Public Works (1897) Department.

G.O., No. 378 W

Dated 8 February 1897

This is wanting

100/3

9/2/97

[Despatch Abstract.]

Drainage of Ootacamund: Pro: Letter dated 5 Feb: 1897 submitting an estimate of Rs. 25,450 for the improvement of the —, Coonoor 6 & 7 E. W. Circle with direction to have the work put in hand at once and completed before the next season.

T.C. 8/2/97

[illegible] Indexed. 5/3/97

BACK PAPERS.

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

FURTHER PAPERS.

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

BUILDINGS AND ROADS.
CIVIL WORKS.

Government {1897} of Madras.

PUBLIC WORKS.

Recd. } 1897. *Enclosures*

Regd. } *Spare copies*

G.O., No. 378 W., 8th February 1897.

FEBRUARY.

Drainage of Ootacamund

Proceedings, Local and Municipal Department, sanctioning an estimate of Rs. 25,450 for the improvement of the —, communicated to Superintending Engineer, IV Circle, with direction to have the work put in hand at once and completed before the next season.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Civil Works.

Read—the following papers :—

From the Superintending Engineer, IV Circle, dated 14th November 1896, No. 575 W.

G.O., No. 107 M., dated 27th January 1897.

Read—the following papers :—

From the Public Works Department, dated 17th October 1896, No. 3598 C.

Abstract.—Transferring note by the Chief Engineer approving plans and estimates in connection with certain improvements to the Ootacamund drainage scheme.

From the Sanitary Board, dated 4th December 1896, No. 299 S.

Read—the following papers :—

Letter from the Superintending Engineer, IV Circle, dated 27th August 1896, No. 422 W.
Endorsement in the Local and Municipal Department, dated 22nd October 1896, No. 1209.
Note by the Sanitary Commissioner, dated 3rd November 1896, No. 457 S B.
Note by the Sanitary Engineer, „ 6th „ „ „ 27.

Note by the President, Sanitary Board.

In forwarding the plans and estimates for the Ootacamund drainage to the Local and Municipal Department I said that I approve generally of the scheme and that I forwarded them to save delay as I would have to note on them again as President, Sanitary Board.

2. As regards the details I agree with the Sanitary Engineer that a 15″ pipe is larger than necessary and I think a 12″ pipe should be substituted, this will reduce the estimate by Rs. 1,490. I can see no object in carrying the pipe to the Muttucherry swamp sump and Mr. Ashpitel's arrangement may be approved.

3. As regards the difference in levels I have no reason to doubt the correctness of those taken by Mr. Ashpitel who informs me that they were taken several times but the matter is not of much consequence as a 12″ pipe is ample to give the required discharge even with the reduced grade of $\frac{1}{410}$, this being what Mr. Ashpitel's grade of $\frac{1}{329}$ is reduced to if there is an error of 1′ as stated by Mr. Jones.

4. As regards the manholes the designs submitted by Mr. Ashpitel are sample ones and are not prepared with reference to any particular site and they will have to be altered to suit the ground level during construction and probably a saving on the estimate will be effected. I do not agree with Mr. Jones that Mr. Ashpitel's flushing arrangements will not answer the purpose, it is impossible to say for certain that it will be a success, but I see no reason to think otherwise. Mr. Ashpitel's reasons for ending the supply channel as he does are given in paragraph 21 of his report and I approve of them.

5. I consider that Mr. Ashpitel's estimate should be sanctioned, the size of pipe being reduced to 12″ instead of 15″, and as the rate is higher I would advise that the pipes be ordered at once. The question raised by the Sanitary Commissioner as regards the drainage of Muttucherry and Kodapanam can be considered hereafter.

(Signed) D. McNEIL CAMPBELL, Colonel, R.E.

24th November 1896.

Resolution—

With his letter No. 422 W., dated 27th August 1896, the Superintending Engineer, IV Circle, submits plans and estimates for town drainage works at Ootacamund. The proposals are drawn up with reference to the recommendations of the Sanitary Board approved in G.O., No. 1390 M., dated 24th August 1895, and in accordance with the undermentioned orders :—

G.O., No. 512 W., dated 10th February 1896.
„ „ 982 W. „ 19th March „

2. They include the following estimates :—

		Rs.
(i)	Estimate for pipes and for removing and relaying the intercepting sewer from junction with Brewery drain to Willow Fund.	15,000
(ii)	Estimate for 21 manholes for intercepting sewer	4,350
(iii)	Flushing sluice at head of sewer	4,200
(iv)	Widening supply channel	470
(v)	Culvert under willow bund	2,920
	Total ...	26,940

3. The plans generally have been approved by the Chief Engineer, and they have now been referred by Government for the remarks of the Sanitary Board.

4. The Board approves the plans and estimates subject to the remarks of the President, who has recorded a separate note on the subject which is submitted for the information of Government.

5. The suggestions of the Sanitary Commissioner are commended by the Board for the consideration of Government when opportunity offers.

(Signed) R. PARSONS,
Secretary.

Order—No. 107 M., dated 27th January 1897.

The estimate prepared by Mr. Ashpitel for the improvement of the drainage of Ootacamund, which, as modified with reference to paragraph 2 of the note by the President of the Sanitary Board, amounts to Rs. 25,450, is sanctioned.

2. To meet the cost of the work, the Municipal Council is requested to appropriate a sum of Rs. 25,450 out of the Provincial grants amounting to Rs. 1,89,000 on account of the water-supply scheme, which it has already received, and to place the sum at the disposal of the Public Works Department.

3. The Public Works Department is requested to put the work in hand at once. Its attention is drawn to the remarks of the President of the Sanitary Board in paragraph 4 of his note.

(True Extract.)

(Signed) G. S. FORBES,
Secretary to Government.

ORDER—No. 378 W., dated 8th February 1897.

Communicated to the Superintending Engineer, IV Circle, who will arrange to have the work put in hand at once and completed before the next season.

2. The Local and Municipal Department will see that the requisite funds are placed at the disposal of the Public Works Department as already ordered in paragraph 2 of the Government Order read above.

3. The sanction accorded in paragraph 1 of the Proceedings quoted above has been registered as Excluded Local No. 61 W. of 1896–97, and classified as Miscellaneous Public Improvements, Original Works.

(True Extract.)

(Signed) D. McNEIL CAMPBELL, Colonel, R.E.,
Secretary to Government.

To the Superintending Engineer, IV Circle, with thirty-one enclosures.
" Examiner, Public Works Accounts.
" Local and Municipal Department.

Exd. T. K. Narayana Aiyangar.

Government {1897} of Madras.

LOCAL AND MUNICIPAL.

Recd. } 1897. *Enclosures*
Regd. *Spare copies*

G.O., No. 107 M., 27th January 1897.

JANUARY.

Drainage.

Sanctioning an estimate of Rs. 25,450 for the improvement of the — of Ootacamund, and requesting the municipal council to meet the cost of the work out of the Provincial grant of Rs. 1,89.000 on account of the water-supply scheme and to place the amount at the disposal of the Public Works department which will put the work in hand at once.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers:—

Endorsement—from the Public Works Department, No. 3598-C., dated 17th October 1896.

Read—the following papers:—

From J. HANNAN, Esq., Superintending Engineer, IV Circle, to the Chief Engineer, Public Works Department, dated Coimbatore, 27th August 1896, No. 422-W.

As more than one reminder has been lately received from your office calling for the estimate for relaying the intercepting sewer and for the drainage of Mettucherry and the main bazaar at Ootacamund, I have the honour to submit herewith the plans and estimate for that portion of the scheme which affects the upper portion of the Ootacamund lake now being filled in. The plans and estimates were received by me on the 10th instant. As no proper data were submitted for the rates which appeared to be excessive, I returned the data sheet to the Executive Engineer for revision. It has not been returned as yet. As, however, the estimates appear to be urgently required, I submit them as received. They have not been checked in this office.

2. Mr. Ashpitel submits a very full report showing, amongst other things, how in his opinion the drainage of the Mettucherry and the main bazaar, &c., should be carried out. His proposals are, I have no doubt, the latest up to date ones from a sanitary engineering point of view. Whether the existing arrangements cannot be made fairly efficient at a less cost is a question which will doubtless be duly considered by the Sanitary Committee of experts.

ENCLOSURES.

REPORT to accompany the Preliminary Estimate for the Ootacamund Drainage Scheme.

Object of Preliminary Estimate.—With the exception of Kandal the drainage of Ootacamund at the present time is discharged into the lake owing to the failure of the existing system of sewerage. The sewers consist of open drains following the natural lines of drainage and an intercepting or main close sewer of varying size and description which follows the line of the supply channel from the back of Mr. Brown's establishment to the Willow Bund. Beyond this point an iron-pipe sewer, 12 inches diameter, has been laid through the lake with an outfall into the Kandal stream.

In G.O., No. 512 W., dated 10th February 1896, the preparation of a complete scheme was ordered, but owing to the delay in obtaining copies of the recent town survey, this has not been possible, and in G.O., No. 982 W., dated 19th March 1896, this preliminary estimate was ordered to be prepared. The estimate provides only for taking up the 9-inch main sewer from the Brewery drain to the Willow Bund and replacing it by a 15-inch pipe as already approved for improving the lake supply channel and the provision of flushing arrangements for the main sewer.

2. *Existing System.*—From time to time considerable sums have been spent on the drainage of Ootacamund, and the result cannot be said to be satisfactory. The main sewer for a length of about 4,560 feet consists of a masonry conduit laid almost on the surface of the ground with an average fall $\frac{1}{500}$, a 9-inch stoneware pipe from 4,764 feet to 6,603 feet laid practically with no fall (*vide* longitudinal section) though a fall of $\frac{1}{320}$ is available and a 12-inch iron pipe through the lake with a fall of $\frac{1}{1000}$. The only really efficient length of this main sewer is the pipe through the lake which is provided with admirable flushing arrangements and needs no improvement. The 9-inch pipe is too small and without fall, and the masonry conduit is, it

is suggested, altogether in the wrong place for the main sewer and of very inferior design. Throughout the system the manholes are too small, and, as the Sanitary Commissioner points out in his notes printed with G.O., No. 648 M., dated 23rd May 1894, there are numerous gully pits along the line of sewer designed to intercept silt and solid matter, which are simply open cess-pools.

3. *Proposed System.*—In any scheme for the drainage of Ootacamund it appears to be absolutely necessary to recognize the fact that, whatever the merits of open drains may be, it is not a good thing to combine them with a closed main sewer. Such a combination is fatal to good sanitation as, owing to the necessity of admitting surface water to the sewers, and the difficulty of excluding solid matters, rubbish and road detritus, gullies are required which retain sewage and become nothing more nor less than evil smelling cess-pools requiring frequent cleansing.

4. Open drains have in this country a number of advocates who echo the old cry that the sun is the best sanitarian; but the sun, like other sanitarians, requires to be given a fair chance. To collect sewage in a number of pits into which liquid is constantly flowing does not give this fair chance, and the result is that the sun, under these circumstances, merely assists putrefaction and the formation of sewer gas. It does not seem advisable, therefore, to have a mixed system of open and closed drains, and one or other of these systems should, it is suggested, be adopted in its entirety with no cess-pools.

5. As an open sewer along the north boundary of the Hobart Park would be extremely unpleasant and unsightly, and as the existing 12-inch iron pipe through the lake is effective and has been laid at considerable expense, it is suggested that a pipe system should be adopted throughout, the existing open drains being retained for surface drainage only. Ootacamund is an ideal place for such a system of sewers, provided that the ordinary principles are adopted with no special contrivances, such as catch-pits or interceptors, which create the very evil the sewers are intended to prevent.

6. *Existing Masonry Sewer to be reserved for the few houses along its course and for flushing purposes.*—In paragraph 2 it was suggested that the existing masonry sewer down to the junction with the Brewery drain is wrongly aligned. Inspection shows that this sewer has not a good fall and directly serves very few houses. It is also of poor design and much obstructed. A better line for the main sewer will be along Commercial Road joining the existing line at proposed manhole No. 1 and picking up the market and latrine drains on the way. If this is approved, the main may, for the present, start at commencement of the Commercial Road bazaar and may be at 12-inch stoneware pipe up to proposed manhole No. 1 (*vide* plan No. 1) and a 15-inch stoneware pipe from this point to the junction with the existing 12-inch iron pipe near the Willow Bund. It appears to be of but little use to fix the size of pipes by calculation, as the amount of sewage to be dealt with is likely to increase enormously as the population increases, and the 12-inch iron pipe through the lake, with its flushing arrangements, will take the discharge from these pipes. It will be noted that the velocity in all these pipes will considerably exceed the limit of $1\frac{1}{2}$ feet per second proposed by Waring for the separate system. The existing masonry sewer from the back of Mr. Brown's premises to manhole No. 1 will be extremely useful to serve the few houses along its course, but will chiefly be valuable for flushing purposes as explained in paragraph 7. When house connections are provided this sewer should be examined and repaired and the manholes altered, so as not to retain sewage, *i.e.*, the catch-pits should be filled up and proper channels formed.

7. *Proposed Flushing arrangements.*—Just above Mr. Brown's stables a small tank formerly existed as is evident from the old surveys of Ootacamund, and, if this tank is restored by damming up the channel at the point shown on the accompanying map, and a pipe laid from this tank to the head of the existing sewer, an efficient flush can be secured. Plan No. 3 shows the proposed flushing sluice with two vents, each 6 feet wide, or the full width of the channel bed. This ventage may be considered to be excessive, but is allowed in order to reduce the velocity through the sluice to the normal channel velocity during the rainy weather when much silt is likely to be brought down from the hills. From this sluice an iron pipe 9-inch diameter is

proposed to be laid to the head of the existing sewer with a fall $\frac{1}{10}$ or thereabouts and regulated by a sluice valve. This pipe will discharge sufficient water for an ample flush under pressure, * and owing to the continuous supply in the channel, even during the hot months of the year, the flush can be effected daily. No automatic flushing arrangements are proposed, as some sort of establishment will necessarily be maintained and automatic valves have a tendency to get out of order. To flush branch sewers water will have to be obtained from the municipal pipes; but if Field's or other suitable flushing tanks are constructed in connection with the stand pipes, the waste water will probably be ample.

* Some of the obstructions in the masonry sewer will probably have to be removed.

8. *Dimensions of proposed Sewers and Position of Manholes.*—In the complete estimates it is suggested that the branch street sewers may be 9-inch, and the house connections 6-inch, stoneware pipes in accordance with the usual practice; the sewers to follow the directions of the streets and to be laid in straight lengths according to the roads, each length being terminated in a manhole with intermediate manholes at intervals of 150 feet to facilitate inspection, ventilation and the localization of leaks. Intermediate manholes will not be numerous as the streets are generally short, and therefore it does not seem worthwhile to substitute ventilators which do not permit inspection of the sewer.

9. *Types of Manholes.*—Plans Nos. 4 and 5 show types of proposed manholes. Plan No 5 is for proposed manhole No. 1 where two branches have to be dealt with, and plan No. 4 for ordinary manhole along the line of the main sewer and elsewhere where the gradient is not too great. Plan No. 6 is the type for sewers with a steep gradient, though its adoption does not seem absolutely necessary. All these designs are of the ordinary pattern.

10. *House Connections.*—The house connections will, it is presumed, be carried out as the sewers are constructed as being the cheapest and most convenient course. Plan No. 7 shows a form of trapped pit into which the sewage can be discharged from the houses and thence through a 6-inch pipe into the sewer. The trap is what is known as Messrs. Ingham and Son's quick motion trap. "It is claimed † for this trap that the obstruction to the flow of sewage is less than in other traps, inasmuch as there is no unnecessary and useless sinking of the sides of the orifice below water level. The top of the trap, crosswise, is straight and horizontal, parallel with the surface of the water in the trap. Its dip is, therefore fully effective, the whole width of the drain pipe, whilst in all round sections both sides dip uselessly into the water and offer unnecessary obstruction to the flow of sewage. Those who had experience of these traps regard them with favour, and when we examine the principles on which they are constructed there appears to be every reason why that should be so. The trap effectively bars the passage of air; its dip is the same as that of other traps about 2 or $2\frac{1}{2}$ inches. The body of the water in the trap being small is frequently renewed. The outlet is on the next adjoining pipe, not on the trap itself. It is one of the points of this trap that when the sewage leaves it, it falls immediately and freely over the lip into the pipe and acquires motion thereby to start with, and a free outlet in the trap is maintained."

† See Professional Papers of the Corps of Royal Engineers edited by Captain W. A. Gale, R.E.

11. *Catch-pit or Gully for Stables.*—Plan No. 6 shows the form of gully for stables with a grating attached to the inlet to the drain which is turned downwards to prevent floating straw, &c., getting into the drain. It is proposed to be used in connection with surface channels carried beyond the building to a distance of 12 feet.

12. *Ventilation.*—In paragraph 8, it is suggested that manholes should be constructed on the line of sewers at maximum distances apart of 150 feet to facilitate inspection, ventilation, &c. With this number of manholes and an ample flush no further ventilation appears to be necessary, except a few 6-inch pipes led at intervals from the manholes or house connections to the gables of houses in the neighbourhood or up lamp-posts.

This question of ventilation appears to merit some attention, as according to Waring (sewerage and land drainage) "the proper requirement should be to make the ventilation universal, to furnish as many openings as possible and to afford abundant

facility for the inlet and outlet of air. The plan recommended by many Engineers *of prohibiting traps on house-druins* and making the soil-pipe itself a ventilator reaching above the roof seems to me to leave nothing to be desired. Under such conditions of ventilation as this will secure, the house-trap is entirely unnecessary in connection with such sewers as should be tolerated for a moment by any community. If the fixtures are trapped from the soil-pipe, the very diluted atmosphere of the sewer may be passed through this pipe without objection." This remark does not altogether apply to the proposed system at Ootacamund as none of the pipes will enter the houses; but if it is accepted that the proposed trap (paragraph 10) is unnecessary, considerable expense will be avoided, as all that will be necessary is to lead 6-inch pipes up the walls of houses from the proposed pit (plan No. 7), and these pipes will not be needed at every connection when the pit is at a distance from the house in a court-yard.

13. *Sewage Farm not necessary at present.*—In paragraph 8 of the Sanitary Commissioner's note of inspection, the existing system of disposal of sewage into a stream is condemned; but, as the municipality will probably find considerable difficulty in providing funds for the drainage, it is suggested that it is not necessary to further burden its resources with the construction and maintenance of a sewage farm pending the advent of the new industry, &c., alluded to. If the present outfall is considered to be too near Ootacamund, it is easy to extend the sewer further down the stream.

14. *Pail Depôts and Latrines.*—No proposals are made for pail depôts or special forms of latrines, as the Sanitary Commissioner is believed to be in possession of suitable designs. It is presumed that the sites will be fixed by the municipality with reference to the sewers, and that the solid matter from private latrines will be taken to pail depôts in connection with public latrines, provided with automatic flushing arrangements of the ordinary type.

15. *Definite orders requested.*—It is requested that definite orders may be issued on the various points raised in this report and that the plans may be approved for adoption or other designs supplied. It is also suggested that the exact areas to be drained should be marked on a map as it is understood that the drainage of additional areas is contemplated by the Sanitary Commissioner; additions which may necessitate modifications in the proposals now made.

16. *Silt and Sludge Interceptor not necessary.*—Orders are also requested regarding the silt interceptor at the upper end of the sewer and the sludge interceptor at the lower between it and its junction with the iron pipe sewer under the lake at Mettucherry swamp ordered to be provided in G.O., No. 512 W., dated 10th February 1896, as with the proposed arrangements these are apparently not necessary. The proposed flushing tank will obviate the necessity for the silt interceptor at the head of the sewer and with existing and proposed flushing arrangements no sludge interceptor seems necessary.

17. It is believed that the new railway station is likely to be located in Mettucherry. If so, it will be necessary to demolish a number of houses and may possibly be cheaper to buy up the remainder and give properly arranged building sites elsewhere rather than extend the system of sewers to the irregularly built houses in this part of Ootacamund.

18. *Lake Supply-Channel.*—In G.O., No. 3246 W., of 19th December 1895, the diversion of the lake supply-channel and the construction of a culvert under the Willow Bund road was sanctioned, but no provision was made for widening the channel below the road immediately east of the Hobart Park. The catchment basin of the lake above the Willow Bund is 3·7 square miles, of which about 3 square miles drain into the supply channel. In the estimates now submitted, it is proposed to widen the channel to a bed width of 12 feet with a fall $\frac{1}{450}$. This will cost only Rs. 470 as the bulk of the earth excavated will be used for filling in the upper part of the lake. A channel 12 feet wide flowing 2 feet deep will discharge 98 cubic feet or sufficient for an effective rainfall of about $3\frac{3}{4}$ inches in 24 hours which is the maximum likely to be dealt with, seeing that the gross maximum rainfall registered only amounts to 6·62 inches. This widening is very necessary as the existing channel below the road at the east end of the park is manifestly too narrow and frequently floods the land above.

19. No provision has been made in the estimate for lining the channel with masonry or concrete as ordered in G.O., No. 512 W., dated 10th February 1896, as this would be very expensive in made earth and would not prevent future silting as the bulk of the silt which enters the lake comes from the hills above the proposed flushing tank.

20. If silting of the lake below the Willow Bund is to be prevented, one of the following alterations might be adopted :—

(*a*) The construction of a reservoir at the foot of the hills to arrest the silt.
(*b*) To carry the channel along the north margin of the lake to the outfall at Kandal with sluices at intervals for supply purposes.
(*c*) The construction of a series of drops in the channel.

21. Of these alternatives it is probable that the better course will be to extend the supply channel along the north margin of the lake to discharge direct into the Kandal stream as this will prevent future silting. The work, however, will have to be carried out gradually as at certain points, for short distances, the margin of the lake is steep and the depth of water considerable, and the only way of forming the channel at a reasonable cost will be to confine the silt to the margin as it is brought down and to continue the channel as the land is reclaimed. It is certain that at the point where the channel water joins the still water in the lake a deposit of silt must take place, and if a pile and brushwood (not wattle) fence is constructed at a certain distance from the margin and is maintained in advance of the silting so as to confine it to the required width, it will eventually be possible to form the channel at these deep places. Elsewhere, the margin has a gradual slope and there is no difficulty.

22. *Lake and main sewer to be handed over to the Public Works Department.*—As the formation of the proposed channel will require technical knowledge and care it is suggested that the whole of the lake and its channel should be transferred to the Public Works department. It would also probably be as well to transfer the main sewer as the flushing arrangements can easily be attended to by the Sub-Divisional officer without prejudice to his other duties, while the municipal authorities have shown their inability in the past to attend to this duty owing to want of proper establishment. The transfer of the lake and main sewer would not necessitate any additional establishment beyond a few coolies to work and keep the gearing clean and this is the only charge, apart from the actual cost of repairs, which need necessarily fall on the municipality. Care in regulating the discharge of the flushing pipe at the head of the sewer will always be required owing to the weak section of the masonry conduit and will be especially necessary until such time as the house connections are completed as, if too great a pressure is allowed to, disc plugs will be displaced.

23. Permission is requested to purchase pipes and to manufacture two lakhs of pressed bricks at the Lawrence Asylum without further delay.

(Signed) F. W. ASHPITEL,
Executive Engineer, Coimbatore Division.

2*nd August* 1896.

Note by the Chief Engineer, Public Works Department.

I approve the plans generally, and as the matter is urgent I forward them on as they will have to be again considered as regards sanitary details by the Sanitary Board of which I am President.

(Signed) D. McNEIL CAMPBELL, Col., R.E.,
Chief Engineer.

No. 3598-C., dated 17th October 1896.

Transferred to the Local and Municipal Department.

(Signed) D. McNEIL CAMPBELL, Col., R.E.,
Secretary.

No. 1209, dated 22nd October 1896.

Referred to the Sanitary Board for early remarks.

(By Order)

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

Proceedings of the Sanitary Board, No. 299-S., dated 4th December 1896.

Read—the following papers :—

Letter from the Superintending Engineer, IV Circle, No. 422 W., dated 27th August 1896.

Endorsement in the Local and Municipal Department, No. 1209, dated 22nd October 1896.

Note by Surgeon-Lieutenant-Colonel W. G. KING, Sanitary Commissioner, dated Fort St. George, 3rd November 1896, No. 457—S.B.

Ootacamund Drainage Scheme.

Reference.—Rule 16 of the revised Sanitary Board Rules . . . . "The plans and estimates for works costing Rs. 500 and upwards shall, after completion by the Sanitary Engineer, be forwarded to the Sanitary Commissioner for opinion on sanitary grounds *only*." . . .

Undersigned considers it highly desirable that Ootacamund should be furnished with a correct sewerage conservancy scheme and that if funds be available Mettucherry and Kodapamund be also included. He also considers it desirable that flooding of the agraharam be prevented, and that silting of the lake be provided against.

2. Undersigned refrains from criticizing the structural method employed by the Engineer to meet sanitary ends with reference to the above rule.

Office-note by J. A. JONES, Esq., Sanitary Engineer, dated Fort St. George, 6th November 1896, No. 27.

[*Reference.*—Ootacamund Intercepting Sewer. Proposals for improvement of —.]

Under the special circumstance of this scheme having been prepared by a Public Works department officer, passed by the Superintending Engineer and approved by the Chief Engineer generally, it is rather difficult for the Sanitary Engineer to know what manner of criticism is expected of him or what measure of advice he should tender, and after the exhaustive examination already given by the Public Works department, it is with some diffidence that the Sanitary Engineer offers the following criticisms :—

1. In the first place the design of the sewer is not in accordance with what was laid down by the Sanitary Board. The Sanitary Board required that the sewer should be laid in a pipe-sewer carried to the *Mettucherry swamp sump*. This has not been done; the present proposal is to join the sewer to the iron pipe at a point above the Willow Bund. Mr. Ashpitel's plans show that in doing so he obtains a grade of 1 in 329, but the undersigned ventures to think that there is an error in the levels and with this note forwards the plan prepared in this office before the decision of the Sanitary Board was arrived at. This shows that Mr. Ashpitel's section shows a fall of 26·96—21·37 = 5·59 between the points fixed by him as the beginning and end of the sewer and a gradient of 1 in 329 for the same length. But the section now forwarded shows that the fall is really only from 29·59 to 25·00 or 4·59, and the length being 2,130—250 or 1,880 the gradient is only about 1 in 410, and to obtain an increased gradient the sewer must be carried to join the iron pipe at the point indicated

by the Sanitary Board, that is, the first sump below the Willow Bund; a fall of 1 in 341 is then possible. This is shown by a red line on the tracing accompanying. [It should be noted that the data of the two sections are not the same.]

2. The section, it is submitted, should therefore be amended in this particular, the levels being, it is believed, incorrect. Mr. Ashpitel in his reports throws aside the recommendation of a 12-inch pipe by the Sanitary Board with the remark that it is no use to fix the size of the pipe by a calculation, because the population will increase enormously! The undersigned ventures to think that this would be a very cogent reason for fixing the pipe by calculation and desires to point out the following facts.

3. Assuming for the moment that Mr. Ashpitel's grade is correct and that a 15-inch pipe were laid, this pipe at his grade would carry about 223 c. ft. per minute, say, 1,394 gallons per minute. Taking this as a maximum it represents the sewage from 48,384 people at 20 gallons per head (the sewer flowing on an average half full and half the sewage carried off in six hours). Is it to be expected that the whole of Ootacamund will ever contain this number, much less that, that number drain into the intercepting sewer?

4. A 15-inch sewer at 1 in 341 (the supposed grade) has a velocity running full or half full of only 188 feet per minute = 3 feet per second; but when this sewer carries the actual sewage of the population which certainly does not amount to that of more than 10,000 people, the sewage of which will not exceed 277 gallons per minute as a maximum, the velocity would be so inappreciably low that silting would indubitably take place. While it has always been maintained that a 9-inch is ample if properly laid, the Sanitary Board decided on a 12-inch so as to allow for a large amount of flood water passing through it; a 12-inch sewer at a grade of 341 will discharge about 130 c. ft. or 812 gallons per minute full and 406 half full which is surely very ample.

5. The undersigned therefore advises that the 12-inch size be retained.

6. Not only has it much more chance of being self-cleansing, but it will be much more easily flushed; a 15-inch sewer would take a very large amount of water to flush properly.

7. Very little of Mr. Ashpitel's report refers to the work to be done, but is rather an essay on his proposals for the design for dealing with the bazaar drains and altering them to underground sewers; this point need not be discussed at present and is only noticed, because it is not easy to understand whether the plans of manholes amongst the drawings refer to such proposals or to the actual work now proposed to be undertaken; one manhole is described as manhole No. 1; the other two designs bear no such description. These manholes are 4′ 9″ high from bottom of sewer to ground level; but at manhole No. 1 the depth of sewer below ground is only (from the Sanitary Engineer's tracing) 31·86—29·59 = 2·27. No ground level at all is shown on Mr. Ashpitel's sections, and apparently the tracing shows the section of the line of the channel and not of the sewer; from the Sanitary Engineer's tracing however this depth of 4′ 9″ will be suitable for the lower end of the sewer only. Each manhole, it is submitted, ought to be separately designed before work is begun, but the practice of the Public Works department on this point is not known. Taking the manholes as a type of what are proposed, it is marked that there is no arrangement whatever from keeping silt out of the sewer nor for the disposal of storm water. It is submitted that such arrangements must be made. The storm water from existing surface drains (whether they are to be abandoned in the future or not) must cross the proposed sewer; these drains carry both sewage and storm water, and it is advisable to prevent any but a small quantity of storm water entering the sewer. Some design for this should therefore be prepared and approved by the Board.

8. Mr. Ashpitel's plan does not show whether he retains existing connection with the sewer or otherwise; it is presumed he does, but these also should have a place on the plan and there the arrangements for interception of silt and overflow should be shown.

9. The desirability of flushing the sewer need not be discussed, but it is doubtful if the arrangements proposed are likely to be successful. The long square sewer

with its many outlets, trap doors, &c., between the flushing pipe and the pipe sewer will, it is believed, render abortive any attempts at successful flushing—it would be much better to arrange for a flush tank (which could be filled with water from the channel by pumping when pipe water is not available) at the actual head of the sewer. No doubt the site of Mr. Ashpitel's proposed flushing tank would be excellent, were there a pipe sewer extended up to it; but, under existing conditions, the plan cannot be advised as one which should be sanctioned.

10. It is not thought that the proposed channel debouches into the lake in the best position. It seems to the undersigned that it would be advisable for the channel to be curved quickly to the left after passing under the Willow Bund, thus reaching deep water much more quickly than it now does.

11. The undersigned does not think it necessary for him to criticise the estimate nor the report other than in regard to the points already touched on.

12. The plans, estimates and reports are returned with the Sanitary Commissioner's note thereon.

Note by Colonel D. McNEIL CAMPBELL, R.E., President, Sanitary Board.

In forwarding the plans and estimates for the Ootacamund drainage to the Local and Municipal department, I said that I approved generally of the scheme and that I forwarded them to save delay as I would have to note on them again as President, Sanitary Board.

2. As regards the details I agree with the Sanitary Engineer that a 15-inch pipe is larger than necessary, and I think a 12-inch pipe should be substituted: this will reduce the estimate by Rs. 1,490. I can see no object in carrying the pipe to the Mettucherry swamp sump and Mr. Ashpitel's arrangement may be approved.

3. As regards the difference in levels I have no reason to doubt the correctness of those taken by Mr. Ashpitel who informs me that they were taken several times; but the matter is not of much consequence, as a 12-inch pipe is ample to give the required discharge even with the reduced grade of $\frac{1}{410}$, this being what Mr. Ashpitel's grade of $\frac{1}{329}$ is reduced to if there is an error of 1 foot as stated by Mr. Jones.

4. As regards the manholes the designs submitted by Mr. Ashpitel are sample ones and are not prepared with reference to any particular site, and they will have to be altered to suit the ground level during construction, and probably a saving on the estimate will be effected. I do not agree with Mr. Jones that Mr. Ashpitel's flushing arrangement will not answer the purpose; it is impossible to say for certain that it will be a success, but I see no reason to think otherwise. Mr. Ashpitel's reasons for ending the supply channel as he does, are given in paragraph 21 of his report, and I approve of them.

5. I consider that Mr. Ashpitel's estimate should be sanctioned, the size of pipe being reduced to 12 inches instead of 15 inches, and as the work is urgent I would advise that the pipes be ordered at once. The question raised by the Sanitary Commissioner as regards the drainage of Mettucherry and Kodapamund can be considered hereafter.

Resolution—No. 299-S., dated 4th December 1896.

With his letter, No. 422-W., dated 27th August 1896, the Superintending Engineer, IV Circle, submits plans and estimates for town drainage works at Ootacamund. The proposals are drawn up with reference to the recommendations of the Sanitary Board approved in G.O., No. 1390 M., dated 24th August 1895, and in accordance with the undermentioned orders:—

G.O., No. 512 W., dated 10th February 1896.
„ „ 982 W. „ 19th March „

2. They include the following estimates :—

		Rs.
(i)	Estimate for pipes and for removing and relaying the intercepting sewer from junction with Brewery drain to Willow Bund	15,000
(ii)	Estimate for 21 manholes for intercepting sewer	4,350
(iii)	Flushing sluice at head of sewer	4,200
(iv)	Widening supply channel	470
(v)	Culvert under Willow Bund	2,920
	Total ..	26,940

3. The plans generally have been approved by the Chief Engineer and they have now been referred by Government for the remarks of the Sanitary Board.

4. The Board approves the plans and estimates subject to the remarks of the President, who has recorded a separate note on the subject which is submitted for the information of Government.

5. The suggestions of the Sanitary Commissioner are commended by the Board for the consideration of Government when opportunity offers.

(True Extract.)

(Signed) R. PARSONS,
Secretary, Sanitary Board.

To the Secretary to Government,
Local and Municipal Department.

ORDER—No. 107 M., dated 27th January 1897.

The estimate prepared by Mr. Ashpitel for the improvement of the drainage of Ootacamund, which, as modified with reference to paragraph 2 of the note by the President of the Sanitary Board, amounts to Rs. 25,450, is sanctioned.

2. To meet the cost of the work, the municipal council is requested to appropriate a sum of Rs. 25,450 out of the Provincial grants amounting to Rs. 1,89,000 on account of the water-supply scheme, which it has already received, and to place the sum at the disposal of the Public Works department.

3. The Public Works department is requested to put the work in hand at once. Its attention is drawn to the remarks of the President of the Sanitary Board in paragraph 4 of his note.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Ootacamund.
„ Collector of Nilgiris.
„ Sanitary Board.
„ Public Works Department.
„ Financial Department.
„ Accountant-General.
Editors' Table.

Exd. A. F. Eccleston.

Ootacamund Drainage

P. W. DEPARTMENT.

No. Print emergently
No. 378 dy 8-2-97

PROCEEDINGS OF THE MADRAS GOVERNMENT.

READ the following

From the Supdg: Engineer IV Circle No. 575 dy 14 November
Proceedings of Govt: in the Local & Municipal Dept. No. 107 M dy 27 January

Communicated to
the Supdg: Engineer IV Circle
who will arrange to have
the work put in hand at
once and completed before
the next season.

Para 2 should be commended by the insertion of the words shown in red ink.

A.S.H. 5.2.97

2. The Local and Municipal Department will place at the disposal of the P.W. Department as already ordered in para 2 of the G.O. cited above.

3. The sanction accorded in para 1 of the Proceedings quoted above has been registered as Excluded Local No. 61 W of 1896-97, and classified as Miscellaneous Public Improvements, Original Works.

The Secretary to Govt
Local & Municipal Dept
For favour of countersignature.

No objection in this Department. The municipal council of Ootacamund has however been already instructed to place the required funds at the disposal of the Public Works Department. Vide para 2 of the Proceedings cited.

3/2/97

The S.E. IV Circle with 31 enclos.
" Assr. P.W. Accts
" L & M. Dept

P. W. 40.
1,000—11-11-96

Public Works (1897) Department.

CURRENT No. 1076

3598C
17.10.96

Order

From The Local & Munl. Deptt "

No. 107 L.S.G.

Dated 27-1-97

Received 29.1.97

Enclosures 3x (x21 Plans)

Spare copies

SUBJECT.

Drainage

Sanctioning an estimate of Rs. 25,450 for the improvement of the —— of Ootacamund, and requesting the Munl: Council to meet the cost of the work out of the Provl. Grant of Rs. 189,000 on account of the water-supply scheme, and to place the amount at the disposal of the P.W.D., which will put the work in hand at once.

Secy. to Govt. 3/2/97
H.S. 4/2 R 6/2/97.

BACK PAPERS.

G.O.	No.	Department.	Date.
No.	299 S.	Sanitary	4-12-96
"	173 S	"	24-10-96
"	3214 W	P.W.	11-11-96
"	3777 C	"	9-11-96
"	3598 C	"	17-10-96
"	512 W	"	10-2-96
"	201 C	"	11-1-96
"	228 D	"	22-5-96
"	1082 D	"	26-9-95
"	1058 C	"	14-3-95
"	787 D	"	17-8-95
"	2066 W	"	19-8-95
"	314 D	"	7-6-95
"	940 D	"	7-9-95
"	2768 W	"	1-11-95
"	3812 C	"	3-12-95
"	395 D	"	19-6-94.

FURTHER PAPERS.

G.O.	No.	Department.	Date.

2,000-3-11-96.

Local and Municipal Department,

PROCEEDINGS OF THE MADRAS GOVERNMENT.

READ the following paper/—

From the Public Works Department, No.3598 C., dated 17"October 1896, transferring note by the Chief Engineer approving plans and estimates in connection with certain improvements to the Ootacamund Drainage Scheme.

From the Sanitary Board, No.299 S., dated 4"December 1896, approving with remarks plans and estimates for town drainage works at Ootacamund.

ORDER No.107 M., dated 27"January 1897.

The estimate prepared by Mr.Ashpitel for the improvement of the drainage of Ootacamund, which, as modified with reference to para.2 of the note by the President of the Sanitary Board, amounts to Rs.25,450, is sanctioned.

2. To meet the cost of the work, the Municipal Council is requested to appropriate a sum of Rs.25,450 out of the Provincial grants amounting to Rs.189,000 on account of the water supply scheme, which it has already received, and to place the sum at the disposal of the Public Works Department.

3. The Public Works Department is requested to put the work in hand at once. Its attention is drawn to the remarks of the President of the Sanitary Board in para.4 of his note.

(True Extract)

Secretary to Government.

To.

The Chairman, Municipal Council, Ootacamund.

,, Public Works Department. with plans & estimates

&c. &c. &c.

L. G. No 253.

Public Works (1896) Department.

CURRENT No. 10464

3784

Order

Arrange return
When papers from
the Sanitary Board

23/11/96

cs

Date Nov 24th 1896

From The Supg. Engineer
4th Circle

No. 575
W

Dated 14th November 1896.

Received 18.11.96

Enclosures (1) One.

Spare copies —

SUBJECT.

Rotacammund Drainage
Scheme.

Expresses his concurrence
with Mr. Walches remarks &
Suggests the Sanction of the
Estimate already Submitted
for—

BACK PAPERS.

G.O.	No.	Department.	Date.

FURTHER PAPERS.

G.O.	No.	Department.	Date.

Data for laying pipes

15" Pipes

	Rs	A	P.
100 Rg Feet 15" stoneware pipes delivered at Mettupalayam including breakage	318	0	0
6 Tons conveyance to Ooty at Rs 15 per ton	90	.	.
Jointing with cement	12	8	.
Earthwork 100 × 2¼ × 5 Say 1000 cft at Rs 10 including refilling	10	.	.
Lighting, fencing, sight rails watching, making roadway &c.	20	.	.
Total per 100 Rg feet	450	8	0

or per foot say Rs 4-8-0

12" Pipes

100 Rg Feet 12" pipes	215	.	.
4⅓ Tons conveyance at Rs 15	65	.	.
Jointing with cement	10	0	0
Earthwork	8	0	0
Lighting &c.	20	.	.
Total per 100 Rg feet	318	0	0

or per Rg foot say 3—4—0

9" Pipes

100 Rg Feet 9" pipes	137	8	0
3 Tons conveyance	45	.	0
Jointing	8	0	0
Earthwork	8	0	0
Lighting &c.	20	.	.
Total per 100 Rg feet.	218	8	0
or per foot say —	2	4	0

Wurtpell
Executive Engineer
Coimbatore Division

J.C.L.
P.L.S

SUPG. ENGINEER'S OFFICE A.W.D.
No. 5750
31 AUG 96
encls: 2
FOURTH CIRCLE.

OWS.1
10464/96

No. 575
W.

Supg. Engineer's office, 4 Circle,
Coimbatore 14th November 1896.

From,

J. Hannan, Esq.,
Supg. Engineer, 4 Circle,

To,

The Chief Engineer,
P.W. Department.

Sir,

Enclosure
1 Schedule.

With reference to G.O. No. 3214W, dated 11th instant, I have the honor to state that the only remark I have to make with reference to para 2 of Order No. 1647, dated 24th September 1896, is to express my entire concurrence with Mr. Walch's remarks and to suggest that the estimate to give effect to his proposals which was forwarded for sanction with this office No. 422W, dated 27th August last may be sanctioned for execution at once. It will not be necessary to revise the estimate except as regards rates for pipe laying, the rates for which should be corrected in accordance with the rates

+ 3598
17-10-96

entered

entered in the accompanying Schedule
and which, in order to save delay, I request
that you will have done in your office.

I have the honor to be,
Sir,
Your most obed.t servant,

(By order)

Romanungam N.D Clerk,
Supg. Engineer's office, Ft Pitt.

3a-11-65

V. Urgent

MEMORANDUM. For C. No.

REQUESTED for reference the undermentioned papers:—

Four attested printed Spare Copies of
Ex. No. 107 M (L & M) dated 27 January 97
regarding Bi-Carbonated Drains.

Compounder

Second Apothecary

Barrack or Hospital Assistant wanted.

P. W. SECRETARIAT,
Chepâk, 21 May 1897.

To
The First Apothecary
L. & M. Dept.

[P. W. 30
500—28-5-96.]

Government {1897} of Madras.

LOCAL AND MUNICIPAL.

Recd. } 1897. Enclosures

Regd. Spare copies

G.O., No. 107 M., 27th January 1897.

JANUARY.

Drainage.

Sanctioning an estimate of Rs. 25,450 for the improvement of the — of Ootacamund, and requesting the municipal council to meet the cost of the work out of the Provincial grant of Rs. 1,89.000 on account of the water-supply scheme and to place the amount at the disposal of the Public Works department which will put the work in hand at once.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers :—

Endorsement—from the Public Works Department, No. 3598-C., dated 17th October 1896.

Read—the following papers :—

From J. HANNAN, Esq., Superintending Engineer, IV Circle, to the Chief Engineer, Public Works Department, dated Coimbatore, 27th August 1896, No. 422-W.

As more than one reminder has been lately received from your office calling for the estimate for relaying the intercepting sewer and for the drainage of Mettucherry and the main bazaar at Ootacamund, I have the honour to submit herewith the plans and estimate for that portion of the scheme which affects the upper portion of the Ootacamund lake now being filled in. The plans and estimates were received by me on the 10th instant. As no proper data were submitted for the rates which appeared to be excessive, I returned the data sheet to the Executive Engineer for revision. It has not been returned as yet. As, however, the estimates appear to be urgently required, I submit them as received. They have not been checked in this office.

2. Mr. Ashpitel submits a very full report showing, amongst other things, how in his opinion the drainage of the Mettucherry and the main bazaar, &c., should be carried out. His proposals are, I have no doubt, the latest up to date ones from a sanitary engineering point of view. Whether the existing arrangements cannot be made fairly efficient at a less cost is a question which will doubtless be duly considered by the Sanitary Committee of experts.

ENCLOSURES.

REPORT to accompany the Preliminary Estimate for the Ootacamund Drainage Scheme.

Object of Preliminary Estimate.—With the exception of Kandal the drainage of Ootacamund at the present time is discharged into the lake owing to the failure of the existing system of sewerage. The sewers consist of open drains following the natural lines of drainage and an intercepting or main close sewer of varying size and description which follows the line of the supply channel from the back of Mr. Brown's establishment to the Willow Bund. Beyond this point an iron-pipe sewer, 12 inches diameter, has been laid through the lake with an outfall into the Kandal stream.

In G.O., No. 512 W., dated 10th February 1896, the preparation of a complete scheme was ordered, but owing to the delay in obtaining copies of the recent town survey, this has not been possible, and in G.O., No. 982 W., dated 19th March 1896, this preliminary estimate was ordered to be prepared. The estimate provides only for taking up the 9-inch main sewer from the Brewery drain to the Willow Bund and replacing it by a 15-inch pipe as already approved for improving the lake supply channel and the provision of flushing arrangements for the main sewer.

2. *Existing System.*—From time to time considerable sums have been spent on the drainage of Ootacamund, and the result cannot be said to be satisfactory. The main sewer for a length of about 4,560 feet consists of a masonry conduit laid almost on the surface of the ground with an average fall $\frac{1}{500}$, a 9-inch stoneware pipe from 4,764 feet to 6,603 feet laid practically with no fall (*vide* longitudinal section) though a fall of $\frac{1}{320}$ is available and a 12-inch iron pipe through the lake with a fall of $\frac{1}{1000}$. The only really efficient length of this main sewer is the pipe through the lake which is provided with admirable flushing arrangements and needs no improvement. The 9-inch pipe is too small and without fall, and the masonry conduit is, it

is suggested, altogether in the wrong place for the main sewer and of very inferior design. Throughout the system the manholes are too small, and, as the Sanitary Commissioner points out in his notes printed with G.O., No. 648 M., dated 23rd May 1894, there are numerous gully pits along the line of sewer designed to intercept silt and solid matter, which are simply open cess-pools.

3. *Proposed System.*—In any scheme for the drainage of Ootacamund it appears to be absolutely necessary to recognize the fact that, whatever the merits of open drains may be, it is not a good thing to combine them with a closed main sewer. Such a combination is fatal to good sanitation as, owing to the necessity of admitting surface water to the sewers, and the difficulty of excluding solid matters, rubbish and road detritus, gullies are required which retain sewage and become nothing more nor less than evil smelling cess-pools requiring frequent cleansing.

4. Open drains have in this country a number of advocates who echo the old cry that the sun is the best sanitarian; but the sun, like other sanitarians, requires to be given a fair chance. To collect sewage in a number of pits into which liquid is constantly flowing does not give this fair chance, and the result is that the sun, under these circumstances, merely assists putrefaction and the formation of sewer gas. It does not seem advisable, therefore, to have a mixed system of open and closed drains, and one or other of these systems should, it is suggested, be adopted in its entirety with no cess-pools.

5. As an open sewer along the north boundary of the Hobart Park would be extremely unpleasant and unsightly, and as the existing 12-inch iron pipe through the lake is effective and has been laid at considerable expense, it is suggested that a pipe system should be adopted throughout, the existing open drains being retained for surface drainage only. Ootacamund is an ideal place for such a system of sewers, provided that the ordinary principles are adopted with no special contrivances, such as catch-pits or interceptors, which create the very evil the sewers are intended to prevent.

6. *Existing Masonry Sewer to be reserved for the few houses along its course and for flushing purposes.*—In paragraph 2 it was suggested that the existing masonry sewer down to the junction with the Brewery drain is wrongly aligned. Inspection shows that this sewer has not a good fall and directly serves very few houses. It is also of poor design and much obstructed. A better line for the main sewer will be along Commercial Road joining the existing line at proposed manhole No. 1 and picking up the market and latrine drains on the way. If this is approved, the main may, for the present, start at commencement of the Commercial Road bazaar and may be at 12-inch stoneware pipe up to proposed manhole No. 1 (*vide* plan No. 1) and a 15-inch stoneware pipe from this point to the junction with the existing 12-inch iron pipe near the Willow Bund. It appears to be of but little use to fix the size of pipes by calculation, as the amount of sewage to be dealt with is likely to increase enormously as the population increases, and the 12-inch iron pipe through the lake, with its flushing arrangements, will take the discharge from these pipes. It will be noted that the velocity in all these pipes will considerably exceed the limit of $1\frac{1}{2}$ feet per second proposed by Waring for the separate system. The existing masonry sewer from the back of Mr. Brown's premises to manhole No. 1 will be extremely useful to serve the few houses along its course, but will chiefly be valuable for flushing purposes as explained in paragraph 7. When house connections are provided this sewer should be examined and repaired and the manholes altered, so as not to retain sewage, *i.e.*, the catch-pits should be filled up and proper channels formed.

7. *Proposed Flushing arrangements.*—Just above Mr. Brown's stables a small tank formerly existed as is evident from the old surveys of Ootacamund, and, if this tank is restored by damming up the channel at the point shown on the accompanying map, and a pipe laid from this tank to the head of the existing sewer, an efficient flush can be secured. Plan No. 3 shows the proposed flushing sluice with two vents, each 6 feet wide, or the full width of the channel bed. This ventage may be considered to be excessive, but is allowed in order to reduce the velocity through the sluice to the normal channel velocity during the rainy weather when much silt is likely to be brought down from the hills. From this sluice an iron pipe 9-inch diameter is

proposed to be laid to the head of the existing sewer with a fall $\frac{1}{40}$ or thereabouts and regulated by a sluice valve. This pipe will discharge sufficient water for an ample flush under pressure,* and owing to the continuous supply in the channel, even during the hot months of the year, the flush can be effected daily. No automatic flushing arrangements are proposed, as some sort of establishment will necessarily be maintained and automatic valves have a tendency to get out of order. To flush branch sewers water will have to be obtained from the municipal pipes; but if Field's or other suitable flushing tanks are constructed in connection with the stand pipes, the waste water will probably be ample.

* Some of the obstructions in the masonry sewer will probably have to be removed.

8. *Dimensions of proposed Sewers and Position of Manholes.*—In the complete estimates it is suggested that the branch street sewers may be 9-inch, and the house connections 6-inch, stoneware pipes in accordance with the usual practice; the sewers to follow the directions of the streets and to be laid in straight lengths according to the roads, each length being terminated in a manhole with intermediate manholes at intervals of 150 feet to facilitate inspection, ventilation and the localization of leaks. Intermediate manholes will not be numerous as the streets are generally short, and therefore it does not seem worthwhile to substitute ventilators which do not permit inspection of the sewer.

9. *Types of Manholes.*—Plans Nos. 4 and 5 show types of proposed manholes. Plan No 5 is for proposed manhole No. 1 where two branches have to be dealt with, and plan No. 4 for ordinary manhole along the line of the main sewer and elsewhere where the gradient is not too great. Plan No. 6 is the type for sewers with a steep gradient, though its adoption does not seem absolutely necessary. All these designs are of the ordinary pattern.

10. *House Connections.*—The house connections will, it is presumed, be carried out as the sewers are constructed as being the cheapest and most convenient course. Plan No. 7 shows a form of trapped pit into which the sewage can be discharged from the houses and thence through a 6-inch pipe into the sewer. The trap is what is known as Messrs. Ingham and Son's quick motion trap. "It is claimed † for this trap that the obstruction to the flow of sewage is less than in other traps, inasmuch as there is no unnecessary and useless sinking of the sides of the orifice below water level. The top of the trap, crosswise, is straight and horizontal, parallel with the surface of the water in the trap. Its dip is therefore fully effective, the whole width of the drain pipe, whilst in all round sections both sides dip uselessly into the water and offer unnecessary obstruction to the flow of sewage. Those who had experience of these traps regard them with favour, and when we examine the principles on which they are constructed there appears to be every reason why that should be so. The trap effectively bars the passage of air; its dip is the same as that of other traps about 2 or $2\frac{1}{2}$ inches. The body of the water in the trap being small is frequently renewed. The outlet is on the next adjoining pipe, not on the trap itself. It is one of the points of this trap that when the sewage leaves it, it falls immediately and freely over the lip into the pipe and acquires motion thereby to start with, and a free outlet in the trap is maintained."

† See Professional Papers of the Corps of Royal Engineers edited by Captain W. A. Gale, R.E.

11. *Catch-pit or Gully for Stables.*—Plan No. 6 shows the form of gully for stables with a grating attached to the inlet to the drain which is turned downwards to prevent floating straw, &c., getting into the drain. It is proposed to be used in connection with surface channels carried beyond the building to a distance of 12 feet.

12. *Ventilation.*—In paragraph 8, it is suggested that manholes should be constructed on the line of sewers at maximum distances apart of 150 feet to facilitate inspection, ventilation, &c. With this number of manholes and an ample flush no further ventilation appears to be necessary, except a few 6-inch pipes led at intervals from the manholes or house connections to the gables of houses in the neighbourhood or up lamp-posts.

This question of ventilation appears to merit some attention, as according to Waring (sewerage and land drainage) "the proper requirement should be to make the ventilation universal, to furnish as many openings as possible and to afford abundant

facility for the inlet and outlet of air. The plan recommended by many Engineers *of prohibiting traps on house-drains* and making the soil-pipe itself a ventilator reaching above the roof seems to me to leave nothing to be desired. Under such conditions of ventilation as this will secure, the house-trap is entirely unnecessary in connection with such sewers as should be tolerated for a moment by any community. If the fixtures are trapped from the soil-pipe, the very diluted atmosphere of the sewer may be passed through this pipe without objection." This remark does not altogether apply to the proposed system at Ootacamund as none of the pipes will enter the houses; but if it is accepted that the proposed trap (paragraph 10) is unnecessary, considerable expense will be avoided, as all that will be necessary is to lead 6-inch pipes up the walls of houses from the proposed pit (plan No. 7), and these pipes will not be needed at every connection when the pit is at a distance from the house in a court-yard.

13. *Sewage Farm not necessary at present.*—In paragraph 8 of the Sanitary Commissioner's note of inspection, the existing system of disposal of sewage into a stream is condemned; but, as the municipality will probably find considerable difficulty in providing funds for the drainage, it is suggested that it is not necessary to further burden its resources with the construction and maintenance of a sewage farm pending the advent of the new industry, &c., alluded to. If the present outfall is considered to be too near Ootacamund, it is easy to extend the sewer further down the stream.

14. *Pail Depôts and Latrines.*—No proposals are made for pail depôts or special forms of latrines, as the Sanitary Commissioner is believed to be in possession of suitable designs. It is presumed that the sites will be fixed by the municipality with reference to the sewers, and that the solid matter from private latrines will be taken to pail depôts in connection with public latrines, provided with automatic flushing arrangements of the ordinary type.

15. *Definite orders requested.*—It is requested that definite orders may be issued on the various points raised in this report and that the plans may be approved for adoption or other designs supplied. It is also suggested that the exact areas to be drained should be marked on a map as it is understood that the drainage of additional areas is contemplated by the Sanitary Commissioner; additions which may necessitate modifications in the proposals now made.

16. *Silt and Sludge Interceptor not necessary.*—Orders are also requested regarding the silt interceptor at the upper end of the sewer and the sludge interceptor at the lower between it and its junction with the iron pipe sewer under the lake at Mettucherry swamp ordered to be provided in G.O., No. 512 W., dated 10th February 1896, as with the proposed arrangements these are apparently not necessary. The proposed flushing tank will obviate the necessity for the silt interceptor at the head of the sewer and with existing and proposed flushing arrangements no sludge interceptor seems necessary.

17. It is believed that the new railway station is likely to be located in Mettucherry. If so, it will be necessary to demolish a number of houses and may possibly be cheaper to buy up the remainder and give properly arranged building sites elsewhere rather than extend the system of sewers to the irregularly built houses in this part of Ootacamund.

18. *Lake Supply-Channel.*—In G.O., No. 3246 W., of 19th December 1895, the diversion of the lake supply-channel and the construction of a culvert under the Willow Bund road was sanctioned, but no provision was made for widening the channel below the road immediately east of the Hobart Park. The catchment basin of the lake above the Willow Bund is 3·7 square miles, of which about 3 square miles drain into the supply channel. In the estimates now submitted, it is proposed to widen the channel to a bed width of 12 feet with a fall $\frac{1}{450}$. This will cost only Rs. 470 as the bulk of the earth excavated will be used for filling in the upper part of the lake. A channel 12 feet wide flowing 2 feet deep will discharge 98 cubic feet or sufficient for an effective rainfall of about $3\frac{3}{4}$ inches in 24 hours which is the maximum likely to be dealt with, seeing that the gross maximum rainfall registered only amounts to 6·62 inches. This widening is very necessary as the existing channel below the road at the east end of the park is manifestly too narrow and frequently floods the land above.

19. No provision has been made in the estimate for lining the channel with masonry or concrete as ordered in G.O., No. 512 W., dated 10th February 1896, as this would be very expensive in made earth and would not prevent future silting as the bulk of the silt which enters the lake comes from the hills above the proposed flushing tank.

20. If silting of the lake below the Willow Bund is to be prevented, one of the following alterations might be adopted :—

(*a*) The construction of a reservoir at the foot of the hills to arrest the silt.
(*b*) To carry the channel along the north margin of the lake to the outfall at Kandal with sluices at intervals for supply purposes.
(*c*) The construction of a series of drops in the channel.

21. Of these alternatives it is probable that the better course will be to extend the supply channel along the north margin of the lake to discharge direct into the Kandal stream as this will prevent future silting. The work, however, will have to be carried out gradually as at certain points, for short distances, the margin of the lake is steep and the depth of water considerable, and the only way of forming the channel at a reasonable cost will be to confine the silt to the margin as it is brought down and to continue the channel as the land is reclaimed. It is certain that at the point where the channel water joins the still water in the lake a deposit of silt must take place, and if a pile and brushwood (not wattle) fence is constructed at a certain distance from the margin and is maintained in advance of the silting so as to confine it to the required width, it will eventually be possible to form the channel at these deep places. Elsewhere, the margin has a gradual slope and there is no difficulty.

22. *Lake and main sewer to be handed over to the Public Works Department.*—As the formation of the proposed channel will require technical knowledge and care it is suggested that the whole of the lake and its channel should be transferred to the Public Works department. It would also probably be as well to transfer the main sewer as the flushing arrangements can easily be attended to by the Sub-Divisional officer without prejudice to his other duties, while the municipal authorities have shown their inability in the past to attend to this duty owing to want of proper establishment. The transfer of the lake and main sewer would not necessitate any additional establishment beyond a few coolies to work and keep the gearing clean and this is the only charge, apart from the actual cost of repairs, which need necessarily fall on the municipality. Care in regulating the discharge of the flushing pipe at the head of the sewer will always be required owing to the weak section of the masonry conduit and will be especially necessary until such time as the house connections are completed as, if too great a pressure is allowed to, disc plugs will be displaced.

23. Permission is requested to purchase pipes and to manufacture two lakhs of pressed bricks at the Lawrence Asylum without further delay.

(Signed) F. W. ASHPITEL,
Executive Engineer, Coimbatore Division.

2nd August 1896.

Note by the Chief Engineer, Public Works Department.

I approve the plans generally, and as the matter is urgent I forward them on as they will have to be again considered as regards sanitary details by the Sanitary Board of which I am President.

(Signed) D. McNEIL CAMPBELL, Col., R.E.,
Chief Engineer.

No. 3598-C., dated 17th October 1896.

Transferred to the Local and Municipal Department.

(Signed) D. McNEIL CAMPBELL, Col., R.E.,
Secretary.

No. 1209, dated 22nd October 1896.

Referred to the Sanitary Board for early remarks.

(By Order)

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

Proceedings of the Sanitary Board, No. 299-S., dated 4th December 1896.

Read—the following papers :—

Letter from the Superintending Engineer, IV Circle, No. 422 W., dated 27th August 1896.

Endorsement in the Local and Municipal Department, No. 1209, dated 22nd October 1896.

Note by Surgeon-Lieutenant-Colonel W. G. KING, Sanitary Commissioner, dated Fort St. George, 3rd November 1896, No. 457—S.B.

Ootacamund Drainage Scheme.

Reference.—Rule 16 of the revised Sanitary Board Rules . . . . "The plans and estimates for works costing Rs. 500 and upwards shall, after completion by the Sanitary Engineer, be forwarded to the Sanitary Commissioner for opinion on sanitary grounds *only*." . . .

Undersigned considers it highly desirable that Ootacamund should be furnished with a correct sewerage conservancy scheme and that if funds be available Mettucherry and Kodapamund be also included. He also considers it desirable that flooding of the agraharam be prevented, and that silting of the lake be provided against.

2. Undersigned refrains from criticizing the structural method employed by the Engineer to meet sanitary ends with reference to the above rule.

Office-note by J. A. JONES, Esq., Sanitary Engineer, dated Fort St. George, 6th November 1896, No. 27.

[*Reference.*—Ootacamund Intercepting Sewer. Proposals for improvement of —.]

Under the special circumstance of this scheme having been prepared by a Public Works department officer, passed by the Superintending Engineer and approved by the Chief Engineer generally, it is rather difficult for the Sanitary Engineer to know what manner of criticism is expected of him or what measure of advice he should tender, and after the exhaustive examination already given by the Public Works department, it is with some diffidence that the Sanitary Engineer offers the following criticisms :—

1. In the first place the design of the sewer is not in accordance with what was laid down by the Sanitary Board. The Sanitary Board required that the sewer should be laid in a pipe-sewer carried to the *Mettucherry swamp sump*. This has not been done ; the present proposal is to join the sewer to the iron pipe at a point above the Willow Bund. Mr. Ashpitel's plans show that in doing so he obtains a grade of 1 in 329, but the undersigned ventures to think that there is an error in the levels and with this note forwards the plan prepared in this office before the decision of the Sanitary Board was arrived at. This shows that Mr. Ashpitel's section shows a fall of 26·96—21·37 = 5·59 between the points fixed by him as the beginning and end of the sewer and a gradient of 1 in 329 for the same length. But the section now forwarded shows that the fall is really only from 29·59 to 25·00 or 4·59, and the length being 2,130—250 or 1,880 the gradient is only about 1 in 410, and to obtain an increased gradient the sewer must be carried to join the iron pipe at the point indicated

by the Sanitary Board, that is, the first sump below the Willow Bund; a fall of 1 in 341 is then possible. This is shown by a red line on the tracing accompanying. [It should be noted that the data of the two sections are not the same.]

2. The section, it is submitted, should therefore be amended in this particular, the levels being, it is believed, incorrect. Mr. Ashpitel in his reports throws aside the recommendation of a 12-inch pipe by the Sanitary Board with the remark that it is no use to fix the size of the pipe by a calculation, because the population will increase enormously! The undersigned ventures to think that this would be a very cogent reason for fixing the pipe by calculation and desires to point out the following facts.

3. Assuming for the moment that Mr. Ashpitel's grade is correct and that a 15-inch pipe were laid, this pipe at his grade would carry about 223 c. ft. per minute, say, 1,394 gallons per minute. Taking this as a maximum it represents the sewage from 48,384 people at 20 gallons per head (the sewer flowing on an average half full and half the sewage carried off in six hours). Is it to be expected that the whole of Ootacamund will ever contain this number, much less that, that number drain into the intercepting sewer?

4. A 15-inch sewer at 1 in 341 (the supposed grade) has a velocity running full or half full of only 188 feet per minute = 3 feet per second; but when this sewer carries the actual sewage of the population which certainly does not amount to that of more than 10,000 people, the sewage of which will not exceed 277 gallons per minute as a maximum, the velocity would be so inappreciably low that silting would indubitably take place. While it has always been maintained that a 9-inch is ample if properly laid, the Sanitary Board decided on a 12-inch so as to allow for a large amount of flood water passing through it; a 12-inch sewer at a grade of 341 will discharge about 130 c. ft. or 812 gallons per minute full and 406 half full which is surely very ample.

5. The undersigned therefore advises that the 12-inch size be retained.

6. Not only has it much more chance of being self-cleansing, but it will be much more easily flushed; a 15-inch sewer would take a very large amount of water to flush properly.

7. Very little of Mr. Ashpitel's report refers to the work to be done, but is rather an essay on his proposals for the design for dealing with the bazaar drains and altering them to underground sewers; this point need not be discussed at present and is only noticed, because it is not easy to understand whether the plans of manholes amongst the drawings refer to such proposals or to the actual work now proposed to be undertaken; one manhole is described as manhole No. 1; the other two designs bear no such description. These manholes are 4′ 9″ high from bottom of sewer to ground level; but at manhole No. 1 the depth of sewer below ground is only (from the Sanitary Engineer's tracing) 31·86—29·59 = 2·27. No ground level at all is shown on Mr. Ashpitel's sections, and apparently the tracing shows the section of the line of the channel and not of the sewer; from the Sanitary Engineer's tracing however this depth of 4′ 9″ will be suitable for the lower end of the sewer only. Each manhole, it is submitted, ought to be separately designed before work is begun, but the practice of the Public Works department on this point is not known. Taking the manholes as a type of what are proposed, it is marked that there is no arrangement whatever from keeping silt out of the sewer nor for the disposal of storm water. It is submitted that such arrangements must be made. The storm water from existing surface drains (whether they are to be abandoned in the future or not) must cross the proposed sewer; these drains carry both sewage and storm water, and it is advisable to prevent any but a small quantity of storm water entering the sewer. Some design for this should therefore be prepared and approved by the Board.

8. Mr. Ashpitel's plan does not show whether he retains existing connection with the sewer or otherwise; it is presumed he does, but these also should have a place on the plan and there the arrangements for interception of silt and overflow should be shown.

9. The desirability of flushing the sewer need not be discussed, but it is doubtful if the arrangements proposed are likely to be successful. The long square sewer

with its many outlets, trap doors, &c., between the flushing pipe and the pipe sewer will, it is believed, render abortive any attempts at successful flushing—it would be much better to arrange for a flush tank (which could be filled with water from the channel by pumping when pipe water is not available) at the actual head of the sewer. No doubt the site of Mr. Ashpitel's proposed flushing tank would be excellent, were there a pipe sewer extended up to it; but, under existing conditions, the plan cannot be advised as one which should be sanctioned.

10. It is not thought that the proposed channel debouches into the lake in the best position. It seems to the undersigned that it would be advisable for the channel to be curved quickly to the left after passing under the Willow Bund, thus reaching deep water much more quickly than it now does.

11. The undersigned does not think it necessary for him to criticise the estimate nor the report other than in regard to the points already touched on.

12. The plans, estimates and reports are returned with the Sanitary Commissioner's note thereon.

Note by Colonel D. McNEIL CAMPBELL, R.E., President, Sanitary Board.

In forwarding the plans and estimates for the Ootacamund drainage to the Local and Municipal department, I said that I approved generally of the scheme and that I forwarded them to save delay as I would have to note on them again as President, Sanitary Board.

2. As regards the details I agree with the Sanitary Engineer that a 15-inch pipe is larger than necessary, and I think a 12-inch pipe should be substituted: this will reduce the estimate by Rs. 1,490. I can see no object in carrying the pipe to the Mettucherry swamp sump and Mr. Ashpitel's arrangement may be approved.

3. As regards the difference in levels I have no reason to doubt the correctness of those taken by Mr. Ashpitel who informs me that they were taken several times; but the matter is not of much consequence, as a 12-inch pipe is ample to give the required discharge even with the reduced grade of $\frac{1}{4\,1\,0}$, this being what Mr. Ashpitel's grade of $\frac{1}{3\,2\,9}$ is reduced to if there is an error of 1 foot as stated by Mr. Jones.

4. As regards the manholes the designs submitted by Mr. Ashpitel are sample ones and are not prepared with reference to any particular site, and they will have to be altered to suit the ground level during construction, and probably a saving on the estimate will be effected. I do not agree with Mr. Jones that Mr. Ashpitel's flushing arrangement will not answer the purpose; it is impossible to say for certain that it will be a success, but I see no reason to think otherwise. Mr. Ashpitel's reasons for ending the supply channel as he does, are given in paragraph 21 of his report, and I approve of them.

5. I consider that Mr. Ashpitel's estimate should be sanctioned, the size of pipe being reduced to 12 inches instead of 15 inches, and as the work is urgent I would advise that the pipes be ordered at once. The question raised by the Sanitary Commissioner as regards the drainage of Mettucherry and Kodapamund can be considered hereafter.

Resolution—No. 299-S., dated 4th December 1896.

With his letter, No. 422-W., dated 27th August 1896, the Superintending Engineer, IV Circle, submits plans and estimates for town drainage works at Ootacamund. The proposals are drawn up with reference to the recommendations of the Sanitary Board approved in G.O., No. 1390 M., dated 24th August 1895, and in accordance with the undermentioned orders:—

G.O., No. 512 W., dated 10th February 1896.
„ „ 982 W. „ 19th March „

2. They include the following estimates :—

		Rs.
(i)	Estimate for pipes and for removing and relaying the intercepting sewer from junction with Brewery drain to Willow Bund	15,000
(ii)	Estimate for 21 manholes for intercepting sewer	4,350
(iii)	Flushing sluice at head of sewer	4,200
(iv)	Widening supply channel	470
(v)	Culvert under Willow Bund	2,920
	Total ..	26,940

3. The plans generally have been approved by the Chief Engineer and they have now been referred by Government for the remarks of the Sanitary Board.

4. The Board approves the plans and estimates subject to the remarks of the President, who has recorded a separate note on the subject which is submitted for the information of Government.

5. The suggestions of the Sanitary Commissioner are commended by the Board for the consideration of Government when opportunity offers.

(True Extract.)

(Signed) R. PARSONS,
Secretary, Sanitary Board.

To the Secretary to Government,
Local and Municipal Department.

ORDER—No. 107 M., dated 27th January 1897.

The estimate prepared by Mr. Ashpitel for the improvement of the drainage of Ootacamund, which, as modified with reference to paragraph 2 of the note by the President of the Sanitary Board, amounts to Rs. 25,450, is sanctioned.

2. To meet the cost of the work, the municipal council is requested to appropriate a sum of Rs. 25,450 out of the Provincial grants amounting to Rs. 1,89,000 on account of the water-supply scheme, which it has already received, and to place the sum at the disposal of the Public Works department.

3. The Public Works department is requested to put the work in hand at once. Its attention is drawn to the remarks of the President of the Sanitary Board in paragraph 4 of his note.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Ootacamund.
" Collector of Nilgiris.
" Sanitary Board.
" Public Works Department.
" Financial Department.
" Accountant-General.
Editors' Table.

Exd. A. F. Eccleston.

Government {1897} of Madras.

LOCAL AND MUNICIPAL.

Recd. } 1897. *Enclosures*
Regd. *Spare copies*

G.O., No. 107 M., 27th January 1897.

JANUARY.

Drainage.

Sanctioning an estimate of Rs. 25,450 for the improvement of the — of Ootacamund, and requesting the municipal council to meet the cost of the work out of the Provincial grant of Rs. 1,89,000 on account of the water-supply scheme and to place the amount at the disposal of the Public Works department which will put the work in hand at once.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers:—

Endorsement—from the Public Works Department, No. 3598-C., dated 17th October 1896.

Read—the following papers:—

From J. HANNAN, Esq., Superintending Engineer, IV Circle, to the Chief Engineer, Public Works Department, dated Coimbatore, 27th August 1896, No. 422-W.

As more than one reminder has been lately received from your office calling for the estimate for relaying the intercepting sewer and for the drainage of Mettucherry and the main bazaar at Ootacamund, I have the honour to submit herewith the plans and estimate for that portion of the scheme which affects the upper portion of the Ootacamund lake now being filled in. The plans and estimates were received by me on the 10th instant. As no proper data were submitted for the rates which appeared to be excessive, I returned the data sheet to the Executive Engineer for revision. It has not been returned as yet. As, however, the estimates appear to be urgently required, I submit them as received. They have not been checked in this office.

2. Mr. Ashpitel submits a very full report showing, amongst other things, how in his opinion the drainage of the Mettucherry and the main bazaar, &c., should be carried out. His proposals are, I have no doubt, the latest up to date ones from a sanitary engineering point of view. Whether the existing arrangements cannot be made fairly efficient at a less cost is a question which will doubtless be duly considered by the Sanitary Committee of experts.

ENCLOSURES.

REPORT to accompany the Preliminary Estimate for the Ootacamund Drainage Scheme.

Object of Preliminary Estimate.—With the exception of Kandal the drainage of Ootacamund at the present time is discharged into the lake owing to the failure of the existing system of sewerage. The sewers consist of open drains following the natural lines of drainage and an intercepting or main close sewer of varying size and description which follows the line of the supply channel from the back of Mr. Brown's establishment to the Willow Bund. Beyond this point an iron-pipe sewer, 12 inches diameter, has been laid through the lake with an outfall into the Kandal stream.

In G.O., No. 512 W., dated 10th February 1896, the preparation of a complete scheme was ordered, but owing to the delay in obtaining copies of the recent town survey, this has not been possible, and in G.O., No. 982 W., dated 19th March 1896, this preliminary estimate was ordered to be prepared. The estimate provides only for taking up the 9-inch main sewer from the Brewery drain to the Willow Bund and replacing it by a 15-inch pipe as already approved for improving the lake supply channel and the provision of flushing arrangements for the main sewer.

2. *Existing System.*—From time to time considerable sums have been spent on the drainage of Ootacamund, and the result cannot be said to be satisfactory. The main sewer for a length of about 4,560 feet consists of a masonry conduit laid almost on the surface of the ground with an average fall $\frac{1}{300}$, a 9-inch stoneware pipe from 4,764 feet to 6,603 feet laid practically with no fall (*vide* longitudinal section) though a fall of $\frac{1}{328}$ is available and a 12-inch iron pipe through the lake with a fall of $\frac{1}{1000}$. The only really efficient length of this main sewer is the pipe through the lake which is provided with admirable flushing arrangements and needs no improvement. The 9-inch pipe is too small and without fall, and the masonry conduit is, it

is suggested, altogether in the wrong place for the main sewer and of very inferior design. Throughout the system the manholes are too small, and, as the Sanitary Commissioner points out in his notes printed with G.O., No. 648 M., dated 23rd May 1894, there are numerous gully pits along the line of sewer designed to intercept silt and solid matter, which are simply open cess-pools.

3. *Proposed System.*—In any scheme for the drainage of Ootacamund it appears to be absolutely necessary to recognize the fact that, whatever the merits of open drains may be, it is not a good thing to combine them with a closed main sewer. Such a combination is fatal to good sanitation as, owing to the necessity of admitting surface water to the sewers, and the difficulty of excluding solid matters, rubbish and road detritus, gullies are required which retain sewage and become nothing more nor less than evil smelling cess-pools requiring frequent cleansing.

4. Open drains have in this country a number of advocates who echo the old cry that the sun is the best sanitarian; but the sun, like other sanitarians, requires to be given a fair chance. To collect sewage in a number of pits into which liquid is constantly flowing does not give this fair chance, and the result is that the sun, under these circumstances, merely assists putrefaction and the formation of sewer gas. It does not seem advisable, therefore, to have a mixed system of open and closed drains, and one or other of these systems should, it is suggested, be adopted in its entirety with no cess-pools.

5. As an open sewer along the north boundary of the Hobart Park would be extremely unpleasant and unsightly, and as the existing 12-inch iron pipe through the lake is effective and has been laid at considerable expense, it is suggested that a pipe system should be adopted throughout, the existing open drains being retained for surface drainage only. Ootacamund is an ideal place for such a system of sewers, provided that the ordinary principles are adopted with no special contrivances, such as catch-pits or interceptors, which create the very evil the sewers are intended to prevent.

6. *Existing Masonry Sewer to be reserved for the few houses along its course and for flushing purposes.*—In paragraph 2 it was suggested that the existing masonry sewer down to the junction with the Brewery drain is wrongly aligned. Inspection shows that this sewer has not a good fall and directly serves very few houses. It is also of poor design and much obstructed. A better line for the main sewer will be along Commercial Road joining the existing line at proposed manhole No. 1 and picking up the market and latrine drains on the way. If this is approved, the main may, for the present, start at commencement of the Commercial Road bazaar and may be at 12-inch stoneware pipe up to proposed manhole No. 1 (*vide* plan No. 1) and a 15-inch stoneware pipe from this point to the junction with the existing 12-inch iron pipe near the Willow Bund. It appears to be of but little use to fix the size of pipes by calculation, as the amount of sewage to be dealt with is likely to increase enormously as the population increases, and the 12-inch iron pipe through the lake, with its flushing arrangements, will take the discharge from these pipes. It will be noted that the velocity in all these pipes will considerably exceed the limit of $1\frac{1}{2}$ feet per second proposed by Waring for the separate system. The existing masonry sewer from the back of Mr. Brown's premises to manhole No. 1 will be extremely useful to serve the few houses along its course, but will chiefly be valuable for flushing purposes as explained in paragraph 7. When house connections are provided this sewer should be examined and repaired and the manholes altered, so as not to retain sewage, *i.e.*, the catch-pits should be filled up and proper channels formed.

7. *Proposed Flushing arrangements.*—Just above Mr. Brown's stables a small tank formerly existed as is evident from the old surveys of Ootacamund, and, if this tank is restored by damming up the channel at the point shown on the accompanying map, and a pipe laid from this tank to the head of the existing sewer, an efficient flush can be secured. Plan No. 3 shows the proposed flushing sluice with two vents, each 6 feet wide, or the full width of the channel bed. This ventage may be considered to be excessive, but is allowed in order to reduce the velocity through the sluice to the normal channel velocity during the rainy weather when much silt is likely to be brought down from the hills. From this sluice an iron pipe 9-inch diameter is

proposed to be laid to the head of the existing sewer with a fall $\frac{1}{40}$ or thereabouts and regulated by a sluice valve. This pipe will discharge sufficient water for an ample flush under pressure, * and owing to the continuous supply in the channel, even during the hot months of the year, the flush can be effected daily. No automatic flushing arrangements are proposed, as some sort of establishment will necessarily be maintained and automatic valves have a tendency to get out of order. To flush branch sewers water will have to be obtained from the municipal pipes; but if Field's or other suitable flushing tanks are constructed in connection with the stand pipes, the waste water will probably be ample.

* Some of the obstructions in the masonry sewer will probably have to be removed.

8. *Dimensions of proposed Sewers and Position of Manholes.*—In the complete estimates it is suggested that the branch street sewers may be 9-inch, and the house connections 6-inch, stoneware pipes in accordance with the usual practice; the sewers to follow the directions of the streets and to be laid in straight lengths according to the roads, each length being terminated in a manhole with intermediate manholes at intervals of 150 feet to facilitate inspection, ventilation and the localization of leaks. Intermediate manholes will not be numerous as the streets are generally short, and therefore it does not seem worthwhile to substitute ventilators which do not permit inspection of the sewer.

9. *Types of Manholes.*—Plans Nos. 4 and 5 show types of proposed manholes. Plan No 5 is for proposed manhole No. 1 where two branches have to be dealt with, and plan No. 4 for ordinary manhole along the line of the main sewer and elsewhere where the gradient is not too great. Plan No. 6 is the type for sewers with a steep gradient, though its adoption does not seem absolutely necessary. All these designs are of the ordinary pattern.

10. *House Connections.*—The house connections will, it is presumed, be carried out as the sewers are constructed as being the cheapest and most convenient course. Plan No. 7 shows a form of trapped pit into which the sewage can be discharged from the houses and thence through a 6-inch pipe into the sewer. The trap is what is known as Messrs. Ingham and Son's quick motion trap. "It is claimed † for this trap that the obstruction to the flow of sewage is less than in other traps, inasmuch as there is no unnecessary and useless sinking of the sides of the orifice below water level. The top of the trap, crosswise, is straight and horizontal, parallel with the surface of the water in the trap. Its dip is therefore fully effective, the whole width of the drain pipe, whilst in all round sections both sides dip uselessly into the water and offer unnecessary obstruction to the flow of sewage. Those who had experience of these traps regard them with favour, and when we examine the principles on which they are constructed there appears to be every reason why that should be so. The trap effectively bars the passage of air; its dip is the same as that of other traps about 2 or $2\frac{1}{2}$ inches. The body of the water in the trap being small is frequently renewed. The outlet is on the next adjoining pipe, not on the trap itself. It is one of the points of this trap that when the sewage leaves it, it falls immediately and freely over the lip into the pipe and acquires motion thereby to start with, and a free outlet in the trap is maintained."

† See Professional Papers of the Corps of Royal Engineers edited by Captain W. A. Gale, R.E.

11. *Catch-pit or Gully for Stables.*—Plan No. 6 shows the form of gully for stables with a grating attached to the inlet to the drain which is turned downwards to prevent floating straw, &c., getting into the drain. It is proposed to be used in connection with surface channels carried beyond the building to a distance of 12 feet.

12. *Ventilation.*—In paragraph 8, it is suggested that manholes should be constructed on the line of sewers at maximum distances apart of 150 feet to facilitate inspection, ventilation, &c. With this number of manholes and an ample flush no further ventilation appears to be necessary, except a few 6-inch pipes led at intervals from the manholes or house connections to the gables of houses in the neighbourhood or up lamp-posts.

This question of ventilation appears to merit some attention, as according to Waring (sewerage and land drainage) "the proper requirement should be to make the ventilation universal, to furnish as many openings as possible and to afford abundant

facility for the inlet and outlet of air. The plan recommended by many Engineers *of prohibiting traps on house-drains* and making the soil-pipe itself a ventilator reaching above the roof seems to me to leave nothing to be desired. Under such conditions of ventilation as this will secure, the house-trap is entirely unnecessary in connection with such sewers as should be tolerated for a moment by any community. If the fixtures are trapped from the soil-pipe, the very diluted atmosphere of the sewer may be passed through this pipe without objection." This remark does not altogether apply to the proposed system at Ootacamund as none of the pipes will enter the houses; but if it is accepted that the proposed trap (paragraph 10) is unnecessary, considerable expense will be avoided, as all that will be necessary is to lead 6-inch pipes up the walls of houses from the proposed pit (plan No. 7), and these pipes will not be needed at every connection when the pit is at a distance from the house in a court-yard.

13. *Sewage Farm not necessary at present.*—In paragraph 8 of the Sanitary Commissioner's note of inspection, the existing system of disposal of sewage into a stream is condemned; but, as the municipality will probably find considerable difficulty in providing funds for the drainage, it is suggested that it is not necessary to further burden its resources with the construction and maintenance of a sewage farm pending the advent of the new industry, &c., alluded to. If the present outfall is considered to be too near Ootacamund, it is easy to extend the sewer further down the stream.

14. *Pail Depôts and Latrines.*—No proposals are made for pail depôts or special forms of latrines, as the Sanitary Commissioner is believed to be in possession of suitable designs. It is presumed that the sites will be fixed by the municipality with reference to the sewers, and that the solid matter from private latrines will be taken to pail depôts in connection with public latrines, provided with automatic flushing arrangements of the ordinary type.

15. *Definite orders requested.*—It is requested that definite orders may be issued on the various points raised in this report and that the plans may be approved for adoption or other designs supplied. It is also suggested that the exact areas to be drained should be marked on a map as it is understood that the drainage of additional areas is contemplated by the Sanitary Commissioner; additions which may necessitate modifications in the proposals now made.

16. *Silt and Sludge Interceptor not necessary.*—Orders are also requested regarding the silt interceptor at the upper end of the sewer and the sludge interceptor at the lower between it and its junction with the iron pipe sewer under the lake at Mettucherry swamp ordered to be provided in G.O., No. 512 W., dated 10th February 1896, as with the proposed arrangements these are apparently not necessary. The proposed flushing tank will obviate the necessity for the silt interceptor at the head of the sewer and with existing and proposed flushing arrangements no sludge interceptor seems necessary.

17. It is believed that the new railway station is likely to be located in Mettucherry. If so, it will be necessary to demolish a number of houses and may possibly be cheaper to buy up the remainder and give properly arranged building sites elsewhere rather than extend the system of sewers to the irregularly built houses in this part of Ootacamund.

18. *Lake Supply-Channel.*—In G.O., No. 3246 W., of 19th December 1895, the diversion of the lake supply-channel and the construction of a culvert under the Willow Bund road was sanctioned, but no provision was made for widening the channel below the road immediately east of the Hobart Park. The catchment basin of the lake above the Willow Bund is 3·7 square miles, of which about 3 square miles drain into the supply channel. In the estimates now submitted, it is proposed to widen the channel to a bed width of 12 feet with a fall $\frac{1}{450}$. This will cost only Rs. 470 as the bulk of the earth excavated will be used for filling in the upper part of the lake. A channel 12 feet wide flowing 2 feet deep will discharge 98 cubic feet or sufficient for an effective rainfall of about $3\frac{3}{4}$ inches in 24 hours which is the maximum likely to be dealt with, seeing that the gross maximum rainfall registered only amounts to 6·62 inches. This widening is very necessary as the existing channel below the road at the east end of the park is manifestly too narrow and frequently floods the land above.

19. No provision has been made in the estimate for lining the channel with masonry or concrete as ordered in G.O., No. 512 W., dated 10th February 1896, as this would be very expensive in made earth and would not prevent future silting as the bulk of the silt which enters the lake comes from the hills above the proposed flushing tank.

20. If silting of the lake below the Willow Bund is to be prevented, one of the following alterations might be adopted :—

(*a*) The construction of a reservoir at the foot of the hills to arrest the silt.
(*b*) To carry the channel along the north margin of the lake to the outfall at Kandal with sluices at intervals for supply purposes.
(*c*) The construction of a series of drops in the channel.

21. Of these alternatives it is probable that the better course will be to extend the supply channel along the north margin of the lake to discharge direct into the Kandal stream as this will prevent future silting. The work, however, will have to be carried out gradually as at certain points, for short distances, the margin of the lake is steep and the depth of water considerable, and the only way of forming the channel at a reasonable cost will be to confine the silt to the margin as it is brought down and to continue the channel as the land is reclaimed. It is certain that at the point where the channel water joins the still water in the lake a deposit of silt must take place, and if a pile and brushwood (not wattle) fence is constructed at a certain distance from the margin and is maintained in advance of the silting so as to confine it to the required width, it will eventually be possible to form the channel at these deep places. Elsewhere, the margin has a gradual slope and there is no difficulty.

22. *Lake and main sewer to be handed over to the Public Works Department.*—As the formation of the proposed channel will require technical knowledge and care it is suggested that the whole of the lake and its channel should be transferred to the Public Works department. It would also probably be as well to transfer the main sewer as the flushing arrangements can easily be attended to by the Sub-Divisional officer without prejudice to his other duties, while the municipal authorities have shown their inability in the past to attend to this duty owing to want of proper establishment. The transfer of the lake and main sewer would not necessitate any additional establishment beyond a few coolies to work and keep the gearing clean and this is the only charge, apart from the actual cost of repairs, which need necessarily fall on the municipality. Care in regulating the discharge of the flushing pipe at the head of the sewer will always be required owing to the weak section of the masonry conduit and will be especially necessary until such time as the house connections are completed as, if too great a pressure is allowed to, disc plugs will be displaced.

23. Permission is requested to purchase pipes and to manufacture two lakhs of pressed bricks at the Lawrence Asylum without further delay.

(Signed) F. W. ASHPITEL,
Executive Engineer, Coimbatore Division.

2nd August 1896.

Note by the Chief Engineer, Public Works Department.

I approve the plans generally, and as the matter is urgent I forward them on as they will have to be again considered as regards sanitary details by the Sanitary Board of which I am President.

(Signed) D. McNEIL CAMPBELL, Col., R.E.,
Chief Engineer.

No. 3598-C., dated 17th October 1896.

Transferred to the Local and Municipal Department.

(Signed) D. McNEIL CAMPBELL, Col., R.E.,
Secretary.

No. 1209, dated 22nd October 1896.

Referred to the Sanitary Board for early remarks.

(By Order)

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

Proceedings of the Sanitary Board, No. 299-S., dated 4th December 1896.

Read—the following papers :—

Letter from the Superintending Engineer, IV Circle, No. 422 W., dated 27th August 1896.

Endorsement in the Local and Municipal Department, No. 1209, dated 22nd October 1896.

Note by Surgeon-Lieutenant-Colonel W. G. KING, Sanitary Commissioner, dated Fort St. George, 3rd November 1896, No. 457—S.B.

Ootacamund Drainage Scheme.

Reference.—Rule 16 of the revised Sanitary Board Rules . . . . "The plans and estimates for works costing Rs. 500 and upwards shall, after completion by the Sanitary Engineer, be forwarded to the Sanitary Commissioner for opinion on sanitary grounds *only*." . . .

Undersigned considers it highly desirable that Ootacamund should be furnished with a correct sewerage conservancy scheme and that if funds be available Mettucherry and Kodapamund be also included. He also considers it desirable that flooding of the agraharam be prevented, and that silting of the lake be provided against.

2. Undersigned refrains from criticizing the structural method employed by the Engineer to meet sanitary ends with reference to the above rule.

Office-note by J. A. JONES, Esq., Sanitary Engineer, dated Fort St. George, 6th November 1896, No. 27.

[*Reference.*—Ootacamund Intercepting Sewer. Proposals for improvement of —.]

Under the special circumstance of this scheme having been prepared by a Public Works department officer, passed by the Superintending Engineer and approved by the Chief Engineer generally, it is rather difficult for the Sanitary Engineer to know what manner of criticism is expected of him or what measure of advice he should tender, and after the exhaustive examination already given by the Public Works department, it is with some diffidence that the Sanitary Engineer offers the following criticisms :—

1. In the first place the design of the sewer is not in accordance with what was laid down by the Sanitary Board. The Sanitary Board required that the sewer should be laid in a pipe-sewer carried to the *Mettucherry swamp sump*. This has not been done ; the present proposal is to join the sewer to the iron pipe at a point above the Willow Bund. Mr. Ashpitel's plans show that in doing so he obtains a grade of 1 in 329, but the undersigned ventures to think that there is an error in the levels and with this note forwards the plan prepared in this office before the decision of the Sanitary Board was arrived at. This shows that Mr. Ashpitel's section shows a fall of 26·96—21·37 = 5·59 between the points fixed by him as the beginning and end of the sewer and a gradient of 1 in 329 for the same length. But the section now forwarded shows that the fall is really only from 29·59 to 25·00 or 4·59, and the length being 2,130—250 or 1,880 the gradient is only about 1 in 410, and to obtain an increased gradient the sewer must be carried to join the iron pipe at the point indicated

by the Sanitary Board, that is, the first sump below the Willow Bund; a fall of 1 in 341 is then possible. This is shown by a red line on the tracing accompanying. [It should be noted that the data of the two sections are not the same.]

2. The section, it is submitted, should therefore be amended in this particular, the levels being, it is believed, incorrect. Mr. Ashpitel in his reports throws aside the recommendation of a 12-inch pipe by the Sanitary Board with the remark that it is no use to fix the size of the pipe by a calculation, because the population will increase enormously! The undersigned ventures to think that this would be a very cogent reason for fixing the pipe by calculation and desires to point out the following facts.

3. Assuming for the moment that Mr. Ashpitel's grade is correct and that a 15-inch pipe were laid, this pipe at his grade would carry about 223 c. ft. per minute, say, 1,394 gallons per minute. Taking this as a maximum it represents the sewage from 48,384 people at 20 gallons per head (the sewer flowing on an average half full and half the sewage carried off in six hours). Is it to be expected that the whole of Ootacamund will ever contain this number, much less that, that number drain into the intercepting sewer?

4. A 15-inch sewer at 1 in 341 (the supposed grade) has a velocity running full or half full of only 188 feet per minute = 3 feet per second; but when this sewer carries the actual sewage of the population which certainly does not amount to that of more than 10,000 people, the sewage of which will not exceed 277 gallons per minute as a maximum, the velocity would be so inappreciably low that silting would indubitably take place. While it has always been maintained that a 9-inch is ample if properly laid, the Sanitary Board decided on a 12-inch so as to allow for a large amount of flood water passing through it; a 12-inch sewer at a grade of 341 will discharge about 130 c. ft. or 812 gallons per minute full and 406 half full which is surely very ample.

5. The undersigned therefore advises that the 12-inch size be retained.

6. Not only has it much more chance of being self-cleansing, but it will be much more easily flushed; a 15-inch sewer would take a very large amount of water to flush properly.

7. Very little of Mr. Ashpitel's report refers to the work to be done, but is rather an essay on his proposals for the design for dealing with the bazaar drains and altering them to underground sewers; this point need not be discussed at present and is only noticed, because it is not easy to understand whether the plans of manholes amongst the drawings refer to such proposals or to the actual work now proposed to be undertaken; one manhole is described as manhole No. 1; the other two designs bear no such description. These manholes are 4′ 9″ high from bottom of sewer to ground level; but at manhole No. 1 the depth of sewer below ground is only (from the Sanitary Engineer's tracing) 31·86—29·59 = 2·27. No ground level at all is shown on Mr. Ashpitel's sections, and apparently the tracing shows the section of the line of the channel and not of the sewer; from the Sanitary Engineer's tracing however this depth of 4′ 9″ will be suitable for the lower end of the sewer only. Each manhole, it is submitted, ought to be separately designed before work is begun, but the practice of the Public Works department on this point is not known. Taking the manholes as a type of what are proposed, it is marked that there is no arrangement whatever from keeping silt out of the sewer nor for the disposal of storm water. It is submitted that such arrangements must be made. The storm water from existing surface drains (whether they are to be abandoned in the future or not) must cross the proposed sewer; these drains carry both sewage and storm water, and it is advisable to prevent any but a small quantity of storm water entering the sewer. Some design for this should therefore be prepared and approved by the Board.

8. Mr. Ashpitel's plan does not show whether he retains existing connection with the sewer or otherwise; it is presumed he does, but these also should have a place on the plan and there the arrangements for interception of silt and overflow should be shown.

9. The desirability of flushing the sewer need not be discussed, but it is doubtful if the arrangements proposed are likely to be successful. The long square sewer

with its many outlets, trap doors, &c., between the flushing pipe and the pipe sewer will, it is believed, render abortive any attempts at successful flushing—it would be much better to arrange for a flush tank (which could be filled with water from the channel by pumping when pipe water is not available) at the actual head of the sewer. No doubt the site of Mr. Ashpitel's proposed flushing tank would be excellent, were there a pipe sewer extended up to it; but, under existing conditions, the plan cannot be advised as one which should be sanctioned.

10. It is not thought that the proposed channel debouches into the lake in the best position. It seems to the undersigned that it would be advisable for the channel to be curved quickly to the left after passing under the Willow Bund, thus reaching deep water much more quickly than it now does.

11. The undersigned does not think it necessary for him to criticise the estimate nor the report other than in regard to the points already touched on.

12. The plans, estimates and reports are returned with the Sanitary Commissioner's note thereon.

Note by Colonel D. McNEIL CAMPBELL, R.E., President, Sanitary Board.

In forwarding the plans and estimates for the Ootacamund drainage to the Local and Municipal department, I said that I approved generally of the scheme and that I forwarded them to save delay as I would have to note on them again as President, Sanitary Board.

2. As regards the details I agree with the Sanitary Engineer that a 15-inch pipe is larger than necessary, and I think a 12-inch pipe should be substituted: this will reduce the estimate by Rs. 1,490. I can see no object in carrying the pipe to the Mettucherry swamp sump and Mr. Ashpitel's arrangement may be approved.

3. As regards the difference in levels I have no reason to doubt the correctness of those taken by Mr. Ashpitel who informs me that they were taken several times; but the matter is not of much consequence, as a 12-inch pipe is ample to give the required discharge even with the reduced grade of $\frac{1}{410}$, this being what Mr. Ashpitel's grade of $\frac{1}{329}$ is reduced to if there is an error of 1 foot as stated by Mr. Jones.

4. As regards the manholes the designs submitted by Mr. Ashpitel are sample ones and are not prepared with reference to any particular site, and they will have to be altered to suit the ground level during construction, and probably a saving on the estimate will be effected. I do not agree with Mr. Jones that Mr. Ashpitel's flushing arrangement will not answer the purpose; it is impossible to say for certain that it will be a success, but I see no reason to think otherwise. Mr. Ashpitel's reasons for ending the supply channel as he does, are given in paragraph 21 of his report, and I approve of them.

5. I consider that Mr. Ashpitel's estimate should be sanctioned, the size of pipe being reduced to 12 inches instead of 15 inches, and as the work is urgent I would advise that the pipes be ordered at once. The question raised by the Sanitary Commissioner as regards the drainage of Mettucherry and Kodapamund can be considered hereafter.

Resolution—No. 299-S., dated 4th December 1896.

With his letter, No. 422-W., dated 27th August 1896, the Superintending Engineer, IV Circle, submits plans and estimates for town drainage works at Ootacamund. The proposals are drawn up with reference to the recommendations of the Sanitary Board approved in G.O., No. 1390 M., dated 24th August 1895, and in accordance with the undermentioned orders:—

G.O., No. 512 W., dated 10th February 1896.
„ „ 982 W. „ 19th March „

2. They include the following estimates :—

		Rs.
(i)	Estimate for pipes and for removing and relaying the intercepting sewer from junction with Brewery drain to Willow Bund	15,000
(ii)	Estimate for 21 manholes for intercepting sewer	4,350
(iii)	Flushing sluice at head of sewer	4,200
(iv)	Widening supply channel	470
(v)	Culvert under Willow Bund	2,920
	Total ..	26,940

3. The plans generally have been approved by the Chief Engineer and they have now been referred by Government for the remarks of the Sanitary Board.

4. The Board approves the plans and estimates subject to the remarks of the President, who has recorded a separate note on the subject which is submitted for the information of Government.

5. The suggestions of the Sanitary Commissioner are commended by the Board for the consideration of Government when opportunity offers.

(True Extract.)

(Signed) R. PARSONS,
Secretary, Sanitary Board.

To the Secretary to Government,
Local and Municipal Department.

ORDER—No. 107 M., dated 27th January 1897.

The estimate prepared by Mr. Ashpitel for the improvement of the drainage of Ootacamund, which, as modified with reference to paragraph 2 of the note by the President of the Sanitary Board, amounts to Rs. 25,450, is sanctioned.

2. To meet the cost of the work, the municipal council is requested to appropriate a sum of Rs. 25,450 out of the Provincial grants amounting to Rs. 1,89,000 on account of the water-supply scheme, which it has already received, and to place the sum at the disposal of the Public Works department.

3. The Public Works department is requested to put the work in hand at once. Its attention is drawn to the remarks of the President of the Sanitary Board in paragraph 4 of his note.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Ootacamund.
„ Collector of Nilgiris.
„ Sanitary Board.
„ Public Works Department.
„ Financial Department.
„ Accountant-General.
Editors' Table.

Exd. A. F. Eccleston.

Government {1897} of Madras.

LOCAL AND MUNICIPAL.

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G.O., No. 107 M., 27th January 1897.

JANUARY.

Drainage.

Sanctioning an estimate of Rs. 25,450 for the improvement of the — of Ootacamund, and requesting the municipal council to meet the cost of the work out of the Provincial grant of Rs. 1,89,000 on account of the water-supply scheme and to place the amount at the disposal of the Public Works department which will put the work in hand at once.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers :—

Endorsement—from the Public Works Department, No. 3598-C., dated 17th October 1896.

Read—the following papers :—

From J. HANNAN, Esq., Superintending Engineer, IV Circle, to the Chief Engineer, Public Works Department, dated Coimbatore, 27th August 1896, No. 422-W.

As more than one reminder has been lately received from your office calling for the estimate for relaying the intercepting sewer and for the drainage of Mettucherry and the main bazaar at Ootacamund, I have the honour to submit herewith the plans and estimate for that portion of the scheme which affects the upper portion of the Ootacamund lake now being filled in. The plans and estimates were received by me on the 10th instant. As no proper data were submitted for the rates which appeared to be excessive, I returned the data sheet to the Executive Engineer for revision. It has not been returned as yet. As, however, the estimates appear to be urgently required, I submit them as received. They have not been checked in this office.

2. Mr. Ashpitel submits a very full report showing, amongst other things, how in his opinion the drainage of the Mettucherry and the main bazaar, &c., should be carried out. His proposals are, I have no doubt, the latest up to date ones from a sanitary engineering point of view. Whether the existing arrangements cannot be made fairly efficient at a less cost is a question which will doubtless be duly considered by the Sanitary Committee of experts.

ENCLOSURES.

REPORT to accompany the Preliminary Estimate for the Ootacamund Drainage Scheme.

Object of Preliminary Estimate.—With the exception of Kandal the drainage of Ootacamund at the present time is discharged into the lake owing to the failure of the existing system of sewerage. The sewers consist of open drains following the natural lines of drainage and an intercepting or main close sewer of varying size and description which follows the line of the supply channel from the back of Mr. Brown's establishment to the Willow Bund. Beyond this point an iron-pipe sewer, 12 inches diameter, has been laid through the lake with an outfall into the Kandal stream.

In G.O., No. 512 W., dated 10th February 1896, the preparation of a complete scheme was ordered, but owing to the delay in obtaining copies of the recent town survey, this has not been possible, and in G.O., No. 982 W., dated 19th March 1896, this preliminary estimate was ordered to be prepared. The estimate provides only for taking up the 9-inch main sewer from the Brewery drain to the Willow Bund and replacing it by a 15-inch pipe as already approved for improving the lake supply channel and the provision of flushing arrangements for the main sewer.

2. *Existing System.*—From time to time considerable sums have been spent on the drainage of Ootacamund, and the result cannot be said to be satisfactory. The main sewer for a length of about 4,560 feet consists of a masonry conduit laid almost on the surface of the ground with an average fall $\frac{1}{500}$, a 9-inch stoneware pipe from 4,764 feet to 6,603 feet laid practically with no fall (*vide* longitudinal section) though a fall of $\frac{1}{329}$ is available and a 12-inch iron pipe through the lake with a fall of $\frac{1}{1000}$. The only really efficient length of this main sewer is the pipe through the lake which is provided with admirable flushing arrangements and needs no improvement. The 9-inch pipe is too small and without fall, and the masonry conduit is, it

is suggested, altogether in the wrong place for the main sewer and of very inferior design. Throughout the system the manholes are too small, and, as the Sanitary Commissioner points out in his notes printed with G.O., No. 648 M., dated 23rd May 1894, there are numerous gully pits along the line of sewer designed to intercept silt and solid matter, which are simply open cess-pools.

3. *Proposed System.*—In any scheme for the drainage of Ootacamund it appears to be absolutely necessary to recognize the fact that, whatever the merits of open drains may be, it is not a good thing to combine them with a closed main sewer. Such a combination is fatal to good sanitation as, owing to the necessity of admitting surface water to the sewers, and the difficulty of excluding solid matters, rubbish and road detritus, gullies are required which retain sewage and become nothing more nor less than evil smelling cess-pools requiring frequent cleansing.

4. Open drains have in this country a number of advocates who echo the old cry that the sun is the best sanitarian; but the sun, like other sanitarians, requires to be given a fair chance. To collect sewage in a number of pits into which liquid is constantly flowing does not give this fair chance, and the result is that the sun, under these circumstances, merely assists putrefaction and the formation of sewer gas. It does not seem advisable, therefore, to have a mixed system of open and closed drains, and one or other of these systems should, it is suggested, be adopted in its entirety with no cess-pools.

5. As an open sewer along the north boundary of the Hobart Park would be extremely unpleasant and unsightly, and as the existing 12-inch iron pipe through the lake is effective and has been laid at considerable expense, it is suggested that a pipe system should be adopted throughout, the existing open drains being retained for surface drainage only. Ootacamund is an ideal place for such a system of sewers, provided that the ordinary principles are adopted with no special contrivances, such as catch-pits or interceptors, which create the very evil the sewers are intended to prevent.

6. *Existing Masonry Sewer to be reserved for the few houses along its course and for flushing purposes.*—In paragraph 2 it was suggested that the existing masonry sewer down to the junction with the Brewery drain is wrongly aligned. Inspection shows that this sewer has not a good fall and directly serves very few houses. It is also of poor design and much obstructed. A better line for the main sewer will be along Commercial Road joining the existing line at proposed manhole No. 1 and picking up the market and latrine drains on the way. If this is approved, the main may, for the present, start at commencement of the Commercial Road bazaar and may be at 12-inch stoneware pipe up to proposed manhole No. 1 (*vide* plan No. 1) and a 15-inch stoneware pipe from this point to the junction with the existing 12-inch iron pipe near the Willow Bund. It appears to be of but little use to fix the size of pipes by calculation, as the amount of sewage to be dealt with is likely to increase enormously as the population increases, and the 12-inch iron pipe through the lake, with its flushing arrangements, will take the discharge from these pipes. It will be noted that the velocity in all these pipes will considerably exceed the limit of $1\frac{1}{2}$ feet per second proposed by Waring for the separate system. The existing masonry sewer from the back of Mr. Brown's premises to manhole No. 1 will be extremely useful to serve the few houses along its course, but will chiefly be valuable for flushing purposes as explained in paragraph 7. When house connections are provided this sewer should be examined and repaired and the manholes altered, so as not to retain sewage, *i.e.*, the catch-pits should be filled up and proper channels formed.

7. *Proposed Flushing arrangements.*—Just above Mr. Brown's stables a small tank formerly existed as is evident from the old surveys of Ootacamund, and, if this tank is restored by damming up the channel at the point shown on the accompanying map, and a pipe laid from this tank to the head of the existing sewer, an efficient flush can be secured. Plan No. 3 shows the proposed flushing sluice with two vents, each 6 feet wide, or the full width of the channel bed. This ventage may be considered to be excessive, but is allowed in order to reduce the velocity through the sluice to the normal channel velocity during the rainy weather when much silt is likely to be brought down from the hills. From this sluice an iron pipe 9-inch diameter is

proposed to be laid to the head of the existing sewer with a fall $\frac{1}{40}$ or thereabouts and regulated by a sluice valve. This pipe will discharge sufficient water for an ample flush under pressure,* and owing to the continuous supply in the channel, even during the hot months of the year, the flush can be effected daily. No automatic flushing arrangements are proposed, as some sort of establishment will necessarily be maintained and automatic valves have a tendency to get out of order. To flush branch sewers water will have to be obtained from the municipal pipes; but if Field's or other suitable flushing tanks are constructed in connection with the stand pipes, the waste water will probably be ample.

* Some of the obstructions in the masonry sewer will probably have to be removed.

8. *Dimensions of proposed Sewers and Position of Manholes.*—In the complete estimates it is suggested that the branch street sewers may be 9-inch, and the house connections 6-inch, stoneware pipes in accordance with the usual practice; the sewers to follow the directions of the streets and to be laid in straight lengths according to the roads, each length being terminated in a manhole with intermediate manholes at intervals of 150 feet to facilitate inspection, ventilation and the localization of leaks. Intermediate manholes will not be numerous as the streets are generally short, and therefore it does not seem worthwhile to substitute ventilators which do not permit inspection of the sewer.

9. *Types of Manholes.*—Plans Nos. 4 and 5 show types of proposed manholes. Plan No 5 is for proposed manhole No. 1 where two branches have to be dealt with, and plan No. 4 for ordinary manhole along the line of the main sewer and elsewhere where the gradient is not too great. Plan No. 6 is the type for sewers with a steep gradient, though its adoption does not seem absolutely necessary. All these designs are of the ordinary pattern.

10. *House Connections.*—The house connections will, it is presumed, be carried out as the sewers are constructed as being the cheapest and most convenient course. Plan No. 7 shows a form of trapped pit into which the sewage can be discharged from the houses and thence through a 6-inch pipe into the sewer. The trap is what is known as Messrs. Ingham and Son's quick motion trap. "It is claimed † for this trap that the obstruction to the flow of sewage is less than in other traps, inasmuch as there is no unnecessary and useless sinking of the sides of the orifice below water level. The top of the trap, crosswise, is straight and horizontal, parallel with the surface of the water in the trap. Its dip is therefore fully effective, the whole width of the drain pipe, whilst in all round sections both sides dip uselessly into the water and offer unnecessary obstruction to the flow of sewage. Those who had experience of these traps regard them with favour, and when we examine the principles on which they are constructed there appears to be every reason why that should be so. The trap effectively bars the passage of air; its dip is the same as that of other traps about 2 or $2\frac{1}{2}$ inches. The body of the water in the trap being small is frequently renewed. The outlet is on the next adjoining pipe, not on the trap itself. It is one of the points of this trap that when the sewage leaves it, it falls immediately and freely over the lip into the pipe and acquires motion thereby to start with, and a free outlet in the trap is maintained."

† See Professional Papers of the Corps of Royal Engineers edited by Captain W. A. Gale, R.E.

11. *Catch-pit or Gully for Stables.*—Plan No. 6 shows the form of gully for stables with a grating attached to the inlet to the drain which is turned downwards to prevent floating straw, &c., getting into the drain. It is proposed to be used in connection with surface channels carried beyond the building to a distance of 12 feet.

12. *Ventilation.*—In paragraph 8, it is suggested that manholes should be constructed on the line of sewers at maximum distances apart of 150 feet to facilitate inspection, ventilation, &c. With this number of manholes and an ample flush no further ventilation appears to be necessary, except a few 6-inch pipes led at intervals from the manholes or house connections to the gables of houses in the neighbourhood or up lamp-posts.

This question of ventilation appears to merit some attention, as according to Waring (sewerage and land drainage) "the proper requirement should be to make the ventilation universal, to furnish as many openings as possible and to afford abundant

facility for the inlet and outlet of air. The plan recommended by many Engineers *of prohibiting traps on house-drains* and making the soil-pipe itself a ventilator reaching above the roof seems to me to leave nothing to be desired. Under such conditions of ventilation as this will secure, the house-trap is entirely unnecessary in connection with such sewers as should be tolerated for a moment by any community. If the fixtures are trapped from the soil-pipe, the very diluted atmosphere of the sewer may be passed through this pipe without objection." This remark does not altogether apply to the proposed system at Ootacamund as none of the pipes will enter the houses; but if it is accepted that the proposed trap (paragraph 10) is unnecessary, considerable expense will be avoided, as all that will be necessary is to lead 6-inch pipes up the walls of houses from the proposed pit (plan No. 7), and these pipes will not be needed at every connection when the pit is at a distance from the house in a court-yard.

13. *Sewage Farm not necessary at present.*—In paragraph 8 of the Sanitary Commissioner's note of inspection, the existing system of disposal of sewage into a stream is condemned; but, as the municipality will probably find considerable difficulty in providing funds for the drainage, it is suggested that it is not necessary to further burden its resources with the construction and maintenance of a sewage farm pending the advent of the new industry, &c., alluded to. If the present outfall is considered to be too near Ootacamund, it is easy to extend the sewer further down the stream.

14. *Pail Depôts and Latrines.*—No proposals are made for pail depôts or special forms of latrines, as the Sanitary Commissioner is believed to be in possession of suitable designs. It is presumed that the sites will be fixed by the municipality with reference to the sewers, and that the solid matter from private latrines will be taken to pail depôts in connection with public latrines, provided with automatic flushing arrangements of the ordinary type.

15. *Definite orders requested.*—It is requested that definite orders may be issued on the various points raised in this report and that the plans may be approved for adoption or other designs supplied. It is also suggested that the exact areas to be drained should be marked on a map as it is understood that the drainage of additional areas is contemplated by the Sanitary Commissioner; additions which may necessitate modifications in the proposals now made.

16. *Silt and Sludge Interceptor not necessary.*—Orders are also requested regarding the silt interceptor at the upper end of the sewer and the sludge interceptor at the lower between it and its junction with the iron pipe sewer under the lake at Mettucherry swamp ordered to be provided in G.O., No. 512 W., dated 10th February 1896, as with the proposed arrangements these are apparently not necessary. The proposed flushing tank will obviate the necessity for the silt interceptor at the head of the sewer and with existing and proposed flushing arrangements no sludge interceptor seems necessary.

17. It is believed that the new railway station is likely to be located in Mettucherry. If so, it will be necessary to demolish a number of houses and may possibly be cheaper to buy up the remainder and give properly arranged building sites elsewhere rather than extend the system of sewers to the irregularly built houses in this part of Ootacamund.

18. *Lake Supply-Channel.*—In G.O., No. 3246 W., of 19th December 1895, the diversion of the lake supply-channel and the construction of a culvert under the Willow Bund road was sanctioned, but no provision was made for widening the channel below the road immediately east of the Hobart Park. The catchment basin of the lake above the Willow Bund is 3·7 square miles, of which about 3 square miles drain into the supply channel. In the estimates now submitted, it is proposed to widen the channel to a bed width of 12 feet with a fall $\frac{1}{450}$. This will cost only Rs. 470 as the bulk of the earth excavated will be used for filling in the upper part of the lake. A channel 12 feet wide flowing 2 feet deep will discharge 98 cubic feet or sufficient for an effective rainfall of about $3\frac{3}{4}$ inches in 24 hours which is the maximum likely to be dealt with, seeing that the gross maximum rainfall registered only amounts to 6·62 inches. This widening is very necessary as the existing channel below the road at the east end of the park is manifestly too narrow and frequently floods the land above.

19. No provision has been made in the estimate for lining the channel with masonry or concrete as ordered in G.O., No. 512 W., dated 10th February 1896, as this would be very expensive in made earth and would not prevent future silting as the bulk of the silt which enters the lake comes from the hills above the proposed flushing tank.

20. If silting of the lake below the Willow Bund is to be prevented, one of the following alterations might be adopted :—

(*a*) The construction of a reservoir at the foot of the hills to arrest the silt.
(*b*) To carry the channel along the north margin of the lake to the outfall at Kandal with sluices at intervals for supply purposes.
(*c*) The construction of a series of drops in the channel.

21. Of these alternatives it is probable that the better course will be to extend the supply channel along the north margin of the lake to discharge direct into the Kandal stream as this will prevent future silting. The work, however, will have to be carried out gradually as at certain points, for short distances, the margin of the lake is steep and the depth of water considerable, and the only way of forming the channel at a reasonable cost will be to confine the silt to the margin as it is brought down and to continue the channel as the land is reclaimed. It is certain that at the point where the channel water joins the still water in the lake a deposit of silt must take place, and if a pile and brushwood (not wattle) fence is constructed at a certain distance from the margin and is maintained in advance of the silting so as to confine it to the required width, it will eventually be possible to form the channel at these deep places. Elsewhere, the margin has a gradual slope and there is no difficulty.

22. *Lake and main sewer to be handed over to the Public Works Department.*—As the formation of the proposed channel will require technical knowledge and care it is suggested that the whole of the lake and its channel should be transferred to the Public Works department. It would also probably be as well to transfer the main sewer as the flushing arrangements can easily be attended to by the Sub-Divisional officer without prejudice to his other duties, while the municipal authorities have shown their inability in the past to attend to this duty owing to want of proper establishment. The transfer of the lake and main sewer would not necessitate any additional establishment beyond a few coolies to work and keep the gearing clean and this is the only charge, apart from the actual cost of repairs, which need necessarily fall on the municipality. Care in regulating the discharge of the flushing pipe at the head of the sewer will always be required owing to the weak section of the masonry conduit and will be especially necessary until such time as the house connections are completed as, if too great a pressure is allowed to, disc plugs will be displaced.

23. Permission is requested to purchase pipes and to manufacture two lakhs of pressed bricks at the Lawrence Asylum without further delay.

(Signed) F. W. ASHPITEL,
Executive Engineer, Coimbatore Division.

2*nd August* 1896.

Note by the Chief Engineer, Public Works Department.

I approve the plans generally, and as the matter is urgent I forward them on as they will have to be again considered as regards sanitary details by the Sanitary Board of which I am President.

(Signed) D. McNEIL CAMPBELL, Col., R.E.,
Chief Engineer.

No. 3598-C., dated 17th October 1896.

Transferred to the Local and Municipal Department.

(Signed) D. McNEIL CAMPBELL, Col., R.E.,
Secretary.

No. 1209, dated 22nd October 1896.

Referred to the Sanitary Board for early remarks.

(By Order)

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

Proceedings of the Sanitary Board, No. 299-S., dated 4th December 1896.

Read—the following papers :—

Letter from the Superintending Engineer, IV Circle, No. 422 W., dated 27th August 1896.

Endorsement in the Local and Municipal Department, No. 1209, dated 22nd October 1896.

Note by Surgeon-Lieutenant-Colonel W. G. KING, Sanitary Commissioner, dated Fort St. George, 3rd November 1896, No. 457—S.B.

Ootacamund Drainage Scheme.

Reference.—Rule 16 of the revised Sanitary Board Rules . . . . "The plans and estimates for works costing Rs. 500 and upwards shall, after completion by the Sanitary Engineer, be forwarded to the Sanitary Commissioner for opinion on sanitary grounds *only*." . . .

Undersigned considers it highly desirable that Ootacamund should be furnished with a correct sewerage conservancy scheme and that if funds be available Mettucherry and Kodapamund be also included. He also considers it desirable that flooding of the agraharam be prevented, and that silting of the lake be provided against.

2. Undersigned refrains from criticizing the structural method employed by the Engineer to meet sanitary ends with reference to the above rule.

Office-note by J. A. JONES, Esq., Sanitary Engineer, dated Fort St. George, 6th November 1896, No. 27.

[*Reference.*—Ootacamund Intercepting Sewer. Proposals for improvement of —.]

Under the special circumstance of this scheme having been prepared by a Public Works department officer, passed by the Superintending Engineer and approved by the Chief Engineer generally, it is rather difficult for the Sanitary Engineer to know what manner of criticism is expected of him or what measure of advice he should tender, and after the exhaustive examination already given by the Public Works department, it is with some diffidence that the Sanitary Engineer offers the following criticisms :—

1. In the first place the design of the sewer is not in accordance with what was laid down by the Sanitary Board. The Sanitary Board required that the sewer should be laid in a pipe-sewer carried to the *Mettucherry swamp sump*. This has not been done ; the present proposal is to join the sewer to the iron pipe at a point above the Willow Bund. Mr. Ashpitel's plans show that in doing so he obtains a grade of 1 in 329, but the undersigned ventures to think that there is an error in the levels and with this note forwards the plan prepared in this office before the decision of the Sanitary Board was arrived at. This shows that Mr. Ashpitel's section shows a fall of 26·96—21·37 = 5·59 between the points fixed by him as the beginning and end of the sewer and a gradient of 1 in 329 for the same length. But the section now forwarded shows that the fall is really only from 29·59 to 25·00 or 4·59, and the length being 2,130—250 or 1,880 the gradient is only about 1 in 410, and to obtain an increased gradient the sewer must be carried to join the iron pipe at the point indicated

by the Sanitary Board, that is, the first sump below the Willow Bund; a fall of 1 in 341 is then possible. This is shown by a red line on the tracing accompanying. [It should be noted that the data of the two sections are not the same.]

2. The section, it is submitted, should therefore be amended in this particular, the levels being, it is believed, incorrect. Mr. Ashpitel in his reports throws aside the recommendation of a 12-inch pipe by the Sanitary Board with the remark that it is no use to fix the size of the pipe by a calculation, because the population will increase enormously! The undersigned ventures to think that this would be a very cogent reason for fixing the pipe by calculation and desires to point out the following facts.

3. Assuming for the moment that Mr. Ashpitel's grade is correct and that a 15-inch pipe were laid, this pipe at his grade would carry about 223 c. ft. per minute, say, 1,394 gallons per minute. Taking this as a maximum it represents the sewage from 48,384 people at 20 gallons per head (the sewer flowing on an average half full and half the sewage carried off in six hours). Is it to be expected that the whole of Ootacamund will ever contain this number, much less that, that number drain into the intercepting sewer?

4. A 15-inch sewer at 1 in 341 (the supposed grade) has a velocity running full or half full of only 188 feet per minute = 3 feet per second; but when this sewer carries the actual sewage of the population which certainly does not amount to that of more than 10,000 people, the sewage of which will not exceed 277 gallons per minute as a maximum, the velocity would be so inappreciably low that silting would indubitably take place. While it has always been maintained that a 9-inch is ample if properly laid, the Sanitary Board decided on a 12-inch so as to allow for a large amount of flood water passing through it; a 12-inch sewer at a grade of 341 will discharge about 130 c. ft. or 812 gallons per minute full and 406 half full which is surely very ample.

5. The undersigned therefore advises that the 12-inch size be retained.

6. Not only has it much more chance of being self-cleansing, but it will be much more easily flushed; a 15-inch sewer would take a very large amount of water to flush properly.

7. Very little of Mr. Ashpitel's report refers to the work to be done, but is rather an essay on his proposals for the design for dealing with the bazaar drains and altering them to underground sewers; this point need not be discussed at present and is only noticed, because it is not easy to understand whether the plans of manholes amongst the drawings refer to such proposals or to the actual work now proposed to be undertaken; one manhole is described as manhole No. 1; the other two designs bear no such description. These manholes are 4′ 9″ high from bottom of sewer to ground level; but at manhole No. 1 the depth of sewer below ground is only (from the Sanitary Engineer's tracing) 31·86—29·59 = 2·27. No ground level at all is shown on Mr. Ashpitel's sections, and apparently the tracing shows the section of the line of the channel and not of the sewer; from the Sanitary Engineer's tracing however this depth of 4′ 9″ will be suitable for the lower end of the sewer only. Each manhole, it is submitted, ought to be separately designed before work is begun, but the practice of the Public Works department on this point is not known. Taking the manholes as a type of what are proposed, it is marked that there is no arrangement whatever from keeping silt out of the sewer nor for the disposal of storm water. It is submitted that such arrangements must be made. The storm water from existing surface drains (whether they are to be abandoned in the future or not) must cross the proposed sewer; these drains carry both sewage and storm water, and it is advisable to prevent any but a small quantity of storm water entering the sewer. Some design for this should therefore be prepared and approved by the Board.

8. Mr. Ashpitel's plan does not show whether he retains existing connection with the sewer or otherwise; it is presumed he does, but these also should have a place on the plan and there the arrangements for interception of silt and overflow should be shown.

9. The desirability of flushing the sewer need not be discussed, but it is doubtful if the arrangements proposed are likely to be successful. The long square sewer

with its many outlets, trap doors, &c., between the flushing pipe and the pipe sewer will, it is believed, render abortive any attempts at successful flushing—it would be much better to arrange for a flush tank (which could be filled with water from the channel by pumping when pipe water is not available) at the actual head of the sewer. No doubt the site of Mr. Ashpitel's proposed flushing tank would be excellent, were there a pipe sewer extended up to it; but, under existing conditions, the plan cannot be advised as one which should be sanctioned.

10. It is not thought that the proposed channel debouches into the lake in the best position. It seems to the undersigned that it would be advisable for the channel to be curved quickly to the left after passing under the Willow Bund, thus reaching deep water much more quickly than it now does.

11. The undersigned does not think it necessary for him to criticise the estimate nor the report other than in regard to the points already touched on.

12. The plans, estimates and reports are returned with the Sanitary Commissioner's note thereon.

Note by Colonel D. McNEIL CAMPBELL, R.E., President, Sanitary Board.

In forwarding the plans and estimates for the Ootacamund drainage to the Local and Municipal department, I said that I approved generally of the scheme and that I forwarded them to save delay as I would have to note on them again as President, Sanitary Board.

2. As regards the details I agree with the Sanitary Engineer that a 15-inch pipe is larger than necessary, and I think a 12-inch pipe should be substituted: this will reduce the estimate by Rs. 1,490. I can see no object in carrying the pipe to the Mettucherry swamp sump and Mr. Ashpitel's arrangement may be approved.

3. As regards the difference in levels I have no reason to doubt the correctness of those taken by Mr. Ashpitel who informs me that they were taken several times; but the matter is not of much consequence, as a 12-inch pipe is ample to give the required discharge even with the reduced grade of $\frac{1}{410}$, this being what Mr. Ashpitel's grade of $\frac{1}{329}$ is reduced to if there is an error of 1 foot as stated by Mr. Jones.

4. As regards the manholes the designs submitted by Mr. Ashpitel are sample ones and are not prepared with reference to any particular site, and they will have to be altered to suit the ground level during construction, and probably a saving on the estimate will be effected. I do not agree with Mr. Jones that Mr. Ashpitel's flushing arrangement will not answer the purpose; it is impossible to say for certain that it will be a success, but I see no reason to think otherwise. Mr. Ashpitel's reasons for ending the supply channel as he does, are given in paragraph 21 of his report, and I approve of them.

5. I consider that Mr. Ashpitel's estimate should be sanctioned, the size of pipe being reduced to 12 inches instead of 15 inches, and as the work is urgent I would advise that the pipes be ordered at once. The question raised by the Sanitary Commissioner as regards the drainage of Mettucherry and Kodapamund can be considered hereafter.

Resolution—No. 299-S., dated 4th December 1896.

With his letter, No. 422-W., dated 27th August 1896, the Superintending Engineer, IV Circle, submits plans and estimates for town drainage works at Ootacamund. The proposals are drawn up with reference to the recommendations of the Sanitary Board approved in G.O., No. 1390 M., dated 24th August 1895, and in accordance with the undermentioned orders:—

G.O., No. 512 W., dated 10th February 1896.
„ „ 982 W. „ 19th March „

2. They include the following estimates:—

		Rs.
(i)	Estimate for pipes and for removing and relaying the intercepting sewer from junction with Brewery drain to Willow Bund	15,000
(ii)	Estimate for 21 manholes for intercepting sewer	4,350
(iii)	Flushing sluice at head of sewer	4,200
(iv)	Widening supply channel	470
(v)	Culvert under Willow Bund	2,920
	Total ..	26,940

3. The plans generally have been approved by the Chief Engineer and they have now been referred by Government for the remarks of the Sanitary Board.

4. The Board approves the plans and estimates subject to the remarks of the President, who has recorded a separate note on the subject which is submitted for the information of Government.

5. The suggestions of the Sanitary Commissioner are commended by the Board for the consideration of Government when opportunity offers.

(True Extract.)

(Signed) R. PARSONS,
Secretary, Sanitary Board.

To the Secretary to Government,
Local and Municipal Department.

ORDER—No. 107 M., dated 27th January 1897.

The estimate prepared by Mr. Ashpitel for the improvement of the drainage of Ootacamund, which, as modified with reference to paragraph 2 of the note by the President of the Sanitary Board, amounts to Rs. 25,450, is sanctioned.

2. To meet the cost of the work, the municipal council is requested to appropriate a sum of Rs. 25,450 out of the Provincial grants amounting to Rs. 1,89,000 on account of the water-supply scheme, which it has already received, and to place the sum at the disposal of the Public Works department.

3. The Public Works department is requested to put the work in hand at once. Its attention is drawn to the remarks of the President of the Sanitary Board in paragraph 4 of his note.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Ootacamund.
" Collector of Nilgiris.
" Sanitary Board.
" Public Works Department.
" Financial Department.
" Accountant-General.
Editors' Table.

Exd. A. F. Eccleston.

Government {1897} of Madras.

LOCAL AND MUNICIPAL.

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G.O., No. 107 M., 27th January 1897.

JANUARY.

Drainage.

Sanctioning an estimate of Rs. 25,450 for the improvement of the — of Ootacamund, and requesting the municipal council to meet the cost of the work out of the Provincial grant of Rs. 1,89,000 on account of the water-supply scheme and to place the amount at the disposal of the Public Works department which will put the work in hand at once.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers:—

Endorsement—from the Public Works Department, No. 3598-C., dated 17th October 1896.

Read—the following papers:—

From J. HANNAN, Esq., Superintending Engineer, IV Circle, to the Chief Engineer, Public Works Department, dated Coimbatore, 27th August 1896, No. 422-W.

As more than one reminder has been lately received from your office calling for the estimate for relaying the intercepting sewer and for the drainage of Mettucherry and the main bazaar at Ootacamund, I have the honour to submit herewith the plans and estimate for that portion of the scheme which affects the upper portion of the Ootacamund lake now being filled in. The plans and estimates were received by me on the 10th instant. As no proper data were submitted for the rates which appeared to be excessive, I returned the data sheet to the Executive Engineer for revision. It has not been returned as yet. As, however, the estimates appear to be urgently required, I submit them as received. They have not been checked in this office.

2. Mr. Ashpitel submits a very full report showing, amongst other things, how in his opinion the drainage of the Mettucherry and the main bazaar, &c., should be carried out. His proposals are, I have no doubt, the latest up to date ones from a sanitary engineering point of view. Whether the existing arrangements cannot be made fairly efficient at a less cost is a question which will doubtless be duly considered by the Sanitary Committee of experts.

ENCLOSURES.

REPORT to accompany the Preliminary Estimate for the Ootacamund Drainage Scheme.

Object of Preliminary Estimate.—With the exception of Kandal the drainage of Ootacamund at the present time is discharged into the lake owing to the failure of the existing system of sewerage. The sewers consist of open drains following the natural lines of drainage and an intercepting or main close sewer of varying size and description which follows the line of the supply channel from the back of Mr. Brown's establishment to the Willow Bund. Beyond this point an iron-pipe sewer, 12 inches diameter, has been laid through the lake with an outfall into the Kandal stream.

In G.O., No. 512 W., dated 10th February 1896, the preparation of a complete scheme was ordered, but owing to the delay in obtaining copies of the recent town survey, this has not been possible, and in G.O., No. 982 W., dated 19th March 1896, this preliminary estimate was ordered to be prepared. The estimate provides only for taking up the 9-inch main sewer from the Brewery drain to the Willow Bund and replacing it by a 15-inch pipe as already approved for improving the lake supply channel and the provision of flushing arrangements for the main sewer.

2. *Existing System.*—From time to time considerable sums have been spent on the drainage of Ootacamund, and the result cannot be said to be satisfactory. The main sewer for a length of about 4,560 feet consists of a masonry conduit laid almost on the surface of the ground with an average fall $\frac{1}{300}$, a 9-inch stoneware pipe from 4,764 feet to 6,603 feet laid practically with no fall (*vide* longitudinal section) though a fall of $\frac{1}{328}$ is available and a 12-inch iron pipe through the lake with a fall of $\frac{1}{1000}$. The only really efficient length of this main sewer is the pipe through the lake which is provided with admirable flushing arrangements and needs no improvement. The 9-inch pipe is too small and without fall, and the masonry conduit is, it

is suggested, altogether in the wrong place for the main sewer and of very inferior design. Throughout the system the manholes are too small, and, as the Sanitary Commissioner points out in his notes printed with G.O., No. 648 M., dated 23rd May 1894, there are numerous gully pits along the line of sewer designed to intercept silt and solid matter, which are simply open cess-pools.

3. *Proposed System.*—In any scheme for the drainage of Ootacamund it appears to be absolutely necessary to recognize the fact that, whatever the merits of open drains may be, it is not a good thing to combine them with a closed main sewer. Such a combination is fatal to good sanitation as, owing to the necessity of admitting surface water to the sewers, and the difficulty of excluding solid matters, rubbish and road detritus, gullies are required which retain sewage and become nothing more nor less than evil smelling cess-pools requiring frequent cleansing.

4. Open drains have in this country a number of advocates who echo the old cry that the sun is the best sanitarian; but the sun, like other sanitarians, requires to be given a fair chance. To collect sewage in a number of pits into which liquid is constantly flowing does not give this fair chance, and the result is that the sun, under these circumstances, merely assists putrefaction and the formation of sewer gas. It does not seem advisable, therefore, to have a mixed system of open and closed drains, and one or other of these systems should, it is suggested, be adopted in its entirety with no cess-pools.

5. As an open sewer along the north boundary of the Hobart Park would be extremely unpleasant and unsightly, and as the existing 12-inch iron pipe through the lake is effective and has been laid at considerable expense, it is suggested that a pipe system should be adopted throughout, the existing open drains being retained for surface drainage only. Ootacamund is an ideal place for such a system of sewers, provided that the ordinary principles are adopted with no special contrivances, such as catch-pits or interceptors, which create the very evil the sewers are intended to prevent.

6. *Existing Masonry Sewer to be reserved for the few houses along its course and for flushing purposes.*—In paragraph 2 it was suggested that the existing masonry sewer down to the junction with the Brewery drain is wrongly aligned. Inspection shows that this sewer has not a good fall and directly serves very few houses. It is also of poor design and much obstructed. A better line for the main sewer will be along Commercial Road joining the existing line at proposed manhole No. 1 and picking up the market and latrine drains on the way. If this is approved, the main may, for the present, start at commencement of the Commercial Road bazaar and may be at 12-inch stoneware pipe up to proposed manhole No. 1 (*vide* plan No. 1) and a 15-inch stoneware pipe from this point to the junction with the existing 12-inch iron pipe near the Willow Bund. It appears to be of but little use to fix the size of pipes by calculation, as the amount of sewage to be dealt with is likely to increase enormously as the population increases, and the 12-inch iron pipe through the lake, with its flushing arrangements, will take the discharge from these pipes. It will be noted that the velocity in all these pipes will considerably exceed the limit of $1\frac{1}{2}$ feet per second proposed by Waring for the separate system. The existing masonry sewer from the back of Mr. Brown's premises to manhole No. 1 will be extremely useful to serve the few houses along its course, but will chiefly be valuable for flushing purposes as explained in paragraph 7. When house connections are provided this sewer should be examined and repaired and the manholes altered, so as not to retain sewage, *i.e.*, the catch-pits should be filled up and proper channels formed.

7. *Proposed Flushing arrangements.*—Just above Mr. Brown's stables a small tank formerly existed as is evident from the old surveys of Ootacamund, and, if this tank is restored by damming up the channel at the point shown on the accompanying map, and a pipe laid from this tank to the head of the existing sewer, an efficient flush can be secured. Plan No. 3 shows the proposed flushing sluice with two vents, each 6 feet wide, or the full width of the channel bed. This ventage may be considered to be excessive, but is allowed in order to reduce the velocity through the sluice to the normal channel velocity during the rainy weather when much silt is likely to be brought down from the hills. From this sluice an iron pipe 9-inch diameter is

proposed to be laid to the head of the existing sewer with a fall $\frac{1}{10}$ or thereabouts and regulated by a sluice valve. This pipe will discharge sufficient water for an ample flush under pressure, * and owing to the continuous supply in the channel, even during the hot months of the year, the flush can be effected daily. No automatic flushing arrangements are proposed, as some sort of establishment will necessarily be maintained and automatic valves have a tendency to get out of order. To flush branch sewers water will have to be obtained from the municipal pipes; but if Field's or other suitable flushing tanks are constructed in connection with the stand pipes, the waste water will probably be ample.

* Some of the obstructions in the masonry sewer will probably have to be removed.

8. *Dimensions of proposed Sewers and Position of Manholes.*—In the complete estimates it is suggested that the branch street sewers may be 9-inch, and the house connections 6-inch, stoneware pipes in accordance with the usual practice; the sewers to follow the directions of the streets and to be laid in straight lengths according to the roads, each length being terminated in a manhole with intermediate manholes at intervals of 150 feet to facilitate inspection, ventilation and the localization of leaks. Intermediate manholes will not be numerous as the streets are generally short, and therefore it does not seem worthwhile to substitute ventilators which do not permit inspection of the sewer.

9. *Types of Manholes.*—Plans Nos. 4 and 5 show types of proposed manholes. Plan No 5 is for proposed manhole No. 1 where two branches have to be dealt with, and plan No. 4 for ordinary manhole along the line of the main sewer and elsewhere where the gradient is not too great. Plan No. 6 is the type for sewers with a steep gradient, though its adoption does not seem absolutely necessary. All these designs are of the ordinary pattern.

10. *House Connections.*—The house connections will, it is presumed, be carried out as the sewers are constructed as being the cheapest and most convenient course. Plan No. 7 shows a form of trapped pit into which the sewage can be discharged from the houses and thence through a 6-inch pipe into the sewer. The trap is what is known as Messrs. Ingham and Son's quick motion trap. "It is claimed † for this trap that the obstruction to the flow of sewage is less than in other traps, inasmuch as there is no unnecessary and useless sinking of the sides of the orifice below water level. The top of the trap, crosswise, is straight and horizontal, parallel with the surface of the water in the trap. Its dip is therefore fully effective, the whole width of the drain pipe, whilst in all round sections both sides dip uselessly into the water and offer unnecessary obstruction to the flow of sewage. Those who had experience of these traps regard them with favour, and when we examine the principles on which they are constructed there appears to be every reason why that should be so. The trap effectively bars the passage of air; its dip is the same as that of other traps about 2 or $2\frac{1}{2}$ inches. The body of the water in the trap being small is frequently renewed. The outlet is on the next adjoining pipe, not on the trap itself. It is one of the points of this trap that when the sewage leaves it, it falls immediately and freely over the lip into the pipe and acquires motion thereby to start with, and a free outlet in the trap is maintained."

† See Professional Papers of the Corps of Royal Engineers edited by Captain W. A. Gale, R.E.

11. *Catch-pit or Gully for Stables.*—Plan No. 6 shows the form of gully for stables with a grating attached to the inlet to the drain which is turned downwards to prevent floating straw, &c., getting into the drain. It is proposed to be used in connection with surface channels carried beyond the building to a distance of 12 feet.

12. *Ventilation.*—In paragraph 8, it is suggested that manholes should be constructed on the line of sewers at maximum distances apart of 150 feet to facilitate inspection, ventilation, &c. With this number of manholes and an ample flush no further ventilation appears to be necessary, except a few 6-inch pipes led at intervals from the manholes or house connections to the gables of houses in the neighbourhood or up lamp-posts.

This question of ventilation appears to merit some attention, as according to Waring (sewerage and land drainage) "the proper requirement should be to make the ventilation universal, to furnish as many openings as possible and to afford abundant

facility for the inlet and outlet of air. The plan recommended by many Engineers *of prohibiting traps on house-drains* and making the soil-pipe itself a ventilator reaching above the roof seems to me to leave nothing to be desired. Under such conditions of ventilation as this will secure, the house-trap is entirely unnecessary in connection with such sewers as should be tolerated for a moment by any community. If the fixtures are trapped from the soil-pipe, the very diluted atmosphere of the sewer may be passed through this pipe without objection." This remark does not altogether apply to the proposed system at Ootacamund as none of the pipes will enter the houses; but if it is accepted that the proposed trap (paragraph 10) is unnecessary, considerable expense will be avoided, as all that will be necessary is to lead 6-inch pipes up the walls of houses from the proposed pit (plan No. 7), and these pipes will not be needed at every connection when the pit is at a distance from the house in a court-yard.

13. *Sewage Farm not necessary at present.*—In paragraph 8 of the Sanitary Commissioner's note of inspection, the existing system of disposal of sewage into a stream is condemned; but, as the municipality will probably find considerable difficulty in providing funds for the drainage, it is suggested that it is not necessary to further burden its resources with the construction and maintenance of a sewage farm pending the advent of the new industry, &c., alluded to. If the present outfall is considered to be too near Ootacamund, it is easy to extend the sewer further down the stream.

14. *Pail Depôts and Latrines.*—No proposals are made for pail depôts or special forms of latrines, as the Sanitary Commissioner is believed to be in possession of suitable designs. It is presumed that the sites will be fixed by the municipality with reference to the sewers, and that the solid matter from private latrines will be taken to pail depôts in connection with public latrines, provided with automatic flushing arrangements of the ordinary type.

15. *Definite orders requested.*—It is requested that definite orders may be issued on the various points raised in this report and that the plans may be approved for adoption or other designs supplied. It is also suggested that the exact areas to be drained should be marked on a map as it is understood that the drainage of additional areas is contemplated by the Sanitary Commissioner; additions which may necessitate modifications in the proposals now made.

16. *Silt and Sludge Interceptor not necessary.*—Orders are also requested regarding the silt interceptor at the upper end of the sewer and the sludge interceptor at the lower between it and its junction with the iron pipe sewer under the lake at Mettucherry swamp ordered to be provided in G.O., No. 512 W., dated 10th February 1896, as with the proposed arrangements these are apparently not necessary. The proposed flushing tank will obviate the necessity for the silt interceptor at the head of the sewer and with existing and proposed flushing arrangements no sludge interceptor seems necessary.

17. It is believed that the new railway station is likely to be located in Mettucherry. If so, it will be necessary to demolish a number of houses and may possibly be cheaper to buy up the remainder and give properly arranged building sites elsewhere rather than extend the system of sewers to the irregularly built houses in this part of Ootacamund.

18. *Lake Supply-Channel.*—In G.O., No. 3246 W., of 19th December 1895, the diversion of the lake supply-channel and the construction of a culvert under the Willow Bund road was sanctioned, but no provision was made for widening the channel below the road immediately east of the Hobart Park. The catchment basin of the lake above the Willow Bund is 3·7 square miles, of which about 3 square miles drain into the supply channel. In the estimates now submitted, it is proposed to widen the channel to a bed width of 12 feet with a fall $\frac{1}{450}$. This will cost only Rs. 470 as the bulk of the earth excavated will be used for filling in the upper part of the lake. A channel 12 feet wide flowing 2 feet deep will discharge 98 cubic feet or sufficient for an effective rainfall of about $3\frac{3}{4}$ inches in 24 hours which is the maximum likely to be dealt with, seeing that the gross maximum rainfall registered only amounts to 6·62 inches. This widening is very necessary as the existing channel below the road at the east end of the park is manifestly too narrow and frequently floods the land above.

19. No provision has been made in the estimate for lining the channel with masonry or concrete as ordered in G.O., No. 512 W., dated 10th February 1896, as this would be very expensive in made earth and would not prevent future silting as the bulk of the silt which enters the lake comes from the hills above the proposed flushing tank.

20. If silting of the lake below the Willow Bund is to be prevented, one of the following alterations might be adopted:—

(*a*) The construction of a reservoir at the foot of the hills to arrest the silt.
(*b*) To carry the channel along the north margin of the lake to the outfall at Kandal with sluices at intervals for supply purposes.
(*c*) The construction of a series of drops in the channel.

21. Of these alternatives it is probable that the better course will be to extend the supply channel along the north margin of the lake to discharge direct into the Kandal stream as this will prevent future silting. The work, however, will have to be carried out gradually as at certain points, for short distances, the margin of the lake is steep and the depth of water considerable, and the only way of forming the channel at a reasonable cost will be to confine the silt to the margin as it is brought down and to continue the channel as the land is reclaimed. It is certain that at the point where the channel water joins the still water in the lake a deposit of silt must take place, and if a pile and brushwood (not wattle) fence is constructed at a certain distance from the margin and is maintained in advance of the silting so as to confine it to the required width, it will eventually be possible to form the channel at these deep places. Elsewhere, the margin has a gradual slope and there is no difficulty.

22. *Lake and main sewer to be handed over to the Public Works Department.*—As the formation of the proposed channel will require technical knowledge and care it is suggested that the whole of the lake and its channel should be transferred to the Public Works department. It would also probably be as well to transfer the main sewer as the flushing arrangements can easily be attended to by the Sub-Divisional officer without prejudice to his other duties, while the municipal authorities have shown their inability in the past to attend to this duty owing to want of proper establishment. The transfer of the lake and main sewer would not necessitate any additional establishment beyond a few coolies to work and keep the gearing clean and this is the only charge, apart from the actual cost of repairs, which need necessarily fall on the municipality. Care in regulating the discharge of the flushing pipe at the head of the sewer will always be required owing to the weak section of the masonry conduit and will be especially necessary until such time as the house connections are completed as, if too great a pressure is allowed to, disc plugs will be displaced.

23. Permission is requested to purchase pipes and to manufacture two lakhs of pressed bricks at the Lawrence Asylum without further delay.

(Signed) F. W. ASHPITEL,
Executive Engineer, Coimbatore Division.

2*nd August* 1896.

Note by the Chief Engineer, Public Works Department.

I approve the plans generally, and as the matter is urgent I forward them on as they will have to be again considered as regards sanitary details by the Sanitary Board of which I am President.

(Signed) D. McNEIL CAMPBELL, Col., R.E.,
Chief Engineer.

No. 3598-C., dated 17th October 1896.

Transferred to the Local and Municipal Department.

(Signed) D. McNEIL CAMPBELL, Col., R.E.,
Secretary.

No. 1209, dated 22nd October 1896.

Referred to the Sanitary Board for early remarks.

(By Order)

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

Proceedings of the Sanitary Board, No. 299-S., dated 4th December 1896.

Read—the following papers:—

Letter from the Superintending Engineer, IV Circle, No. 422 W., dated 27th August 1896.

Endorsement in the Local and Municipal Department, No. 1209, dated 22nd October 1896.

Note by Surgeon-Lieutenant-Colonel W. G. KING, Sanitary Commissioner, dated Fort St. George, 3rd November 1896, No. 457—S.B.

Ootacamund Drainage Scheme.

Reference.—Rule 16 of the revised Sanitary Board Rules . . . . "The plans and estimates for works costing Rs. 500 and upwards shall, after completion by the Sanitary Engineer, be forwarded to the Sanitary Commissioner for opinion on sanitary grounds *only*." . . .

Undersigned considers it highly desirable that Ootacamund should be furnished with a correct sewerage conservancy scheme and that if funds be available Mettucherry and Kodapamund be also included. He also considers it desirable that flooding of the agraharam be prevented, and that silting of the lake be provided against.

2. Undersigned refrains from criticizing the structural method employed by the Engineer to meet sanitary ends with reference to the above rule.

Office-note by J. A. JONES, Esq., Sanitary Engineer, dated Fort St. George, 6th November 1896, No. 27.

[*Reference.*—Ootacamund Intercepting Sewer. Proposals for improvement of —.]

Under the special circumstance of this scheme having been prepared by a Public Works department officer, passed by the Superintending Engineer and approved by the Chief Engineer generally, it is rather difficult for the Sanitary Engineer to know what manner of criticism is expected of him or what measure of advice he should tender, and after the exhaustive examination already given by the Public Works department, it is with some diffidence that the Sanitary Engineer offers the following criticisms:—

1. In the first place the design of the sewer is not in accordance with what was laid down by the Sanitary Board. The Sanitary Board required that the sewer should be laid in a pipe-sewer carried to the *Mettucherry swamp sump*. This has not been done; the present proposal is to join the sewer to the iron pipe at a point above the Willow Bund. Mr. Ashpitel's plans show that in doing so he obtains a grade of 1 in 329, but the undersigned ventures to think that there is an error in the levels and with this note forwards the plan prepared in this office before the decision of the Sanitary Board was arrived at. This shows that Mr. Ashpitel's section shows a fall of 26·96—21·37 = 5·59 between the points fixed by him as the beginning and end of the sewer and a gradient of 1 in 329 for the same length. But the section now forwarded shows that the fall is really only from 29·59 to 25·00 or 4·59, and the length being 2,130—250 or 1,880 the gradient is only about 1 in 410, and to obtain an increased gradient the sewer must be carried to join the iron pipe at the point indicated

by the Sanitary Board, that is, the first sump below the Willow Bund; a fall of 1 in 341 is then possible. This is shown by a red line on the tracing accompanying. [It should be noted that the data of the two sections are not the same.]

2. The section, it is submitted, should therefore be amended in this particular, the levels being, it is believed, incorrect. Mr. Ashpitel in his reports throws aside the recommendation of a 12-inch pipe by the Sanitary Board with the remark that it is no use to fix the size of the pipe by a calculation, because the population will increase enormously! The undersigned ventures to think that this would be a very cogent reason for fixing the pipe by calculation and desires to point out the following facts.

3. Assuming for the moment that Mr. Ashpitel's grade is correct and that a 15-inch pipe were laid, this pipe at his grade would carry about 223 c. ft. per minute, say, 1,394 gallons per minute. Taking this as a maximum it represents the sewage from 48,384 people at 20 gallons per head (the sewer flowing on an average half full and half the sewage carried off in six hours). Is it to be expected that the whole of Ootacamund will ever contain this number, much less that, that number drain into the intercepting sewer?

4. A 15-inch sewer at 1 in 341 (the supposed grade) has a velocity running full or half full of only 188 feet per minute = 3 feet per second; but when this sewer carries the actual sewage of the population which certainly does not amount to that of more than 10,000 people, the sewage of which will not exceed 277 gallons per minute as a maximum, the velocity would be so inappreciably low that silting would indubitably take place. While it has always been maintained that a 9-inch is ample if properly laid, the Sanitary Board decided on a 12-inch so as to allow for a large amount of flood water passing through it; a 12-inch sewer at a grade of 341 will discharge about 130 c. ft. or 812 gallons per minute full and 406 half full which is surely very ample.

5. The undersigned therefore advises that the 12-inch size be retained.

6. Not only has it much more chance of being self-cleansing, but it will be much more easily flushed; a 15-inch sewer would take a very large amount of water to flush properly.

7. Very little of Mr. Ashpitel's report refers to the work to be done, but is rather an essay on his proposals for the design for dealing with the bazaar drains and altering them to underground sewers; this point need not be discussed at present and is only noticed, because it is not easy to understand whether the plans of manholes amongst the drawings refer to such proposals or to the actual work now proposed to be undertaken; one manhole is described as manhole No. 1; the other two designs bear no such description. These manholes are 4′ 9″ high from bottom of sewer to ground level; but at manhole No. 1 the depth of sewer below ground is only (from the Sanitary Engineer's tracing) 31·86—29·59 = 2·27. No ground level at all is shown on Mr. Ashpitel's sections, and apparently the tracing shows the section of the line of the channel and not of the sewer; from the Sanitary Engineer's tracing however this depth of 4′ 9″ will be suitable for the lower end of the sewer only. Each manhole, it is submitted, ought to be separately designed before work is begun, but the practice of the Public Works department on this point is not known. Taking the manholes as a type of what are proposed, it is marked that there is no arrangement whatever from keeping silt out of the sewer nor for the disposal of storm water. It is submitted that such arrangements must be made. The storm water from existing surface drains (whether they are to be abandoned in the future or not) must cross the proposed sewer; these drains carry both sewage and storm water, and it is advisable to prevent any but a small quantity of storm water entering the sewer. Some design for this should therefore be prepared and approved by the Board.

8. Mr. Ashpitel's plan does not show whether he retains existing connection with the sewer or otherwise; it is presumed he does, but these also should have a place on the plan and there the arrangements for interception of silt and overflow should be shown.

9. The desirability of flushing the sewer need not be discussed, but it is doubtful if the arrangements proposed are likely to be successful. The long square sewer

with its many outlets, trap doors, &c., between the flushing pipe and the pipe sewer will, it is believed, render abortive any attempts at successful flushing—it would be much better to arrange for a flush tank (which could be filled with water from the channel by pumping when pipe water is not available) at the actual head of the sewer. No doubt the site of Mr. Ashpitel's proposed flushing tank would be excellent, were there a pipe sewer extended up to it; but, under existing conditions, the plan cannot be advised as one which should be sanctioned.

10. It is not thought that the proposed channel debouches into the lake in the best position. It seems to the undersigned that it would be advisable for the channel to be curved quickly to the left after passing under the Willow Bund, thus reaching deep water much more quickly than it now does.

11. The undersigned does not think it necessary for him to criticise the estimate nor the report other than in regard to the points already touched on.

12. The plans, estimates and reports are returned with the Sanitary Commissioner's note thereon.

Note by Colonel D. McNEIL CAMPBELL, R.E., President, Sanitary Board.

In forwarding the plans and estimates for the Ootacamund drainage to the Local and Municipal department, I said that I approved generally of the scheme and that I forwarded them to save delay as I would have to note on them again as President, Sanitary Board.

2. As regards the details I agree with the Sanitary Engineer that a 15-inch pipe is larger than necessary, and I think a 12-inch pipe should be substituted: this will reduce the estimate by Rs. 1,490. I can see no object in carrying the pipe to the Mettucherry swamp sump and Mr. Ashpitel's arrangement may be approved.

3. As regards the difference in levels I have no reason to doubt the correctness of those taken by Mr. Ashpitel who informs me that they were taken several times; but the matter is not of much consequence, as a 12-inch pipe is ample to give the required discharge even with the reduced grade of $\frac{1}{4\,1\,5}$, this being what Mr. Ashpitel's grade of $\frac{1}{3\,2\,9}$ is reduced to if there is an error of 1 foot as stated by Mr. Jones.

4. As regards the manholes the designs submitted by Mr. Ashpitel are sample ones and are not prepared with reference to any particular site, and they will have to be altered to suit the ground level during construction, and probably a saving on the estimate will be effected. I do not agree with Mr. Jones that Mr. Ashpitel's flushing arrangement will not answer the purpose; it is impossible to say for certain that it will be a success, but I see no reason to think otherwise. Mr. Ashpitel's reasons for ending the supply channel as he does, are given in paragraph 21 of his report, and I approve of them.

5. I consider that Mr. Ashpitel's estimate should be sanctioned, the size of pipe being reduced to 12 inches instead of 15 inches, and as the work is urgent I would advise that the pipes be ordered at once. The question raised by the Sanitary Commissioner as regards the drainage of Mettucherry and Kodapamund can be considered hereafter.

Resolution—No. 299-S., dated 4th December 1896.

With his letter, No. 422-W., dated 27th August 1896, the Superintending Engineer, IV Circle, submits plans and estimates for town drainage works at Ootacamund. The proposals are drawn up with reference to the recommendations of the Sanitary Board approved in G.O., No. 1390 M., dated 24th August 1895, and in accordance with the undermentioned orders:—

G.O., No. 512 W., dated 10th February 1896.
„ „ 982 W. „ 19th March „

2. They include the following estimates :—

		Rs.
(i)	Estimate for pipes and for removing and relaying the intercepting sewer from junction with Brewery drain to Willow Bund	15,000
(ii)	Estimate for 21 manholes for intercepting sewer	4,350
(iii)	Flushing sluice at head of sewer	4,200
(iv)	Widening supply channel	470
(v)	Culvert under Willow Bund	2,920
	Total ..	26,940

3. The plans generally have been approved by the Chief Engineer and they have now been referred by Government for the remarks of the Sanitary Board.

4. The Board approves the plans and estimates subject to the remarks of the President, who has recorded a separate note on the subject which is submitted for the information of Government.

5. The suggestions of the Sanitary Commissioner are commended by the Board for the consideration of Government when opportunity offers.

(True Extract.)

(Signed) R. PARSONS,
Secretary, Sanitary Board.

To the Secretary to Government,
Local and Municipal Department.

ORDER—No. 107 M., dated 27th January 1897.

The estimate prepared by Mr. Ashpitel for the improvement of the drainage of Ootacamund, which, as modified with reference to paragraph 2 of the note by the President of the Sanitary Board, amounts to Rs. 25,450, is sanctioned.

2. To meet the cost of the work, the municipal council is requested to appropriate a sum of Rs. 25,450 out of the Provincial grants amounting to Rs. 1,89,000 on account of the water-supply scheme, which it has already received, and to place the sum at the disposal of the Public Works department.

3. The Public Works department is requested to put the work in hand at once. Its attention is drawn to the remarks of the President of the Sanitary Board in paragraph 4 of his note.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Ootacamund.
" Collector of Nilgiris.
" Sanitary Board.
" Public Works Department.
" Financial Department.
" Accountant-General.
Editors' Table.

Ed. A. F. Eccleston.

Government {1897} of Madras.

LOCAL AND MUNICIPAL.

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Recd. } 1897. *Enclosures*
Regd. } *Spare copies*

G.O., No. 107 M., 27th January 1897.

JANUARY.

Drainage.

Sanctioning an estimate of Rs. 25,450 for the improvement of the — of Ootacamund, and requesting the municipal council to meet the cost of the work out of the Provincial grant of Rs. 1,89,000 on account of the water-supply scheme and to place the amount at the disposal of the Public Works department which will put the work in hand at once.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers :—

Endorsement—from the Public Works Department, No. 3598-C., dated 17th October 1896.

Read—the following papers :—

From J. HANNAN, Esq., Superintending Engineer, IV Circle, to the Chief Engineer, Public Works Department, dated Coimbatore, 27th August 1896, No. 422-W.

As more than one reminder has been lately received from your office calling for the estimate for relaying the intercepting sewer and for the drainage of Mettucherry and the main bazaar at Ootacamund, I have the honour to submit herewith the plans and estimate for that portion of the scheme which affects the upper portion of the Ootacamund lake now being filled in. The plans and estimates were received by me on the 10th instant. As no proper data were submitted for the rates which appeared to be excessive, I returned the data sheet to the Executive Engineer for revision. It has not been returned as yet. As, however, the estimates appear to be urgently required, I submit them as received. They have not been checked in this office.

2. Mr. Ashpitel submits a very full report showing, amongst other things, how in his opinion the drainage of the Mettucherry and the main bazaar, &c., should be carried out. His proposals are, I have no doubt, the latest up to date ones from a sanitary engineering point of view. Whether the existing arrangements cannot be made fairly efficient at a less cost is a question which will doubtless be duly considered by the Sanitary Committee of experts.

ENCLOSURES.

REPORT to accompany the Preliminary Estimate for the Ootacamund Drainage Scheme.

Object of Preliminary Estimate.—With the exception of Kandal the drainage of Ootacamund at the present time is discharged into the lake owing to the failure of the existing system of sewerage. The sewers consist of open drains following the natural lines of drainage and an intercepting or main close sewer of varying size and description which follows the line of the supply channel from the back of Mr. Brown's establishment to the Willow Bund. Beyond this point an iron-pipe sewer, 12 inches diameter, has been laid through the lake with an outfall into the Kandal stream.

In G.O., No. 512 W., dated 10th February 1896, the preparation of a complete scheme was ordered, but owing to the delay in obtaining copies of the recent town survey, this has not been possible, and in G.O., No. 982 W., dated 19th March 1896, this preliminary estimate was ordered to be prepared. The estimate provides only for taking up the 9-inch main sewer from the Brewery drain to the Willow Bund and replacing it by a 15-inch pipe as already approved for improving the lake supply channel and the provision of flushing arrangements for the main sewer.

2. *Existing System.*—From time to time considerable sums have been spent on the drainage of Ootacamund, and the result cannot be said to be satisfactory. The main sewer for a length of about 4,560 feet consists of a masonry conduit laid almost on the surface of the ground with an average fall $\frac{1}{500}$, a 9-inch stoneware pipe from 4,764 feet to 6,603 feet laid practically with no fall (*vide* longitudinal section) though a fall of $\frac{1}{325}$ is available and a 12-inch iron pipe through the lake with a fall of $\frac{1}{1000}$. The only really efficient length of this main sewer is the pipe through the lake which is provided with admirable flushing arrangements and needs no improvement. The 9-inch pipe is too small and without fall, and the masonry conduit is, it

is suggested, altogether in the wrong place for the main sewer and of very inferior design. Throughout the system the manholes are too small, and, as the Sanitary Commissioner points out in his notes printed with G.O., No. 648 M., dated 23rd May 1894, there are numerous gully pits along the line of sewer designed to intercept silt and solid matter, which are simply open cess-pools.

3. *Proposed System.*—In any scheme for the drainage of Ootacamund it appears to be absolutely necessary to recognize the fact that, whatever the merits of open drains may be, it is not a good thing to combine them with a closed main sewer. Such a combination is fatal to good sanitation as, owing to the necessity of admitting surface water to the sewers, and the difficulty of excluding solid matters, rubbish and road detritus, gullies are required which retain sewage and become nothing more nor less than evil smelling cess-pools requiring frequent cleansing.

4. Open drains have in this country a number of advocates who echo the old cry that the sun is the best sanitarian; but the sun, like other sanitarians, requires to be given a fair chance. To collect sewage in a number of pits into which liquid is constantly flowing does not give this fair chance, and the result is that the sun, under these circumstances, merely assists putrefaction and the formation of sewer gas. It does not seem advisable, therefore, to have a mixed system of open and closed drains, and one or other of these systems should, it is suggested, be adopted in its entirety with no cess-pools.

5. As an open sewer along the north boundary of the Hobart Park would be extremely unpleasant and unsightly, and as the existing 12-inch iron pipe through the lake is effective and has been laid at considerable expense, it is suggested that a pipe system should be adopted throughout, the existing open drains being retained for surface drainage only. Ootacamund is an ideal place for such a system of sewers, provided that the ordinary principles are adopted with no special contrivances, such as catch-pits or interceptors, which create the very evil the sewers are intended to prevent.

6. *Existing Masonry Sewer to be reserved for the few houses along its course and for flushing purposes.*—In paragraph 2 it was suggested that the existing masonry sewer down to the junction with the Brewery drain is wrongly aligned. Inspection shows that this sewer has not a good fall and directly serves very few houses. It is also of poor design and much obstructed. A better line for the main sewer will be along Commercial Road joining the existing line at proposed manhole No. 1 and picking up the market and latrine drains on the way. If this is approved, the main may, for the present, start at commencement of the Commercial Road bazaar and may be at 12-inch stoneware pipe up to proposed manhole No. 1 (*vide* plan No. 1) and a 15-inch stoneware pipe from this point to the junction with the existing 12-inch iron pipe near the Willow Bund. It appears to be of but little use to fix the size of pipes by calculation, as the amount of sewage to be dealt with is likely to increase enormously as the population increases, and the 12-inch iron pipe through the lake, with its flushing arrangements, will take the discharge from these pipes. It will be noted that the velocity in all these pipes will considerably exceed the limit of $1\frac{1}{2}$ feet per second proposed by Waring for the separate system. The existing masonry sewer from the back of Mr. Brown's premises to manhole No. 1 will be extremely useful to serve the few houses along its course, but will chiefly be valuable for flushing purposes as explained in paragraph 7. When house connections are provided this sewer should be examined and repaired and the manholes altered, so as not to retain sewage, *i.e.*, the catch-pits should be filled up and proper channels formed.

7. *Proposed Flushing arrangements.*—Just above Mr. Brown's stables a small tank formerly existed as is evident from the old surveys of Ootacamund, and, if this tank is restored by damming up the channel at the point shown on the accompanying map, and a pipe laid from this tank to the head of the existing sewer, an efficient flush can be secured. Plan No. 3 shows the proposed flushing sluice with two vents, each 6 feet wide, or the full width of the channel bed. This ventage may be considered to be excessive, but is allowed in order to reduce the velocity through the sluice to the normal channel velocity during the rainy weather when much silt is likely to be brought down from the hills. From this sluice an iron pipe 9-inch diameter is

proposed to be laid to the head of the existing sewer with a fall $\frac{1}{40}$ or thereabouts and regulated by a sluice valve. This pipe will discharge sufficient water for an ample flush under pressure, * and owing to the continuous supply in the channel, even during the hot months of the year, the flush can be effected daily. No automatic flushing arrangements are proposed, as some sort of establishment will necessarily be maintained and automatic valves have a tendency to get out of order. To flush branch sewers water will have to be obtained from the municipal pipes; but if Field's or other suitable flushing tanks are constructed in connection with the stand pipes, the waste water will probably be ample.

* Some of the obstructions in the masonry sewer will probably have to be removed.

8. *Dimensions of proposed Sewers and Position of Manholes.*—In the complete estimates it is suggested that the branch street sewers may be 9-inch, and the house connections 6-inch, stoneware pipes in accordance with the usual practice; the sewers to follow the directions of the streets and to be laid in straight lengths according to the roads, each length being terminated in a manhole with intermediate manholes at intervals of 150 feet to facilitate inspection, ventilation and the localization of leaks. Intermediate manholes will not be numerous as the streets are generally short, and therefore it does not seem worthwhile to substitute ventilators which do not permit inspection of the sewer.

9. *Types of Manholes.*—Plans Nos. 4 and 5 show types of proposed manholes. Plan No 5 is for proposed manhole No. 1 where two branches have to be dealt with, and plan No. 4 for ordinary manhole along the line of the main sewer and elsewhere where the gradient is not too great. Plan No. 6 is the type for sewers with a steep gradient, though its adoption does not seem absolutely necessary. All these designs are of the ordinary pattern.

10. *House Connections.*—The house connections will, it is presumed, be carried out as the sewers are constructed as being the cheapest and most convenient course. Plan No. 7 shows a form of trapped pit into which the sewage can be discharged from the houses and thence through a 6-inch pipe into the sewer. The trap is what is known as Messrs. Ingham and Son's quick motion trap. "It is claimed † for this trap that the obstruction to the flow of sewage is less than in other traps, inasmuch as there is no unnecessary and useless sinking of the sides of the orifice below water level. The top of the trap, crosswise, is straight and horizontal, parallel with the surface of the water in the trap. Its dip is therefore fully effective, the whole width of the drain pipe, whilst in all round sections both sides dip uselessly into the water and offer unnecessary obstruction to the flow of sewage. Those who had experience of these traps regard them with favour, and when we examine the principles on which they are constructed there appears to be every reason why that should be so. The trap effectively bars the passage of air; its dip is the same as that of other traps about 2 or $2\frac{1}{2}$ inches. The body of the water in the trap being small is frequently renewed. The outlet is on the next adjoining pipe, not on the trap itself. It is one of the points of this trap that when the sewage leaves it, it falls immediately and freely over the lip into the pipe and acquires motion thereby to start with, and a free outlet in the trap is maintained."

† See Professional Papers of the Corps of Royal Engineers edited by Captain W. A. Gale, R.E.

11. *Catch-pit or Gully for Stables.*—Plan No. 6 shows the form of gully for stables with a grating attached to the inlet to the drain which is turned downwards to prevent floating straw, &c., getting into the drain. It is proposed to be used in connection with surface channels carried beyond the building to a distance of 12 feet.

12. *Ventilation.*—In paragraph 8, it is suggested that manholes should be constructed on the line of sewers at maximum distances apart of 150 feet to facilitate inspection, ventilation, &c. With this number of manholes and an ample flush no further ventilation appears to be necessary, except a few 6-inch pipes led at intervals from the manholes or house connections to the gables of houses in the neighbourhood or up lamp-posts.

This question of ventilation appears to merit some attention, as according to Waring (sewerage and land drainage) "the proper requirement should be to make the ventilation universal, to furnish as many openings as possible and to afford abundant facility for the inlet and outlet of air. The plan recommended by many Engineers *of prohibiting traps on house-drains* and making the soil-pipe itself a ventilator reaching above the roof seems to me to leave nothing to be desired. Under such conditions of ventilation as this will secure, the house-trap is entirely unnecessary in connection with such sewers as should be tolerated for a moment by any community. If the fixtures are trapped from the soil-pipe, the very diluted atmosphere of the sewer may be passed through this pipe without objection." This remark does not altogether apply to the proposed system at Ootacamund as none of the pipes will enter the houses; but if it is accepted that the proposed trap (paragraph 10) is unnecessary, considerable expense will be avoided, as all that will be necessary is to lead 6-inch pipes up the walls of houses from the proposed pit (plan No. 7), and these pipes will not be needed at every connection when the pit is at a distance from the house in a court-yard.

13. *Sewage Farm not necessary at present.*—In paragraph 8 of the Sanitary Commissioner's note of inspection, the existing system of disposal of sewage into a stream is condemned; but, as the municipality will probably find considerable difficulty in providing funds for the drainage, it is suggested that it is not necessary to further burden its resources with the construction and maintenance of a sewage farm pending the advent of the new industry, &c., alluded to. If the present outfall is considered to be too near Ootacamund, it is easy to extend the sewer further down the stream.

14. *Pail Depôts and Latrines.*—No proposals are made for pail depôts or special forms of latrines, as the Sanitary Commissioner is believed to be in possession of suitable designs. It is presumed that the sites will be fixed by the municipality with reference to the sewers, and that the solid matter from private latrines will be taken to pail depôts in connection with public latrines, provided with automatic flushing arrangements of the ordinary type.

15. *Definite orders requested.*—It is requested that definite orders may be issued on the various points raised in this report and that the plans may be approved for adoption or other designs supplied. It is also suggested that the exact areas to be drained should be marked on a map as it is understood that the drainage of additional areas is contemplated by the Sanitary Commissioner; additions which may necessitate modifications in the proposals now made.

16. *Silt and Sludge Interceptor not necessary.*—Orders are also requested regarding the silt interceptor at the upper end of the sewer and the sludge interceptor at the lower between it and its junction with the iron pipe sewer under the lake at Mettucherry swamp ordered to be provided in G.O., No. 512 W., dated 10th February 1896, as with the proposed arrangements these are apparently not necessary. The proposed flushing tank will obviate the necessity for the silt interceptor at the head of the sewer and with existing and proposed flushing arrangements no sludge interceptor seems necessary.

17. It is believed that the new railway station is likely to be located in Mettucherry. If so, it will be necessary to demolish a number of houses and may possibly be cheaper to buy up the remainder and give properly arranged building sites elsewhere rather than extend the system of sewers to the irregularly built houses in this part of Ootacamund.

18. *Lake Supply-Channel.*—In G.O., No. 3246 W., of 19th December 1895, the diversion of the lake supply-channel and the construction of a culvert under the Willow Bund road was sanctioned, but no provision was made for widening the channel below the road immediately east of the Hobart Park. The catchment basin of the lake above the Willow Bund is 3·7 square miles, of which about 3 square miles drain into the supply channel. In the estimates now submitted, it is proposed to widen the channel to a bed width of 12 feet with a fall $\frac{1}{450}$. This will cost only Rs. 470 as the bulk of the earth excavated will be used for filling in the upper part of the lake. A channel 12 feet wide flowing 2 feet deep will discharge 98 cubic feet or sufficient for an effective rainfall of about $3\frac{3}{4}$ inches in 24 hours which is the maximum likely to be dealt with, seeing that the gross maximum rainfall registered only amounts to 6·62 inches. This widening is very necessary as the existing channel below the road at the east end of the park is manifestly too narrow and frequently floods the land above.

19. No provision has been made in the estimate for lining the channel with masonry or concrete as ordered in G.O., No. 512 W., dated 10th February 1896, as this would be very expensive in made earth and would not prevent future silting as the bulk of the silt which enters the lake comes from the hills above the proposed flushing tank.

20. If silting of the lake below the Willow Bund is to be prevented, one of the following alterations might be adopted :—

(*a*) The construction of a reservoir at the foot of the hills to arrest the silt.
(*b*) To carry the channel along the north margin of the lake to the outfall at Kandal with sluices at intervals for supply purposes.
(*c*) The construction of a series of drops in the channel.

21. Of these alternatives it is probable that the better course will be to extend the supply channel along the north margin of the lake to discharge direct into the Kandal stream as this will prevent future silting. The work, however, will have to be carried out gradually as at certain points, for short distances, the margin of the lake is steep and the depth of water considerable, and the only way of forming the channel at a reasonable cost will be to confine the silt to the margin as it is brought down and to continue the channel as the land is reclaimed. It is certain that at the point where the channel water joins the still water in the lake a deposit of silt must take place, and if a pile and brushwood (not wattle) fence is constructed at a certain distance from the margin and is maintained in advance of the silting so as to confine it to the required width, it will eventually be possible to form the channel at these deep places. Elsewhere, the margin has a gradual slope and there is no difficulty.

22. *Lake and main sewer to be handed over to the Public Works Department.*—As the formation of the proposed channel will require technical knowledge and care it is suggested that the whole of the lake and its channel should be transferred to the Public Works department. It would also probably be as well to transfer the main sewer as the flushing arrangements can easily be attended to by the Sub-Divisional officer without prejudice to his other duties, while the municipal authorities have shown their inability in the past to attend to this duty owing to want of proper establishment. The transfer of the lake and main sewer would not necessitate any additional establishment beyond a few coolies to work and keep the gearing clean and this is the only charge, apart from the actual cost of repairs, which need necessarily fall on the municipality. Care in regulating the discharge of the flushing pipe at the head of the sewer will always be required owing to the weak section of the masonry conduit and will be especially necessary until such time as the house connections are completed as, if too great a pressure is allowed to, disc plugs will be displaced.

23. Permission is requested to purchase pipes and to manufacture two lakhs of pressed bricks at the Lawrence Asylum without further delay.

(Signed) F. W. ASHPITEL,
Executive Engineer, Coimbatore Division.

2*nd August* 1896.

Note by the Chief Engineer, Public Works Department.

I approve the plans generally, and as the matter is urgent I forward them on as they will have to be again considered as regards sanitary details by the Sanitary Board of which I am President.

(Signed) D. McNEIL CAMPBELL, Col., R.E.,
Chief Engineer.

No. 3598-C., dated 17th October 1896.

Transferred to the Local and Municipal Department.

(Signed) D. McNEIL CAMPBELL, Col., R.E.,
Secretary.

No. 1209, dated 22nd October 1896.

Referred to the Sanitary Board for early remarks.

(By Order)

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

Proceedings of the Sanitary Board, No. 299-S., dated 4th December 1896.

Read—the following papers :—

Letter from the Superintending Engineer, IV Circle, No. 422 W., dated 27th August 1896.

Endorsement in the Local and Municipal Department, No. 1209, dated 22nd October 1896.

Note by Surgeon-Lieutenant-Colonel W. G. KING, Sanitary Commissioner, dated Fort St. George, 3rd November 1896, No. 457—S.B.

Ootacamund Drainage Scheme.

Reference.—Rule 16 of the revised Sanitary Board Rules . . . . "The plans and estimates for works costing Rs. 500 and upwards shall, after completion by the Sanitary Engineer, be forwarded to the Sanitary Commissioner for opinion on sanitary grounds *only*." . . .

Undersigned considers it highly desirable that Ootacamund should be furnished with a correct sewerage conservancy scheme and that if funds be available Mettucherry and Kodapamund be also included. He also considers it desirable that flooding of the agraharam be prevented, and that silting of the lake be provided against.

2. Undersigned refrains from criticizing the structural method employed by the Engineer to meet sanitary ends with reference to the above rule.

Office-note by J. A. JONES, Esq., Sanitary Engineer, dated Fort St. George, 6th November 1896, No. 27.

[*Reference.*—Ootacamund Intercepting Sewer. Proposals for improvement of —.]

Under the special circumstance of this scheme having been prepared by a Public Works department officer, passed by the Superintending Engineer and approved by the Chief Engineer generally, it is rather difficult for the Sanitary Engineer to know what manner of criticism is expected of him or what measure of advice he should tender, and after the exhaustive examination already given by the Public Works department, it is with some diffidence that the Sanitary Engineer offers the following criticisms :—

1. In the first place the design of the sewer is not in accordance with what was laid down by the Sanitary Board. The Sanitary Board required that the sewer should be laid in a pipe-sewer carried to the *Mettucherry swamp sump*. This has not been done; the present proposal is to join the sewer to the iron pipe at a point above the Willow Bund. Mr. Ashpitel's plans show that in doing so he obtains a grade of 1 in 329, but the undersigned ventures to think that there is an error in the levels and with this note forwards the plan prepared in this office before the decision of the Sanitary Board was arrived at. This shows that Mr. Ashpitel's section shows a fall of 26·96—21·37 = 5·59 between the points fixed by him as the beginning and end of the sewer and a gradient of 1 in 329 for the same length. But the section now forwarded shows that the fall is really only from 29·59 to 25·00 or 4·59, and the length being 2,130—250 or 1,880 the gradient is only about 1 in 410, and to obtain an increased gradient the sewer must be carried to join the iron pipe at the point indicated

by the Sanitary Board, that is, the first sump below the Willow Bund; a fall of 1 in 341 is then possible. This is shown by a red line on the tracing accompanying. [It should be noted that the data of the two sections are not the same.]

2. The section, it is submitted, should therefore be amended in this particular, the levels being, it is believed, incorrect. Mr. Ashpitel in his reports throws aside the recommendation of a 12-inch pipe by the Sanitary Board with the remark that it is no use to fix the size of the pipe by a calculation, because the population will increase enormously! The undersigned ventures to think that this would be a very cogent reason for fixing the pipe by calculation and desires to point out the following facts.

3. Assuming for the moment that Mr. Ashpitel's grade is correct and that a 15-inch pipe were laid, this pipe at his grade would carry about 223 c. ft. per minute, say, 1,394 gallons per minute. Taking this as a maximum it represents the sewage from 48,384 people at 20 gallons per head (the sewer flowing on an average half full and half the sewage carried off in six hours). Is it to be expected that the whole of Ootacamund will ever contain this number, much less that, that number drain into the intercepting sewer?

4. A 15-inch sewer at 1 in 341 (the supposed grade) has a velocity running full or half full of only 188 feet per minute = 3 feet per second; but when this sewer carries the actual sewage of the population which certainly does not amount to that of more than 10,000 people, the sewage of which will not exceed 277 gallons per minute as a maximum, the velocity would be so inappreciably low that silting would indubitably take place. While it has always been maintained that a 9-inch is ample if properly laid, the Sanitary Board decided on a 12-inch so as to allow for a large amount of flood water passing through it; a 12-inch sewer at a grade of 341 will discharge about 130 c. ft. or 812 gallons per minute full and 406 half full which is surely very ample.

5. The undersigned therefore advises that the 12-inch size be retained.

6. Not only has it much more chance of being self-cleansing, but it will be much more easily flushed; a 15-inch sewer would take a very large amount of water to flush properly.

7. Very little of Mr. Ashpitel's report refers to the work to be done, but is rather an essay on his proposals for the design for dealing with the bazaar drains and altering them to underground sewers; this point need not be discussed at present and is only noticed, because it is not easy to understand whether the plans of manholes amongst the drawings refer to such proposals or to the actual work now proposed to be undertaken; one manhole is described as manhole No. 1; the other two designs bear no such description. These manholes are 4′ 9″ high from bottom of sewer to ground level; but at manhole No. 1 the depth of sewer below ground is only (from the Sanitary Engineer's tracing) 31·86—29·59 = 2·27. No ground level at all is shown on Mr. Ashpitel's sections, and apparently the tracing shows the section of the line of the channel and not of the sewer; from the Sanitary Engineer's tracing however this depth of 4′ 9″ will be suitable for the lower end of the sewer only. Each manhole, it is submitted, ought to be separately designed before work is begun, but the practice of the Public Works department on this point is not known. Taking the manholes as a type of what are proposed, it is marked that there is no arrangement whatever from keeping silt out of the sewer nor for the disposal of storm water. It is submitted that such arrangements must be made. The storm water from existing surface drains (whether they are to be abandoned in the future or not) must cross the proposed sewer; these drains carry both sewage and storm water, and it is advisable to prevent any but a small quantity of storm water entering the sewer. Some design for this should therefore be prepared and approved by the Board.

8. Mr. Ashpitel's plan does not show whether he retains existing connection with the sewer or otherwise; it is presumed he does, but these also should have a place on the plan and there the arrangements for interception of silt and overflow should be shown.

9. The desirability of flushing the sewer need not be discussed, but it is doubtful if the arrangements proposed are likely to be successful. The long square sewer

with its many outlets, trap doors, &c., between the flushing pipe and the pipe sewer will, it is believed, render abortive any attempts at successful flushing—it would be much better to arrange for a flush tank (which could be filled with water from the channel by pumping when pipe water is not available) at the actual head of the sewer. No doubt the site of Mr. Ashpitel's proposed flushing tank would be excellent, were there a pipe sewer extended up to it; but, under existing conditions, the plan cannot be advised as one which should be sanctioned.

10. It is not thought that the proposed channel debouches into the lake in the best position. It seems to the undersigned that it would be advisable for the channel to be curved quickly to the left after passing under the Willow Bund, thus reaching deep water much more quickly than it now does.

11. The undersigned does not think it necessary for him to criticise the estimate nor the report other than in regard to the points already touched on.

12. The plans, estimates and reports are returned with the Sanitary Commissioner's note thereon.

Note by Colonel D. McNEIL CAMPBELL, R.E., President, Sanitary Board.

In forwarding the plans and estimates for the Ootacamund drainage to the Local and Municipal department, I said that I approved generally of the scheme and that I forwarded them to save delay as I would have to note on them again as President, Sanitary Board.

2. As regards the details I agree with the Sanitary Engineer that a 15-inch pipe is larger than necessary, and I think a 12-inch pipe should be substituted: this will reduce the estimate by Rs. 1,490. I can see no object in carrying the pipe to the Mettucherry swamp sump and Mr. Ashpitel's arrangement may be approved.

3. As regards the difference in levels I have no reason to doubt the correctness of those taken by Mr. Ashpitel who informs me that they were taken several times; but the matter is not of much consequence, as a 12-inch pipe is ample to give the required discharge even with the reduced grade of $\frac{1}{4\frac{1}{0}}$, this being what Mr. Ashpitel's grade of $\frac{1}{3\,2\,9}$ is reduced to if there is an error of 1 foot as stated by Mr. Jones.

4. As regards the manholes the designs submitted by Mr. Ashpitel are sample ones and are not prepared with reference to any particular site, and they will have to be altered to suit the ground level during construction, and probably a saving on the estimate will be effected. I do not agree with Mr. Jones that Mr. Ashpitel's flushing arrangement will not answer the purpose; it is impossible to say for certain that it will be a success, but I see no reason to think otherwise. Mr. Ashpitel's reasons for ending the supply channel as he does, are given in paragraph 21 of his report, and I approve of them.

5. I consider that Mr. Ashpitel's estimate should be sanctioned, the size of pipe being reduced to 12 inches instead of 15 inches, and as the work is urgent I would advise that the pipes be ordered at once. The question raised by the Sanitary Commissioner as regards the drainage of Mettucherry and Kodapamund can be considered hereafter.

Resolution—No. 299-S., dated 4th December 1896.

With his letter, No. 422-W., dated 27th August 1896, the Superintending Engineer, IV Circle, submits plans and estimates for town drainage works at Ootacamund. The proposals are drawn up with reference to the recommendations of the Sanitary Board approved in G.O., No. 1390 M., dated 24th August 1895, and in accordance with the undermentioned orders:—

G.O., No. 512 W., dated 10th February 1896.
,, ,, 982 W. ,, 19th March ,,

2. They include the following estimates :—

		Rs.
(i)	Estimate for pipes and for removing and relaying the intercepting sewer from junction with Brewery drain to Willow Bund	15,000
(ii)	Estimate for 21 manholes for intercepting sewer	4,350
(iii)	Flushing sluice at head of sewer	4,200
(iv)	Widening supply channel	470
(v)	Culvert under Willow Bund	2,920
	Total ..	26,940

3. The plans generally have been approved by the Chief Engineer and they have now been referred by Government for the remarks of the Sanitary Board.

4. The Board approves the plans and estimates subject to the remarks of the President, who has recorded a separate note on the subject which is submitted for the information of Government.

5. The suggestions of the Sanitary Commissioner are commended by the Board for the consideration of Government when opportunity offers.

(True Extract.)

(Signed) R. PARSONS,
Secretary, Sanitary Board.

To the Secretary to Government,
Local and Municipal Department.

ORDER—No. 107 M., dated 27th January 1897.

The estimate prepared by Mr. Ashpitel for the improvement of the drainage of Ootacamund, which, as modified with reference to paragraph 2 of the note by the President of the Sanitary Board, amounts to Rs. 25,450, is sanctioned.

2. To meet the cost of the work, the municipal council is requested to appropriate a sum of Rs. 25,450 out of the Provincial grants amounting to Rs. 1,89,000 on account of the water-supply scheme, which it has already received, and to place the sum at the disposal of the Public Works department.

3. The Public Works department is requested to put the work in hand at once. Its attention is drawn to the remarks of the President of the Sanitary Board in paragraph 4 of his note.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Ootacamund.
" Collector of Nilgiris.
" Sanitary Board.
" Public Works Department.
" Financial Department.
" Accountant-General.
Editors' Table.

Exd. A. F. Eccleston.