum upon the proposed Karúr drainage scheme.

2. The plans and estimates which accompanied the above reference are herewith returned.

Enclosure.

The Scheme.

I. (*Paragraph* 1).—Although there is a slope on all sides, it is far from equal, and the expenditure necessary for surrounding the town with an intercepting sewer should therefore be reconsidered. Holding in memory the fact that, as the scheme stands, the large area to the west of Karúr channel has been omitted—an area which is now rapidly increasing as to new houses and prosperity, and where all future extension of the town must occur—it is worth while considering whether the simple plan of surrounding the main portion of the town is the best to follow, *in the interests of economy*. I believe intercepting sewers No. 1 and No. 2 could safely be dispensed with. The chief purpose of sewer No. 2 is the receipt of sewage from very small portions of the town bordering the river. Inspection of these areas shows that they consist almost exclusively of mud-thatched pariah huts, placed with the utmost irregularity, so that nothing short of rebuilding the whole would allow of drainage being carried out; and, then, the question as to who is to pay for impervious surfaces in these poor private dwellings would still be a matter of doubt. Intercepting sewer No. 1 also means heavy expenditure, for the very few houses between the station and north Agraharam street.

It is practicable to drain the chief and well populated parts of the town towards the valley in which the Karúr channel lies, and by trusting to a single intercepting sewer laid here that important part of the town to the west now ignored can also be efficiently drained. This intercepting sewer could discharge upon land with a suitable level in the direction of the discharge of the channel on the west of the town, or on the opposite side of the railway line. A collecting well, as in the original design, might be necessary; but it is possible land could be commanded direct by the outfall sewer. Given a limited sum of money, I believe this modification of the scheme would afford the best sanitary results in practice, although the scheme of the Sanitary Engineer's department is theoretically complete *for the portion of the town* attended to.

II. (*Paragraphs* 6 *and* 7).—I consider $\frac{1}{2}$ inch of rainfall per hour an unnecessarily large amount to receive in the instance of this town. In consideration of the excellent surface fall available, storm water might practically be ignored except as to small amounts for courtyards, and, thus, further economy as to size of surface drains could be secured. Notwithstanding the receipt on an area of, roughly, 105 acres of $\frac{1}{2}$ inch rainfall per hour or about 132·72 cubic feet per minute, it is noted not a single overflow has been provided, although good facilities for these exist, and are desirable. The outfall sewer is capable of discharging 115·4 cubic feet per minute only. Overflow must therefore be expected at the third manhole from the junction with sewer No. 1 unless storm water overflows are provided, whilst both sewers Nos. 1 and 2 will back up for a considerable distance beyond this point. In case the collecting well is adopted, during storms, and at times when lifting machinery is not working, silting and storage of sewage will occur in both sewers.

III. (*Paragraph* 15).—The principle here advocated of building the intercepting sewer after the surface drains have been formed should be avoided both from an engineering and sanitary point of view. Construction should commence from the main sewers to the periphery.

Estimate and Plans.

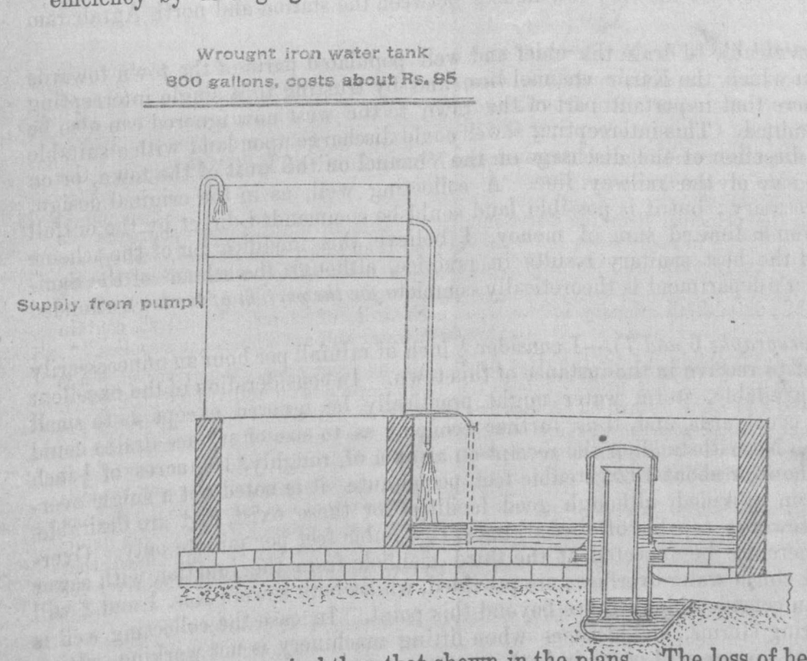
IV. *Sewage Farm.*—Whether the Rs. 2,000 includes compensation or not for ground is not stated. Likewise, neither the nature of the soil and its suitability for sewage farming, nor whether it is to be underdrained is stated. No value for land acquired nor for the realignment of streets or houses is mentioned. None of these are trivial points, and should have been quoted. It would not be advisable to take up a site for the sewage farm liable to flood.

No specification, or reference to the standard plans, is afforded as to the form of the manholes, nature of joints of stoneware pipes, or name of the maker.

In my opinion the silt traps are bad in form; no idea is given as to the position of these.

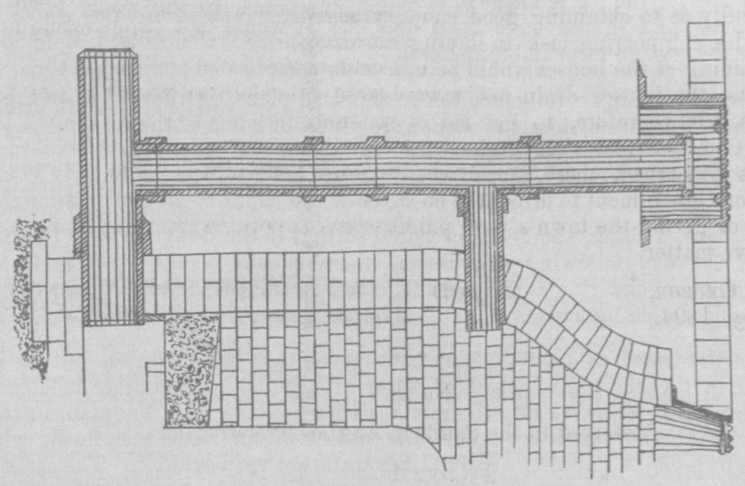
All plans, I think, should be prepared so that if the designer were to proceed on leave on the day following submission, there should be no doubt as to what his intentions were, and this is the rule followed in all engineering undertakings, and would be advisable here also.

The statement as to "flushing arrangements" is indefinite, but it is to be supposed in the absence of a public water-supply that pumping from a convenient well or stream is intended into the iron reservoir, exhibited in the plan, in communication with the automatic syphon. The object of an automatic flush, when it is requisite to pump the water by manual labour, is not very evident. The attendance of a cooly once daily, in any case, is necessary, and it would not be too much to expect this cooly to repeat this in the evening, so as to secure the pulling up of a plug from an inexpensive cistern. But granting something neater than this rough mode is requisite, I cannot see the object of the chamber for the automatic syphon *plus* the storage for *the full amount of water*. Economy would be secured without loss of efficiency by arranging that a reservoir be made to contain half the total water, so that on its being filled completely it would allow of overflow by a *large* pipe to the syphon compartment which could thus discharge, allowing for a gradual filling and a second automatic discharge, that might be regulated by a *small* pipe (*vide* margin). The arrangement would, I think, be more economical than that shown in the plans. The loss of head for starting flushing is of no moment in practice—a full bore flush only is what is required.



Automatic syphons are of such various descriptions, and their efficiency differs so greatly, that the maker's name should have been specified. By most makers it is

laid down as a *sine qua non* that a free air inlet should be arranged for in the syphon chamber to allow of venting the syphon readily, it being, in fact, stated that without this the syphon will not work. Possibly, the form selected by the Sanitary Engineering department will work without this precaution; but the usual arrangement adopted in consequence of this belief is as follows:—



Irrespective of the syphon question, this being the head of the sewer it would be better that it be ventilated. The plan leaves it to imagination how the syphon flush chamber is to be entered for cleansing, regulating flow, &c.

Necessity for the Scheme.

V. (*Paragraph* 4).—The Sanitary Engineer's department relies upon statements in abstracts of sanitary reports, page 76, annual report for 1892, as to necessity of drainage. These "abstracts" are from reports by Chairmen of Municipalities, and, although the Sanitary Commissioner may modify or expunge certain statements and is responsible, it must be remembered they are not "original." The following are the views expressed by my predecessors:—

"The river is the principal drinking water-supply, but it is an unsatisfactory source as it is subjected to contamination in many ways and bodies are burnt and buried in its bed. There are 17 public wells, all having walls and platforms, but they are not provided with drains to carry away the waste water. The private wells in the backyards of houses usually contain brackish water and are wholesome supplies." *

* G.O., No. 115 M., dated 27th January 1893.

"Drinking water is obtained from the river Amarávati and from wells. The river supply is not satisfactory, for the water has probably been polluted at every town and village near which the river has flowed and after its arrival at Karúr the water is made still more impure by the burning and burial of bodies, by the washing of bodies and clothes, and by the discharge into the river of town sewage. . . . . There are several well-constructed wells in the town, but the water of some of them is in danger of being contaminated with sewage. Except towards the river, water is at a considerable depth from the surface of the ground. The people living to the north of New Street complained that they had to go all the way to the river for drinking water." †

† G.O., No. 1584 M., dated 16th November 1893.

Indeed, the mere fact of consumption being reckoned by the Sanitary Engineer's department at only three gallons per head seems to me a sufficient reason urgency for a water-supply being established. The restriction of the us below requirements for sanitary purposes shows the difficulty with wh obtained. As a fact, great inconvenience is felt as to the distance of th The Chairman, for example, informed me that he lives so far from t

has to content himself with "brackish well water." The river water is highly contaminated with fœcal matter. Cholera mortality in Karúr amounted, during the last epidemic, to 9·1 per mille. I believe, therefore, that the reason given by the Sanitary Engineer's department as to the urgency of drainage when compared with a water-supply is not tenable. Any scheme of drainage of Karúr would be attended with much difficulty as to obtaining good sanitary results, if applied to the whole town. Although the engineering task in laying out drains, &c., would be simple enough, the after joining of the houses would be unusually complicated; except in three of the main streets, the houses drain not towards the front but to the back into *lengthy* court-yards. If, therefore, to get rid of existing nuisance Car Street, Main Bazaar Street and Comity Street were drained into suitably situated land, I believe, so far as drainage is concerned, these steps would *temporarily* suffice, whilst it would be advisable for Government to direct the energies of the Sanitary Engineer's department to the task of giving the town a pure public water-supply, which ought not to prove an expensive matter.

Fort St. George,
19*th May* 1894.

(Signed) W. G. KING, Surgn.-Lieut.-Col.,
Acting Sanitary Commissioner for Madras.

No. 427.

Referred to the Sanitary Engineer for remarks.

(By Order.)

Fort St. George,
4*th June* 1894.

(Signed) L. DAVIDSON,
Ag. Assistant Secretary.

To the Sanitary Engineer.

From R. E. ELLIS, Esq., Assoc. M. Inst. C.E., Acting Sanitary Engineer to Government, to the Chief Secretary to Government, dated Fort St. George, 25th June 1894, No. 1411.

With reference to your endorsement No. 427, dated 4th June 1894, I have the honour to submit herewith a memorandum on the Acting Sanitary Commissioner's remarks on the Karúr drainage scheme.

2. The papers which accompanied the reference above quoted are herewith returned.

Enclosure.

Memorandum on the Acting Sanitary Commissioner's remarks on the Karur Drainage Scheme.

The principal point in the Acting Sanitary Commissioner's memorandum that requires a reply is the urgency or otherwise of a drainage scheme for Karúr. Doctor King quotes certain remarks of his predecessors in support of his contention that Karúr stands more in need of a water-supply than drainage. Dr. King would have represented facts more correctly if he had quoted also the remarks of his predecessors on the drainage of Karúr side by side with their remarks on its water-supply. The undersigned begs to invite the attention of Government to the following remarks of Doctors Laing and Dymott extracted from the very Government Orders quoted by Dr. King:—

G.O., dated 13*th February* 1892, *No.* 291 *M., Local and Municipal.*

Drainage.—"There is no system of drainage and most of the sewage sinks into soil of the town. Three streets have been provided with drains which discharge he Amarávati river and Panchamadevi channel. The 'Komaty drain' is in the ndition, and as no arrangements have been made for the disposal of its contents, an elongated cess-pool at its end. Some measures should be taken to remedy

this defect; arrangements could easily be made so that the sewage from the drain could be used for irrigating and manuring land in the neighbourhood. *A drainage scheme is much required for this town and one is to be prepared.*"

G.O., dated 27th January 1893, No. 115 M., Local and Municipal.

Drainage.—"No change since last inspection, and most of the sewage sinks into the soil of the ground. The 'Komaty drain' was in the same defective condition and no proper arrangements had been made for the disposal of its contents. *A drainage scheme for the town is much needed and one is to be prepared.*"

G.O., dated 16th November 1893, No. 1584 M., Local and Municipal.

Drainage.—"The matter is at present engaging the attention of the Sanitary Engineer. The sewage is to be conducted to the north-east of the town; there is a suitable site for a sewage farm to the west of the Vangal road beyond the Pallars' village. The present drains are very unsatisfactory, and in many places the air is poisoned by the emanations from stagnant sewage. *A good drainage system will, no doubt, improve the quality of the well water of the town.* The Komaty drain appears to have been well constructed, but unfortunately the sewage is discharged directly into the river, and some people draw water below the point of discharge."

2. The above extracts go to prove that the Sanitary Commissioner's department has been for years perfectly cognizant of the fact that a drainage scheme for Karúr was under preparation, that they attached more importance to a drainage scheme than to a water-supply scheme, and that they reiterated remarks to the above effect in every inspection report since 1891.

3. As has been stated in the report on the drainage scheme, the original object of the scheme was that it should enable the municipality of Karúr to construct street drains in such localities where they were most needed on some concerted plan so as to form part of a general scheme for the town. But during the period that elapsed between the time that the question of a drainage scheme was first considered and its final submission to Government such emphatic opinions were pronounced by Doctors Laing and Dymott as to the necessity of a comprehensive drainage scheme that this department thought it desirable to suggest methods for carrying out the works within a limited number of years. There was, however, no wish on the part of this department to insist that the scheme should be taken up as a whole, for, in the concluding portion of paragraph 14 of the drainage report, it has been suggested that if means do not permit of the scheme being undertaken as a whole, the municipality should spend Rs. 2,000 yearly in constructing new drains according to the scheme.

4. Dr. King admits that Car Street, Main Bazaar Street and Komati Street need drains apart from the question of the introduction of a water-supply. With Rs. 2,000 annually it will take five years to drain the above three streets; at the expiration of five years there will probably be other streets that require draining. The undersigned adheres to the opinion expressed in the report on the drainage scheme that if means cannot be found to undertake the drainage scheme as a whole, the municipality should spend Rs. 2,000 annually in constructing street drains, taking up those first that require most attention.

5. A water-supply project for Karúr will cost not less than a lakh of rupees. The interest and sinking fund on a lakh of rupees will be Rs. 6,000 annually. Th
cost of pumping and maintenance of works will be about Rs. 4,000 annually.
project will thus cost the municipality about Rs. 10,000 annually, or if Gover
contribute a moiety of the capital cost, the annual charge will be Rs. 7,000.

6. A water-tax will bring to the municipality a revenue of Rs. 2,500
added to the Rs. 2,000 estimated as the probable yield from enhancement
and the imposition of profession tax, the total sum available for the
project would be Rs. 4,500 which, looking to the figures given
paragraph, is quite inadequate.

7. The other remarks of the Sanitary Commissioner will no
their order :—

I. The area to the west of the town is shown on the map (sheet No. 1). This area is not included in the scheme as it is beyond the thickly populated area of the town, but the question of draining it in future has been duly considered. The levels of this area are marked on the plan—*vide* sheet No. 1—and an inspection of these levels will show that the levels admit of this area being drained into the proposed sewers.

The Sanitary Commissioner's recommendation that sewer No. 2 be omitted must be condemned. The sewer is intended to intercept the sewage of an area that drains into the river which is the principal source of drinking water. Looking to this fact, and also that the area holds a population of 4,000 which is not insignificant enough to be ignored, the proposal of the Sanitary Commissioner to do away with the intercepting sewer does not appear to be advisable.

Sewer No. 1 is the sewer which passes through the valley in which the Karúr irrigation channel lies. It is not understood what Dr. King means by first saying that this sewer should be omitted and then recommending that an intercepting sewer should be laid in the valley through which the irrigation channel flows.

II. The undersigned cannot agree with Dr. King in thinking that a provision for quarter of an inch of rainfall would be sufficient. In England, where the rainfall is more equable than in tropical climates, it is considered necessary to provide for a rainfall of $\frac{1}{2}$ to 1 inch per hour. In India most of the rain falls in about three months of the year, and the rate of fall is frequently in excess of half an inch per hour. The reason advanced for curtailing the provision for rainfall, namely, that the town has a good surface fall, does not hold good in the case of a surface drainage scheme, though it would be so in an underground drainage scheme. In an underground drainage scheme proper arrangements can be made for excluding rain water from the sewers. It is impossible to exclude storm water from surface drains, and when a surface drain is not sufficiently large for storm water, it overflows, and the tendency is, it has been found, to scour out the sides of the road; on the cessation of rain the mud thus scoured out subsides into the bottom of the drain.

There will be no economy in limiting the rainfall to quarter of an inch. Most of the drains are 6 inches in size. It is inadvisable to have street drains of any smaller size. There will be a small saving in the large sizes of the drains, but this economy can only be effected at the sacrifice of efficiency.

Storm overflows on the intercepting sewer were fully contemplated when working out the scheme. Their omission on the plan is an inadvertence.

III. The proposal to defer the construction of the intercepting sewers was with reference to the execution of the scheme piecemeal. If only Rs. 2,000 are available yearly for expenditure on the scheme, it would take 15 years to complete the sewers alone. Until the street drains are completed the intercepting sewers would be inactive. The money should decidedly be laid out in the construction of street drains first. The great point is to remove the sewage from the streets; at present it soaks into ground at the door of the houses. If street drains are constructed first, it would remove the sewage from the immediate vicinity of the houses and could be discharged into the adjoining fields or cess-pits.

IV. Rupees 2,000 include cost of land. The land is suitable for sewage farming. There is no necessity or reason for underdraining the land. It is not proposed to realign streets. The realignment of a single street may probably cost as much as the whole scheme. All that would be necessary is to remove some very prominent projections in the shape of verandahs or pyals. What these will be can only be ascertained during the actual construction of the drains. There is no reason why a land liable to floods should not be converted into sewage farms. Of the two sites proposed, only one is liable to be flooded occasionally. Both the lands are now cultivated. If liability to floods is not a bar to its cultivation, it would not be a bar for a sewage farm, as when the land is flooded the sewers would be discharging at the overflows.

8. The manholes will be of the standard type proposed for Negapatam, the
inage scheme for which town has been approved by the Chief Engineer, Public
ks Department. Messrs. Burn and Co.'s stoneware pipes have been estimated for.
ill be jointed with cement with an inner ring of tarred yarn.

9. The silt traps are economical and their efficiency has been practically tested. Their positions are marked on the sections of streets.

10. The iron tank holds water sufficient to charge the syphon twice. A flush is most needed when the sewers run at their lowest. This is usually between 12 and 3 P.M., or between 9 P.M. and 3 A.M. These are inconvenient hours for a cooly to work, it is therefore considered best to store the full supply required in the iron tank, and so regulate the tap that the syphons will act about the time a flush is most needed. It is proposed to manufacture the syphon locally.

11. Dr. King has reproduced in his memorandum an illustration which he describes as a free air inlet arrangement. The exact function of this arrangement is to expel air from the syphon chamber as it is being gradually filled up. A simple opening in the side of the chamber near its top will serve the purpose of an air outlet efficiently. In fact, the arrangement shown by Dr. King is not applicable to the syphon proposed for Karúr. It can only be adopted when the syphon chamber is placed under a street, in which case it is not desirable to have an opening immediately over the top of the chamber as this would admit dust.

Fort St. George,
25*th June* 1894.

(Signed) R. E. ELLIS,
Ag. Sanitary Engineer to Government.

No. 633.

Referred to the Public Works Department for favour of remarks.

Fort St. George,
4*th August* 1894.

(Signed) W. FRANCIS,
Ag. Assistant Secretary.

To the Public Works Department, with plans.

Note by the Chief Engineer, Public Works Department.

I consider that Mr. Ellis has fully met the Sanitary Commissioner's objections to the proposed scheme for the drainage of Karúr with the following qualifications:—

(*a*) I am of opinion that for Karúr, as for any other town in India, a sufficient water-supply is of more importance than a drainage scheme, and that, if the town cannot have both, the former should have the preference. At the same time it is conclusively shown that Dr. King or his predecessors concurred in the necessity for the latter.

(*b*) Mr. Ellis explains, or rather explains away, the proposal to defer the construction of the intercepting sewers, but in point of fact, if only Rs. 2,000 yearly were available for expenditure on the scheme, it would not be worth while to begin it at all; if it is to be undertaken funds should be provided sufficient to complete it in at most two years and in that case the intercepting sewers should be the first and not the last part to be carried out.

I regret that, by an oversight on my part, these papers have been mislaid and their disposal thus postponed.

(Signed) J. PENNYCUICK, Colonel, R. E.,
11*th February* 1895. *Chief Engineer, P.W.D.*

No. 564-C.

Transferred to the Local and Municipal Department with advertence to its endorsement No. 633, dated 4th August 1894, and the referred papers returned.

(Signed) J. PENNYCUICK, Colonel, R. E.,
13*th February* 1895. *Secretary to Government, P.W.D.*

To the Local and Municipal Department, with papers.

Order—dated 19th March 1895, No. 469 M., Local and Municipal.

The Government agrees with the Chief Engineer in considering that in Karúr a sufficient water-supply is of more importance than a drainage scheme. The Sanitary Engineer will accordingly be requested to draw up a scheme of water-supply as soon as his other engagements will permit him to do so.

(True Extract.)

J. F. PRICE,
Chief Secretary.

To the Chairman, Municipal Council, Karúr.
" Collector of Coimbatore.
" Sanitary Commissioner.
" Sanitary Engineer.
" Public Works Department.
" Editors' Table.

Govt. of {1895} Madras.

LOCAL AND MUNICIPAL.

Issued

Recd. *Encl.*

G.O., 19th March 1895, No. 469 M.

MARCH.

Water-supply and Drainage.

Agreeing with the Chief Engineer in considering that in Karúr a water-supply is of more importance than a drainage scheme, and requesting the Sanitary Engineer to draw up a scheme of water-supply for the town.

READ AGAIN ORDER OF GOVERNMENT, DATED 18 , No.

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