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9

& Munl. (189) Department.

MISCELLANEOUS.

G.O., No. 1884 M

DATED 8-11-98

INDEXED.

[Despatch Abstract.]

Cuddapah Drainage Scheme – Referring to the Sanitary Board's remarks the memorandum of the Sanitary commissioner on the —

Vol

BACK PAPERS.

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

FURTHER PAPERS.

G.O.	No.	Department.	Date.	G.O.	No.	Department.	Date.
C.O. 441/100							

Cuddalore Drainage

LOCAL AND MUNICIPAL DEPARTMENT.

[L. & M.]
200—13-

Papers to be read in Proceedings:—

Again G.O., No. dated 189 ,

Again G.O., No dated 189 ,

Current No. 3149 M of 1897, dated 3rd September 97 from the Sanitary Board.

" " 1955 M " 1898, " 4th June 98 " " Sanitary Commissioner

" " " 189 , " , "

" "

ORDER. No. 1884 in mis 8/11/98

The memorandum of the Sani
Commissioner submitted with hi
letter read above, will be referred
the Sanitary Board for early re

From orde

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V.R.
3/11/98

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To

The Sanitary Board

with C.P. 1955/M in original
Plans Hotmals to be returned.

Sept 11/11/98

Cuddapah Drainage Scheme. Local and Municipal Department.

Current Nos. 3149-M of 1897 and 1955-M of 1898.

For Orders.

In his notes on the inspection of the Cuddapah Municipality embodied in G.O No. 313M, dated 5th March 1891, the Sanitary Commissioner (Dr. Laing) pointed out that Cuddapah had been noted for its heat and unhealthiness and that the inhabitants suffered from fever and affections traceable to the effects of dampness of soil, which was water-logged owing to the defective drainage of the town, and the existence of the Dongal Cheruvu tank above it, and he accordingly recommended that the Dongal Cheruvu tank and the supply channel of the Patha Cuddapah tank should be closed. The Government thereupon called on the Municipal Council to report what steps it proposed to take for the closure of the Dongal Cheruvu tank and the supply channel of the Patha Cuddapah tank - Vide G.O. No. 313 M, dated 5th March 1891. The Collector, however, pointed out that the closure of the Dongal Cheruvu tank was not within the province of the Municipal Council, as the tank was under the control of the Public Works Department; but in order to carry out the desire of Government, that Cuddapah should be rendered more fit for habitation, he agreed with the Sanitary Commissioner in recommending the abandonment

C

vide clauses (iii) & (iv) of para 9 of his Inspection Notes.

D

Vide his letter in G.O. 2723 Rev. 4-5-91 E

abandonment of the Dongal Cheruvu tank and the wet cultivation under it. Before, however, coming to any decision on the question of abandoning the tank, the Government called upon the Sanitary Engineer (Mr. Jones) to inspect the locality and to report on the best method of treating the tank and the wet cultivation under it, and as to whether a system of drainage would not be likely to provide an effectual remedy for the water logging of the subsoil, to which the prevalence of fever at Cuddapah was attributed, at far less cost than the abandonment of the tank, which would result in a considerable loss of revenue to Government. In reporting on this subject, the Sanitary Engineer stated that the level of the subsoil water in Cuddapah was not affected by the presence of the Dongal Cheruvu above the town, that it had not been shown that irrigation per se had a deleterious effect on the health of the people and that the porosity of the soil and the position of the strata had much more influence on the subsoil water-level than the mere quantity of water distributed over the surface, and he accordingly recommended inter alia, that for the improvement of the sanitation of the town a drainage channel six feet wide at bottom, thirty feet wide at top and eight feet deep should be excavated to the east of the town in order

(1) to carry off the subsoil water as much as possible rising above the summer level

(2) to receive and carry off the surplus water for the irrigation which might be permitted to the east of the Channel

and

and

(3) to carry off the rainfall from the portion of the town sloping towards this channel, which would otherwise find its way into the soil.

2. The Sanitary Engineer who was requested in G.O. No.1086 M, dated 24th June 1892 to make arrangements for the preparation of plans and estimates for this work, submitted in the following November an estimate amounting to Rs.19,210. This was approved by the Chief Engineer and sanctioned by Government in G.O. No.127 M dated 30th January 1893; but as there was some delay in allotting the required funds, the work was not undertaken immediately.

3. In the meantime, the question of removing from Cuddapah the Head Quarters of the District was raised in connection with the closure of the Cuddapah Jail, on account of its notorious unhealthiness and the consequent excessive mortality among the prisoners in that jail. It was however then decided to drop that question, and to help the Municipality of Cuddapah in carrying out a proper drainage scheme which it was believed would render the place less unhealthy - Vide the notes in G.O. No.2211, Judicial, dated 11th September 1894. The Sanitary Engineer was also requested in G.O. No.1337 M, dated 26th September 1894, to draw up a comprehensive scheme of drainage for the town as early as possible.

4. Not long after this, the Sanitary Commissioner (Dr. King) who inspected the town in August 1894, pointed out that the notoriously malarious condition of

Cuddapah

...Board, therefore exp...

Cuddapah was due to the existence of malarial germs in the soil, which was ever on the increase owing to the presence of the favouring agents viz., heat, organic matter and moisture, and that the chief factor in the propagation of malaria was the presence of moisture in the impregnated soil caused by the obstruction to the subsoil flow resulting from the water-logged condition of the soil within the area of the Patha Cuddapah tank, and he accordingly recommended

(1) that the Patha Cuddapah tank should be breached so completely as to offer no obstruction to surface drainage in all directions, and that the supply to the fields below should be effected by irrigation from the canal direct, the bed of the tank being effectually cultivated and if necessary, provided with subsoil drainage and

(2) that the Bugga anicut should be breached and the Bugga bed correctly trained, the old Bugga channel being left open or, if filled up, being supplied with subsoil drainage throughout its length before being so dealt with.

These recommendations of the Sanitary Commissioner were referred to the Sanitary Board with the request that it would go fully into the causes of the malarial fever in Cuddapah and suggest comprehensive measures for removing them as thoroughly and completely as possible.

5. The Sanitary Board was of opinion that the unhealthiness of Cuddapah was due to the prevalence in a very marked degree of the malarial fever, that the town site was contaminated with the active agent of malaria, the plasmodium malariæ, the propagation of which was greatly facilitated by the existence of heat, organic matter and moisture in the soil, the two latter conditions being caused by the numerous pervious cess-pools in existence throughout the town, into which, in the absence of a sewerage system, all the sullage water is discharged, and by obstruction to the overflow of subsoil water, and that the remedial measures should therefore take the direction of attempting to deprive the malarial germ of favourable environment, which could be secured by preventing undue accumulation of organic matter and inhibiting extensive disturbances of subsoil air and water. The Board accordingly made the following recommendations:-

(1) That the Patha Cuddapah tank
" by percolation and prevention of the free
" outfall of the subsoil water has the ef-
" fect of causing great fluctuation of the
" sub-soil water level and that the aban-
" donment of the tank is desirable; that
" this can be effected without loss of re-
" venue by carrying on the lately-constructed
" channel (which now fills the tank) along
" the sluices of the said tank, and the Board
" recommend that this be done; that the
" bund of the tank should be breached so
" that no obstruction should exist to the
" free outfall of surface drainage from the
" town; that the Public Works Department
" should be called upon to prepare the ne-
" cessary plans and estimates for submission
" to Government in order to carry out these
" objects.

(2)

Vide paras 5 to 14 of his inspection notes in f/o 182-M 7-2-95 N

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Vide f/o 1311-M 12-8-95 R

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Vide para 2 of f/o 182-M 7-2-95

R

(3) That it is desirable to afford means for carrying off the sub-soil water from under the town; that it is also desirable that the town should be drained and the existing sewage cess-pools which abound in the town removed, and therefore recommend that a scheme should be drawn up by the Sanitary Engineer to Government for these purposes; the Board consider that these two objects can best be attained by a pipe system of sewerage, under which trenches should be cut and filled with gravel through which the subsoil water will percolate, both the sewage and sub-soil water being carried to appropriate outlets. It is probable that pumping may be required, and the amount of pumping power to be provided for raising the sub-soil water may be taken for the purpose of an estimate as that necessary to raise the quantity of rainfall falling over double the town area, or, say, over five square miles; the sewage to be disposed of over a suitable area of land which will be underdrained and furnished with sewage filters beyond the present Patha Cuddapah tank. The bed of this tank, after its abolition as a tank, should be allotted for dry cultivation only.

(3) That, at present, the existence of the Dongal Cheruvu does not influence the rise and fall of the sub-soil water to such an extent as to render its abolition desirable, but that, at some future time, when the results of the works already proposed have been in operation for some time, it may be desirable to reconsider this opinion; the Board also consider that the execution of the sanctioned open drainage channel may, in the meantime, be delayed.

(4) That it is desirable to resection the bed of the Bugga river above the existing anicut, which should be removed, the channel from the anicut to the Patha Cuddapah tank being closed or used for a line of sewers as may be hereafter found necessary.

(5) That in view of the fact that the malarial germ is capable of being conveyed to the system of the human being both by air and water, it is advised that the existing public water-supply should be supplied with effective filter beds.

(6) That the design of these works, except those in regard to the extension of the channel to the Patha Cuddapah tank sluices, be entrusted to the Sanitary Engineer to Government."

6. The Sanitary Engineer was thereupon requested to prepare the estimates for the works specified in Nos. 2, 4 and 5 of the Sanitary Board's recommendations ~~referred to~~ in the preceding paragraph - Vide G.O. No. 1311 M, dated 13th August 1895.

7. With the first of the letters read above, the Sanitary Board forwarded the plans and estimates of a drainage scheme prepared by Mr. Jones, on the lines recommended by it in 1895. Mr. Jones stated that as from the sections taken along the bed of the Bugga river it did not appear that any material lowering of its bed could be effected, he made no proposals regarding the resectioning of the river bed, but that the anicut might be removed and

and that it might either be sold as it stands, the stones in it being valuable, or that the stones might be used in the construction of the drainage works. This point, however, he stated, might be left to the officer who would be in charge of the works when they were undertaken. Mr Jones observed that the town occupied a position on a plain almost surrounded by hills, about four to seven miles distant from it, the slope of the plain being from west to east towards the valley of the Pennar, that the borings, of which twenty-one were taken by him within the town showed that the description of the soil given by Dr. King in para. 2 of his Inspection notes recorded in G.O. No. 182 M, dated 7th February 1895 was incorrect, as there was no red gravel or blackish alluvial deposit and in fact nothing but clay below the ordinary surface mould until the Kunkur was reached, that the geological formation of the the soil was such that water could rise up or pass down through it to a very limited extent, that the clay was so thick and impermeable that it was only when the Kunkur or quartzite formation was reached that the water was tapped at all and that the rise or fall in the wells, had no connection whatever with the rise or fall of water in the subsoil, but was due entirely to the head of water in the lower strata passed through or into by the well. He therefore withdrew from the resolution of the Sanitary Board wherein it was stated that the Patha Cuddapah tank backed up the subsoil water, that he gave his assent to it for want of the information which had

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Vide para 9 of his report

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Vide para 11 of his report T

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Vide para 12 of his report V

then been obtained and which showed that the strata were anticlinical across the centre of the town, one portion sloping south to a line drawn east and west to the south of the jail, and the other portion sloping towards the Patha Cuddapah tank, that the water tapped in the subsoil was at such a level, viz. 8 to 12 feet below the ground level that the Patha Cuddapah tank could not influence it, that as the intervening strata were clayey, it was difficult, if not impossible, to imagine that there could be any connection whatever between the surface and the subsoil water as no water could rise through such thick and compact beds of clay and that therefore the dampness of soil, apart from surface water i.e., rainfall, could be but infinitesimally increased by the small amount of water found at depths of 8 to 12 feet below the surface. Mr. Jones further observed that although he had worked out the scheme on the basis of the Sanitary Board's recommendations, he did not believe that any scheme of subsoil drainage would have the slightest effect on the level of the subsoil water, as it was quite incorrect to base the rise and fall (of subsoil water on the rise and fall) in the wells, and that he could not recommend the execution of the scheme which he submitted, as it was not likely to affect, much less to determine the malarial conditions then existing. He added that the scheme should be looked upon as one simply for the removal of the ordinary sewage and a portion of the surface rainfall from the town, that even for these latter purposes the scheme would be ineffective,

Owing

owing
~~caring~~ to the sparse population per house and per unit of street and the limited amount of water supply, and that the cost of carrying out the work was incommensurate with any improvement in the sanitary condition of the town which was likely to result from it, as the mortality from fever would remain unaffected. He also pointed out that the majority of the houses in the town were of a very low class consisting of mere huts and such as would either generally be connected to a branch sewer by surface drains, or would be unable to construct house connections, if these were not provided for them, that the number of houses which would be individually connected to the sewers would be very few viz. about 1,900, that as the water supply of the town was capable of giving only ten gallons per head per diem, it was almost impossible to design sewers which would be self-cleansing, and that although it was proposed to lay the sewers at very good gradients and to have velocities, when full or half full, of from 2.317 to 3.12 feet per second, the flows from the population to be served would be simply dribbles at the bottom of the sewers with a hardly calculable velocity. Mr. Jones therefore considered that in the existing state of the water supply of the town, it would be most injudicious to adopt any underground drainage scheme and added that the main reason for preferring an underground system of drainage for Cuddapah, was the necessity for the

removal

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Vide para 13 of the report

-para 17 of the report W

para 16 of the report W

para 19 of the report W

para 20 of the report W

Vide para 24 of the report X

127

Vide paras 34 & 35 of the Report Y

removal of subsoil water ~~from~~ [illegible]

had already been shown, it was improbable that any system of subsoil drainage would be effectual because the subsoil water did not, and could not, rise towards the surface and any rainfall ~~falling~~ on the surface could not penetrate far below it and hence must run off quickly. He also stated that provision was made in the estimates submitted by him for filling with gravel the space over all sewers which were more than six feet below the ground level, but pointed out that the cuttings for the sewers when they were below water level, would undoubtedly open up a passage for the water to rise, but that the subsoil water would not rise if a bore or cutting were not made until it was reached, that therefore while the use of the gravel above the sewers would aid in taking off the subsoil water which the works would practically produce, and allow it to rise to

the

Madanapalle, Royachoti or elsewhere, could be erected. The Board therefore

owing
caring to the sp... ...
...surface perhaps, at times, yet if

the sewers were not constructed, the

water below would remain undisturbed,

that it was therefore a very important

point to consider whether the very

execution of the works would not tend

to increase the dampness of the soil,

at any rate in the vicinity of the

sewers, because the gravel could never

be dried even with extensive pump-

ing and the adjacent ground would

therefore be always damp and that

as a result of this, the malaria would

increase and the sewers would pro-

duce the very opposite effect to that

for which they were designed. Mr. Jones

therefore expressed the opinion that

the construction of the sewers would

be fraught with danger and that such a

work ought not to be lightly undertaken.

In para. 52 of his report on the subject,

he again observed as follows in regard

to this scheme:-

" It

Mr. Jones' remarks are made under con-

siderable misapprehension. He points out

... term " subsoil water"

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" It is a scheme which if the water supply
were sufficient would carry off effect-
ively the sewage of the population, but
under present circumstances the undersign-
ed cannot recommend its execution, nor
does he believe that any effective design
for the purpose can be prepared until the
water supply is much more ample than it
As to the scheme benefiting the health of
the people by rendering the subsoil drier,
the undersigned believes it will have the opposite ef-
fect and he does not believe that any sub
soil drainage scheme for a town standing
on a great depth of clayey soil is likely
to be effective in reducing the dampness
of the soil which must be caused by the
rainfall alone and does not penetrate into
the underlying clay, any more than the
water in the quartzite rocks and Cuddapah
slabs would rise up to the surface".

8. This scheme was estimated by the Sa-
Sanitary Engineer at Rs.540,000, or Rs.27
per head of the population, and he stated
that in Negapatam which was the only other
Mufassal town for which an underground sys-
tem of sewers was designed, the cost was
Rs.13 per head. The maintenance charges
which are put down at Rs.12,810, per annum,
will, if capitalized at 4 per cent, amount
to Rs.320,250 so that the total cost of
the scheme including the initial outlay
may be taken at 8½ lakhs, for this sum,
and the Sanitary Board was of opinion that all
the public buildings required, if the head
quarters of the District were removed to
Madanapalle, Royachoti or elsewhere, could
be erected. The Board there-

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168
Para. 53 of the report. U
Proceedings of the San. Board B²

owing to the sp... surface perhaps, at ..., yet if the sewers were ...

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the project, it was one which it was desirable to undertake and stated that it could not recommend the scheme as one designed to remedy the malarial character of Cuddapah.

9. As directed by the Honourable Member in his note dated 9th December 1897, the papers were referred to the Sanitary Commissioner for remarks. With the second letter read above, Dr: King forwards a memorandum in which he refutes the several arguments adduced by Mr: Jones against the introduction of a subsoil drainage scheme. He states that the description of the soil of Cuddapah given in his inspection notes of 1895, to which exception is taken by the Sanitary Engineer, was based on an inspection of well-cuttings, that the absence of gravel in the soil examined by Mr: Jones is due to his borings having been made almost entirely by the side of the Bugga, and that with this exception he does not see that his description of the soil departs meterially from its character as described by Mr Jones. He states that when he recommended in the inspection Notes that the Bugga bed should be correctly trained, he did not contemplate that the whole bed of the Bugga river should be lowered as supposed by the Sanitary Engineer, but only meant that the obstructions along its bed should be removed __ a measure which would not necessarily involve a departure from its present gradients. In regard to the borings made by the Sanitary Engineer, Dr.King states that they are ill suited for exhibiting the state of the town site, as not a single boring is to be found within the inhabited area, that they follow chiefly the line of the Bugga, having been made pri-

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C.No. 19551A.

Vide para 2 of C.No. 19551A.

Para 3 of C.No. 19551A.

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15.

Mr. Jones' remarks are made under considerable misapprehension. He points out that the use of the term " subsoil water" both by Mr: Jones and by the Sanitary Board is absolutely misleading, that subsoil water, as usually understood, is that water which is supported by the first not readily permeable layer, while the water which Mr. Jones constantly alludes to as "subsoil water" is "subterranean" or "deep-seated water". Referring to the Sanitary Engineer's statement that " the rainwater falling on the surface cannot penetrate far below and hence must run off quickly", the Sanitary Commissioner observes that rain passing through subsoil till arrested by a stratum not readily permeable would be "subsoil water" whether it flowed off quickly or not, that it is not understood on what data Mr. Jones concluded that subsoil water flows off "quickly", that not a drop of rainfall penetrates the soil that has not to undergo the opposition to its entrance of friction caused by the particles of earth between which it penetrates, that under fair conditions for its flow towards a natural outlet, the rate of the flow is about 15 feet per day, that if the gradient is very marked the flow will be more rapid, and that to dispose of the question of subsoil water by imagining that it will flow off as if from the roof of a house, because it happens to be supported by a stratum of clay, is not tenable. He adds that Mr. Jones' borings reveal that in Cuddapah a pervious soil stands upon a stratum of clay, that this stratum must support all rainfall penetrating the soil, or in other words "ground water"

or"subsoil water", that below the clay is water under pressure derived presumably from a foreign area, that clay is highly retentive of water, even if it is not readily permeable, and that by capillary attraction the subsoil would be rendered damp, so long as the level of the springs below the clay is high. He states that he is not singular in considering that moisture is retained in the soil of Cuddapah, as Mr.Jones himself has, in his report embodied in G.O. No. 869 Rev: 13-9-91, expressed the same opinion, that there is nothing in Mr. Jones' present borings to upset the theory that the partly visible Bugga springs enter the soil above the town and thus add to the moisture and the subsoil water due to that whether there be water from a"foreign area" above the clay stratum or not, the fact remains that the clay which will absorb water to the extent of 51 to 66 per cent of its volume, will in consideration of its small depth from the surface suffice to keep the soil damp by capillarity, so much so that many of the houses in Cuddapah at his inspection were found to be exceedingly damp both as to the walls and floors. With regard to the statement of Mr.Jones that the Pathar Cuddapah tank does not back up the subsoil water from the town, he states that the confusion as to what is "subsoil water" has again influenced Mr. Jones' opinion, and that the borings made by Mr.Jones do not point to that result . He therefore states that he sees no reason whatever to change his views and observes that Mr. Jones' dread, that by tapping the clay a worse condition might be secured is not consistent with the known effects of tapping clay substrata for agricultural purposes under exactly the same conditions. Turning to the Sanitary Engineer's Scheme, Dr. King

Dr. King remarks that the open drainage scheme advocated by Mr.Jones and which to date disfigures Madras is absolutely unfit to fulfil sanitary requirements in proportion to expenditure upon it, that this is a worn out subject on which he does not like to weary Government with a repitition, that the fact that Madras is now going to have an underground sewerage system suffices to show that the principle has been acknowledged in this Presidency, that not only do open drainage schemes not fulfil sanitary requirements, but that they are also far from economical in respect to sludge disposal and night soil conservancy, and that if Cuddapah is to have a sewerage scheme it should certainly be an underground one. If an underground scheme is to be carried out, he asks why advantage should not be taken of it to have also a subsoil drainage system. He admits that this question has to be answered simply on the score of expense, but observes that it is worth while ascertaining whether the Sanitary Engineer cannot excogitate a cheaper scheme. He enquires whether considering that the town has according to Mr. Jones a slope of about 1 in 400 towards the Pennar valley, it could not have been possible to find a point of discharge further down the valley and thus entirely dispense with all necessity for pumping, whether it is absolutely necessary to adopt what is practically a low level scheme by running the intercepting sewer along the Bugga channel, and whether other main lines could not have been taken up that would have economised the head available, and states that if the head be thus economised, at least the engine lift would

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would prove less expensive. If the borings reveal subterranean water below the clay stratum, and if by capillarity, by faults and by openings already made through it by wells, the soil is rendered more damp, he suggests that it may be cut off at some point above the town by sinking wells filled with stones and allowing it to appear in a channel. If however, it be impossible to secure a point of discharge by gravitation, by extending the outlet sewer to a point further removed towards the Pennar, and a pumping scheme is essential, he suggests the desirability of employing the Shone pneumatic system, as it can then be arranged to receive at certain points and at varying levels, both subsoil water and subterranean water and thus supplement the flushing powers, and states that this utilization of subsoil or subterranean water would effectually get rid of Mr Jones' objection to underground system of drainage on the ground that the water works of the town supply only 10 gallons per head. He further considers that a comparative estimate should be made of the cost of using ordinary tile drains and gravel for conveying subsoil water that whilst concrete may be advisable for foundation for the house drains up to junctions with sewers, this may not be necessary for the main sewers to be laid with clay, and that if the sinking of pipes be feared, at least the use of special jointed pipes such as Stanford's or Doulton's may overcome the difficulty. He points out that although the

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expensive scheme for sewerage by the pipe system and advises the adoption of the "Open-drain" system, yet he (the Sanitary Engineer) has given no idea of the cost of the latter scheme and believes that if an "open drain" scheme, which covers exactly the same area and streets and which allows for all improvements for altering levels of streets and lines of houses, be worked out, it is very unlikely that a saving can be shown. He therefore adheres to the view already expressed by him that the subsoil of Cuddapah requires being freed of moisture, and states that the borings simply show that there is more scope for working out a suitable scheme by the Sanitary Engineer. He adds that there has been ample proof that failure of monsoons and an unusually dry soil means both for the District and the town of Cuddapah immediately improved health and that it is in the power of the Sanitary Engineer to evolve a scheme that will artificially produce the same result.

11. It will be seem from the above that while Mr. Jones raises all possible difficulties in adopting a scheme of underground drainage for Cuddapah, Dr. King prefers that system to one of open drainage. As regards the scheme submitted by Mr. Jones for the drainage of Cuddapah, the Sanitary Board states that it cannot recommend it as one designed to remedy the malarial character of Cuddapah. It is therefore submitted that the remarks of the Sanitary Commissioner may be referred to the Sanitary Board for consideration and report whether a cheaper scheme can not

Cannot be designed for Cuddapah.

21

P.R
28/10/98

H.M.
I think the San.y Bd
shd have its say on
Dr. King's report.
H.T.
31.10.98

Yes - Dr. K. seems one right -
Subsoil drainage is well known & simple
seems one the exact thing for Cuddapah -
But this is the way.

BD
1/11/98

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[25]
250—7-4-97.

LOCAL AND MUNICIPAL DEPARTMENT.

C. No. 3149-M. of 1897

SUBJECT.

Cuddapah Drainage Scheme.

FOR ORDERS.

Apparently the Sanr. Comr. has not seen this. Let it be sent for his remarks

BD
9/12/97

C.

D

Vide clauses (iii) & (iv) of para. 9 of the inspection note.

In his notes on the inspection of the Cuddapah municipality, embodied in G.O. No 313-M, dated 5th March 1891, the Sanitary Commissioner (Dr. Laing) pointed out that Cuddapah had been noted for its heat and unhealthiness, and that the inhabitants suffered from fever and affections traceable to the effects of dampness of the soil, which was water-logged owing to the defective drainage of the town and the existence of the Dongal Cheruvu tank above it, and he accordingly recommended that the Dongal Cheruvu tank and the supply channel of the Patha Cuddapah tank should be closed. The Government thereupon called on the municipal council to report what steps it proposed to take regarding the closure of the Dongal Cheruvu tank

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Cannot

RB 25/10/95

rud of the supply channel of the Patta Cuddapah tank – vide G.O. No 313. M. dated 5th March 1891. The Collector however pointed out that the closure of the Dongal cheruvu tank was not within the province of the municipal council as the tank was under the control of the Public Works Department; but in order to carry out the desire of Government and to render Cuddapah more fit for human habitation, he agreed with the Sanitary Commissioner in recommending the abandonment of the Dongal cheruvu tank and of the wet cultivation in its bed. Before, however, coming to any decision on the question of abandoning this tank, the Government called upon the Sanitary Engineer (Mr. Jones) to inspect the locality and to report on the best method of treating the tank and the wet cultivation under it and as to whether a system of drainage would not be likely to provide an effectual remedy for the water-logging of the sub-soil to which the prevalence of fevers at Cuddapah was attributed, at

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vide his letter in G.O. 2723-2. 4-5-91.

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F.

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vide G.O. No 2723. Revr. 4-5-91. in G.O. 1876. M. 29-10-91.

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Vide para 10 of his letter in G.O. 2150 1876 M. 29-10-91.

G.

far less cost than the abandonment of the tank, which would result in a considerable loss of revenue. In reporting on this subject, the Sanitary Engineer stated that the level of the sub-soil water in Cuddapah was not affected by the presence of the Dongal Cheruvu above the town, that it had not been shown that irrigation per se had a deleterious effect on the health of the people, and that the porosity of the soil and the position of the strata had much more influence on the subsoil water level than the mere quantity of water distributed over the surface, and he accordingly recommended, among other

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things, that for the improvement of the sanitation of the town a drainage channel six feet wide at bottom, thirty feet wide at top and eight feet deep should be

excavated to the east of the town in order.

(1) to carry off, as much as possible, the subsoil water rising much above summer level.

(2) to receive and carry off the surplus water for the irrigation which might be permitted to the east of the Channel and

(3) to carry off rain fall from that portion of the town which slopes towards this Channel and which would otherwise find its way into the soil.

2. In G.O. No. 1086-M, dated 24th June 1892, the Sanitary Engineer was requested to make arrangements for the preparation of plans and estimates for this work and Mr. Jones accordingly submitted in the following November an estimate amounting to Rs 19,210, which was approved by the Chief Engineer Public

vide his report H

123.2. 52-91.

Public Works Department and was sanctioned in G.O. No. 127. M, dated 30th January 1893; but as there was some delay in allotting the requisite funds, the work was not undertaken immediately.

3. In the meantime, the question of removing the Head Quarters of the Cuddapah Jail was raised in connection with the closure of the Cuddapah Jail. It was, however, then decided not to reopen that question of Cuddapah but to help the town to carry out a proper drainage scheme- vide the notes in G.O. No. 2211 Judicial, dated 11th September 1894. The Sanitary Engineer was accordingly requested in G.O. No. 1337. M, dated 26th September 1894, to draw up a comprehensive scheme of drainage for the town as early as possible. Not long after, the Sanitary Commissioner (Dr. Kuig)

Vide fo. no 516 M. K 23-4-94.

on account of its notorious unhealthiness & the Consequent excessive mortality among the prisoners in that jail.

who inspected the town in August 1894, pointed out that the notoriously malarious condition of Cuddapah was due to the existence of malarial germs in the soil, which was ever on the increase owing to the presence of the favouring agents. viz heat, organic matter and moisture, and that the chief factor in the propagation of malaria, was the presence of moisture in the impregnated soil caused by the obstruction to the subsoil flow by the water-logged condition of the soil within the area of the Patha Cuddapah tank and he accordingly recommended —

(1) that the Patha Cuddapah tank be breached so completely as to offer no obstruction to surface drainage in all directions and that the supply of the fields below be effected by irrigation from the Canal direct, the bed of the tank being effectually

vide paras 5 to 14 of this inspection notes in G.O. 182. Rv. dy 7th February 1895.

2723. R. 4-12-91.

15 287

cultivated and [illegible] provided with subsoil drainage

(2) that the Bugga anicut should be breached and the Bugga bed correctly trained, the old Bugga Channel being left open or if filled being supplied with subsoil drainage throughout its length before being dealt with.

These remarks of the Sanitary Commissioner were referred to the then Sanitary Board, with the request that it will go fully into the causes of the malarial fever in Cuddapah and suggest comprehensive measures for removing them as thoroughly and completely as may be possible.

Vide para 2 of G.O. No. 182 Rv. 7-2-95 P

R. That Board was of opinion that the unhealthiness of Cuddapah was due to the prevalence in a very marked degree of malarial fever, that the townsite was contaminated with the active agent of malaria, namely, the

29

vide. G.O. No 1311. M. 12-8-1895.

2723. R. 4-12-91.

plasmodium malaria, the propa-

oko inspegation of which was greatly faci-

1894, pointitated by the existence of heat,

ly malar organic matter in the soil and moisture, the

was due two latter conditions being caused

germs in by the numerous pervious cesspools

the incrin existence throughout the town into which in the absence of a sewerage system, all the

of the sand by the obstruction to the over- sullage water is discharged.

organic flow of subsoil water, that the

that the existence of the Dongal cheruvu

gation does not influence the rise and fall

of moi of the subsoil water to such an ex-

soil co tent as to render its abolition desi-

the sa sirable, that the execution of the

conditi sanctioned open drainage channel

of the may be deferred and that the

he acc remedial measures should ~~thus~~

(1) t "take the direction of prevent-

e bree "ing undue accumulation of organic

o obs "matter and inhibiting extensive dis-

all "turbances of subsoil air and water."

the The Sanitary Board therefore re-

ige commended among other things

bec

that the remedial measures should therefore take the direction of attempting to deprive the malarial germs of favourable environment, which could be secured by preventing undue accumulation of organic matter & inhibiting extensive disturbances of subsoil air & water.)

(1) that the Patka Addapah tank should be abandoned, the bund of the tank being breached, so that no obstruction should exist to the free outfall of surface drainage from the town and that the Public Works Department should be called upon to prepare plans and estimates for these works.

(2) that as it was desirable to carry off the subsoil water from under the town, to provide for the drainage of the town generally and to remove the existing sewage cesspools which abounded in the town, the Sanitary Engineer should be called upon to prepare a scheme of the drainage of the town, which should provide for a pipe system of sewage under which trenches should be cut and filled with gravel through which the subsoil water will percolate, both the

sewage

plasmodium malaria t...

sewage and the subsoil water being carried to appropriate outlets.

(3) that the bed of the Bugga river above the existing anicut should be resectioned and the anicut removed and

(4) that the existing water-works should be supplied with effective filter beds.

4. With its Proceedings read above, the Sanitary Board now forwards the plans and estimates of a drainage scheme prepared by Mr. Jones on the lines recommended by the Board in 1895. The cost of the scheme is estimated at Rs. 5,40,000. The Sanitary Engineer, however, states that as from the sections taken along the bed of the Bugga river, it does not appear that any material lowering of its bed can be effected, he has not made any proposals regarding the resectioning of the

Vide para. 8 of his report. S.

Clo. 3149.M.

17 32 11

Vide para. 11 of the report. T.

river bed. As regards the drainage scheme, he states that considering the geological formation of Cuddapah it is not possible that the Pathacuddapah tank can have any influence on the subsoil water, that it is quite incorrect to base the rise and fall of the subsoil water on the rise and fall in the wells, that the scheme he has prepared is not likely to affect, and much less determine, the malarial conditions at present existing, and that "the

Vide para. 13 of the report.

"scheme will be ineffective, though "designed to the best of his ability, "to meet the existing circumstances "of the town, owing to the sparse po- "pulation per house and per unit "of sheet and the limited amount "of water-supply," and he concludes with the following remarks:—

Vide para. 52 of the report. U.

"It is a scheme which if the water- "supply were sufficient, would

plasmo

12

carry off effectively the sewage of
the the population, but under present
undersigned
circumstances the, cannot recom-
mend its execution, nor does he
believe that any effective design
for the purpose can be prepared
until the water-supply is much more
ample than it is. As to the scheme
benefiting the health of the people
by rendering the subsoil drier, the undersigned
believes it will have the opposite
effect and he does not believe that
any subsoil drainage scheme for
a town standing on a great depth
of clayey soil is likely to be effective
in reducing the dampness of the soil
which must be caused by rainfall
alone and does not penetrate into
the underlying clay." The Sanitary
Engineer therefore says that the
scheme must be looked at as
one simply for the removal of
the ordinary sewage and a portion

Vide para. 12 of his report. V.

of the surface rainfall from the
town, that the large expenditure
involved in its execution cannot
therefore well be justified, more es-
pecially as the heavy deathrate
from fever is not likely to be dimi-
nished by carrying it out. The main-
tenance charges amounting to Rs 12,810
per annum, will, if capitalized at
4 per cent, amount to Rs 320,250
So that
the total cost of the scheme
including the initial outlay of
Rs 5,40,000 may be taken at
8½ lakhs. For this sum, the Sanitary
Board thinks that all the public
buildings required, if the head
quarters of the District were removed
to Madanapalle, Royachoti or else-
where, could be erected. The Sanitary
Board also doubts whether, looking
to the costliness of the works and
the inefficiency of the scheme, the
project is one which it is desirable

Vide para. 6 of the Sanitary Bd's Resolution.

14

35

Vide para 7 & 8 of the Sanitary Bd's Resolution.

ary to undertake and states that it
e cannot recommend the scheme
ian as one designed to remedy the
end malarial character of Cuddapah.
el In these circumstances, there seems
or to be no alternative but to abandon
ati this scheme. The Sanitary Board may
mp however be asked to suggest any
hen other measures for improving the
y sanitation of the town at a
el comparatively less cost.

Yes - a cheap scheme on the lines of ordinary town SR

V.R
12/11/97

H.O.

The San. Engineer San. Board fully explains the futility of the scheme as designed to improve the health of the town by affecting the subsoil drainage. As a scheme for removing the ordinary sewage its expense wd be quite out of proportion to the benefits that might accrue & moreover its cost so far

36

beyond municipal resources.

If Cuddapah cannot be saved from being a death trap by this & any similar scheme, it is for the Public Dept to consider whether it shd be retained as the Hdqrs of the district.

SR
3/12/97

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20 37

Local & Munl. (1897) Department.

CURRENT No. 3149.M

OFFICE OF SANITARY COMMISSIONER WITH THE GOVERNMENT OF MADRAS
No. 4237/S
14 DEC 97

TO BE RETURNED WITH REPLY.

No. 1298 dy 13-12-97
~~Order~~

From The Secretary
Sanitary Board

Referred to the Sanitary Commissioner for remarks.

No. 620-S.

H. Tremenheere
Secretary to Govt.

Dated 3-9-1897
Received 3-9-1897
Registered
Enclosures 3. (one book containing 18 plans)
Spare copies. (1 counterfoil of plans, 2 diagrams & 1 section of boring)

Plans & Estimates sent with No. 550 dt 10-4-98

V.R. 11/12/97

To
The Sanitary Commissioner.
(with plans & estimate, if returned)

SUBJECT.

Cuddapah Drainage Scheme

Submitting, with remarks, report, plans and estimates of the —— prepared by the Sanitary Engineer.

8

BACK PAPERS

G.O.	No.	Department.	Date.

FURTHER PAPERS.

G.O.	No.	Department.	Date.

21 38

Report accompanying designs and estimates for the drainage of Cuddapah.

The town of Cuddapah has long been known as one highly malarious. In 1894 the Sanitary Commissioner , in his inspection notes embodied in G.O. No. 182 M. dated 7th.February 1895 shewed that , during the four years ending 1894, the deaths from Fevers ranged between 67.9 and 45.8 per cent and that probably not less than half the population suffered from the influence of malaria. Government in its order above referred to ordered the Sanitary Commissioner's notes (paras 5 to 14) to be referred to the Sanitary Board which was requested to go fully into the causes of the malarial fever in Cuddapah and to suggest comprehensive measures for removing them as thoroughly & completely as might be possible. The Sanitary Board met on the 15th. June 1895 and discussed the matter and reported to Government. This report will be found embodied in G.O.No. 1311. M. dated the 12th. August 1895.

2. The first recommendation of the Board was in reference to the breaching of the Patha Cuddapah tank & the substitution of a channel for which the P.W. Dept was requested to prepare plans & estimates. The Undersigned is not aware whether action has been taken or not in regard to this point but, it is believed, that the tank is still unbreached.

3. The second recommendation was that a scheme of drainage should be prepared by the Sanitary Engineer on principles enunciated by the Board. It is to this scheme, which has now been completed, that this report mainly has reference.

4. The third conclusion of the Board was that the Dongal Cheruvu tank need not be interfered with at present.

5. The fourth recommendation was that the bed of the Gurr-Booga river should be resectioned and the anicut removed.

6. It does not appear from the sections taken along the river bed that any material lowering of the bed can be effected & no proposals in this respect are made in this report.

to

to the anicut the best method of removal will be either to sell it as it stands for removal (the stone in it is valuable) or to use the stone in the construction of the drainage works. This point may be left to the Officer who will be in charge of the Drainage Works if they are undertaken.

7. The time which has elapsed between the receipt of G.O. No. 1311.M, dated 12th. August 1895 and this date has been taken up as follows:-

The G.O. was received on 5-9-95

Sanction for staff was asked for on 26-9-95

Sanction for staff was received on 19-10-95

Staff was appointed on 28-10-95

Additional staff was asked for on 10-2-96

Additional staff was sanctioned on 26-2-96

The surveys begun on 28th.October 1895 were supposed to be completed on 30th. June 1896 but the Undersigned found after sometime that the Chief Surveyor had left portions incomplete and staff had again to be sent to Cuddapah on 9th. July 1896 and the full information required for the scheme was not available until 30th. November 1896. Even now the undersigned regrets to say that the information available is not quite satisfactory and it has been found that the system of employing temporary surveyors is one that gives anything but satisfactory results; in fact there has been considerable trouble and delay caused by the inefficient work turned out, the errors in which were not discovered until making out the design and after the surveyors had been relieved of their duties. Since the date on which the information required was fairly complete the time has been occupied in working out the scheme, a scheme, which, needless to say, is one of much detail and has required considerable thought and labor.

There ought to have been closer supervision over their work G.H.

8. Before describing the proposed scheme it is desirable to give a few statistics which have been collected during the preparation of the scheme.

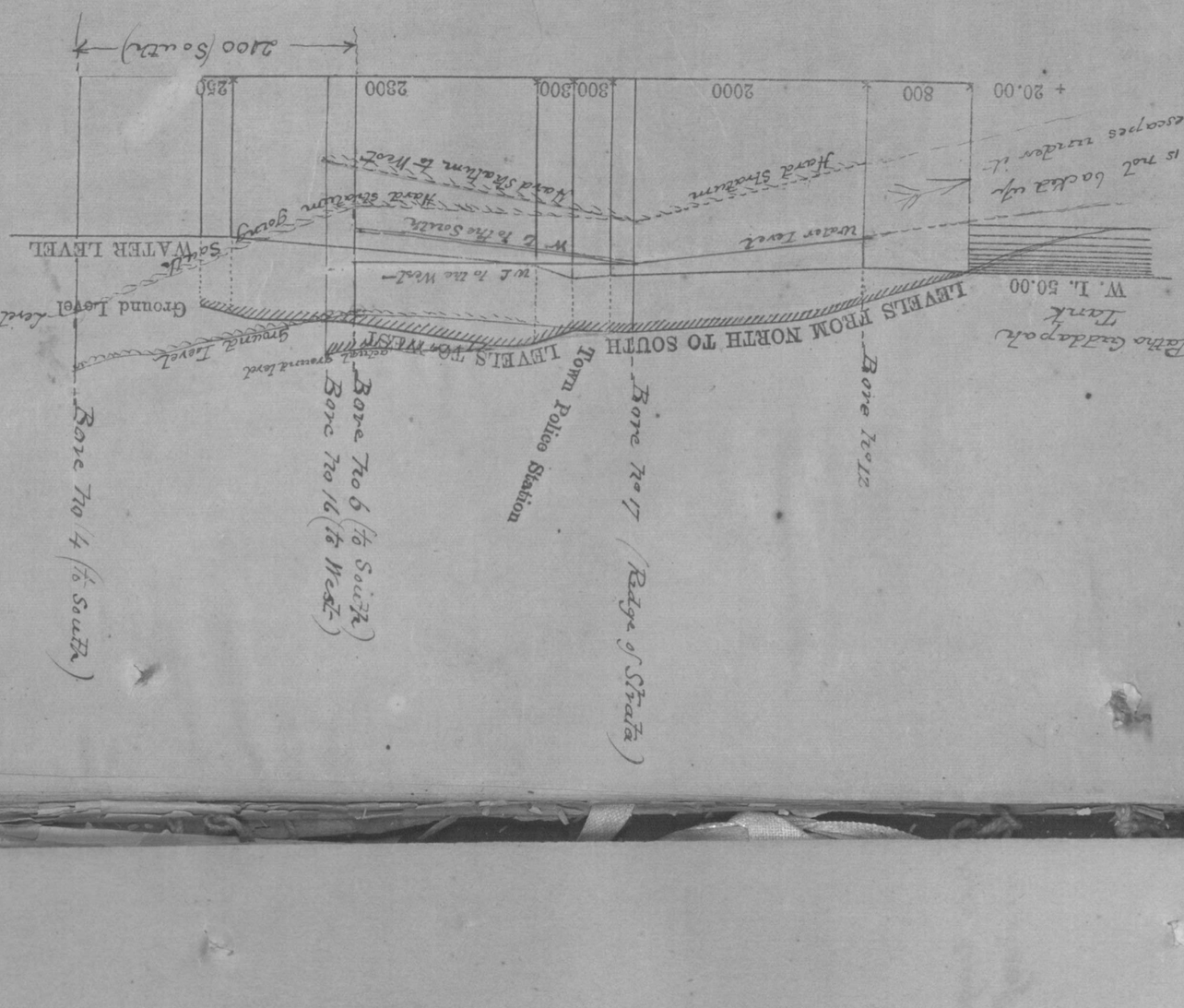
9. The town occupies a position on a plain almost surrounded by hills and about four to seven miles distant from them . The slope of the plain is from west to east towards the Valley of the Pennar.

10. Twenty one borings were taken within the town area. These are shewn on one sheet ~~at the end of~~ accompanying this report and the position of each boring will be found marked on the general plans. These borings shew that the description Given by Dr. King in para 2 of his notes already referred to is incorrect, because there is no red gravel and no blackish alluvial deposit , there being little else below the ordinary surface mould but clay until the kunkur is reached. Some of the clay is exceedingly compact and shaley.

11. The actual geological formation must be carefully considered in relation to the suitability or otherwise of the scheme. As will be seen the formation is such that water can rise up or pass down through it to a very limited extent. The clay is of such thickness and of such an impermeable description that it is only when borings are made and the kunkur or quartzite formation reached that water is tapped at all except in a few places where a thin sandy stratum yields some water; the undersigned therefore believes that the rise and fall in the wells has no connection whatever with the rise and fall of water in the subsoil and that such rise and fall is due entirely to the head of water in the lower strata passed through or into by the well. The undersigned feels therefore that he must now withdraw from his agreement with the proceedings of the Sanitary Board (to which he gave assent because of the want of information now obtained) that the Patha Cuddapah tank backs up the subsoil water because the real facts of the case are that the strata* are anticlinal across the centre of the town, one portion sloping south to a line drawn east and west to the south of the Jail the other portion of the strata sloping towards the Patha Cuddapah tank and the water tapped in the subsoil is at such a level that the Patha Cuddapah tank cannot influence it. The subsoil water tapped is usually 8 to 12 feet below the ground level. The intervening strata are clays and it is difficult, if not impossible, to imagine that there can be any connection whatever between the surface and the subsoil water. From these considerations though the undersigned has worked out the scheme on the basis of the Sanitary Boards recommendations he does not believe that any

vide diagrams enclosed

scheme


Bathe Gadaapoli Tank
W. L. 50.00
LEVELS FROM NORTH TO SOUTH
LEVELS FROM WEST
Ground Level
Ground Level
Bore No 4 (to South)
Bore No 6 (to South)
Bore No 16 (to West)
Town Police Station
Bore No 17 (Ridge of Strata)
Bore No 12
Ground Level of Mand (no water
Sand
WATER LEVEL
Ground
W. L to the South
W. L to the West
Mand Station
Mand Station
Mand Station to Mhow
Water Level
+ 20.00
800
2000
300
300
2300
250
2100 (South)
Scale { Horizontal 1/10000 ; Vertical 1/200
Note – The portions of the Mandrem & Block are by Dr King & the Red & White lines are dykes
by Jennings & Steen that the flow from Mest & Sandy has NOT its natural outlet
to the Pathe Gadaapoli Tank – hence Dugwan Road for detection of flow
Litho, Survey Office, Madras.
1895
Reg. No. 1814–Copies 85
Note – This water is not located
by Tank but escapes westerly

42 43 26

25

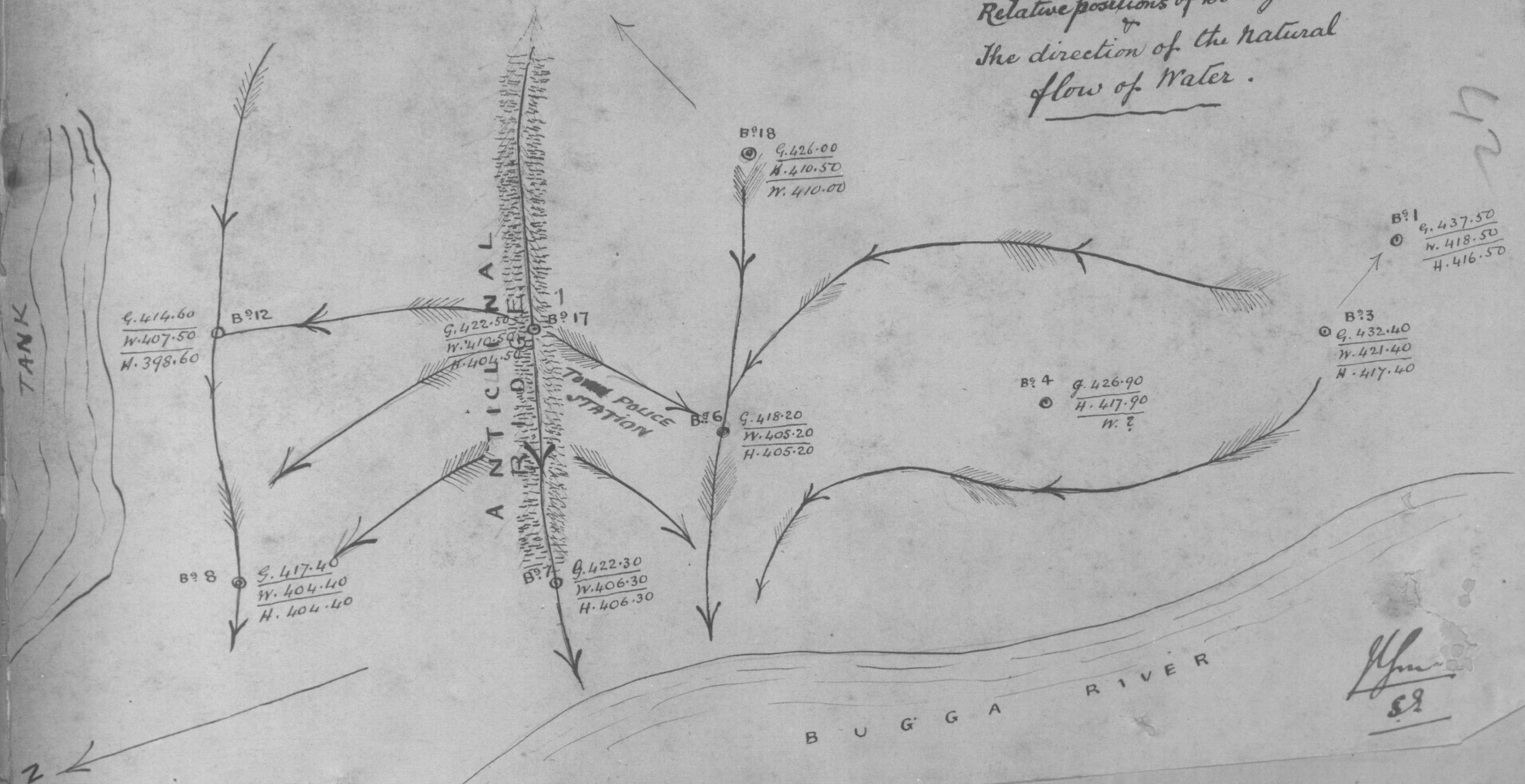
4/S.C441of97

5/S.C441of97

DIAGRAM No 2

Cuddapah Drainage.

Sketch Plan Shewing Relative positions of Borings & The direction of the natural flow of Water.



Sd

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scheme of subsoil drainage will have the slightest effect on the level of the subsoil water & as already pointed out it is quite incorrect to base the rise & fall of the subsoil water on the rise and fall in the wells. No water will rise through such thick and compact beds of clay and the dampness of soil apart from surface water, i.e., the rainfall, can be but infinitesimally increased by the small amount of water found at depths of 8 to 12 feet below the surface. Hence the Undersigned feels that he cannot recommend the carrying out of the scheme he has prepared as it is not likely to effect and much less determine the malarial conditions at present existing.

12. The scheme must therefore be looked on simply for the removal of the ordinary sewage and a portion of the surface rainfall from the Cuddapah town area. Though it has been designed to meet as far as possible these requirements, for many reasons which the undersigned will point out he does not think that even for this purpose it will be effective and the expense involved is such as he believes would not be justified by any improvement which is likely to result by its execution for, [illegible] fevers eliminated from the death causes of the population, (and believing as he does that the carrying out of the scheme would not affect this cause of mortality in the slightest degree), the death rate of Cuddapah would be a satisfactory one.

13. The reasons why the Sanitary Engineer thinks the scheme will be ineffective though designed to the best of his ability, to meet the circumstances of the town are to be found in the sparse population per house and per unit of street and the limited amount of the water supply.

14. The scheme as designed will affect the following villages &c., forming the town:-

	Acreage.	Population.	No. of houses
Yenumpally	13.64	735	327
Nagarayapet	56. 34	3813	1073
Town proper	202.16	9408	2989
Moochampett	138.20	3115	940
Total.....	400	17,131	5,329

.625 sq. miles

Thus,

Thus the average per acre is only 45 people and per house a fraction over 5 persons and this proportion , it will be observed, is fairly maintained in each of the above mentioned divisions.

15. As designed there will be

Branch Sewers	Total Length	75,470
Surface Drains ..... / 2	"	22,870
		98,340

16. Many of the so-called houses included in the Census figures are in reality but small huts composing parcherries. It has been a difficult matter to arrive at the actual number of houses which will drain directly to the sewers. While the census figures shew the houses to be 5,289 in number the house assessment registers shew the number of 2,502 and even some of this lesser number are very small houses; on a consideration of the low taxation on some of these houses and the fact that a number of the houses say 600 will be connected directly to surface drains, the number of houses which will be individually connected to the sewers has been estimated at about 1900 .

This is because of the difference in the mode of assessment adopted for Municipal purposes.

17. The difference of the two figures 5,289 and 2,502 represents blocks of huts or parcherries and these will generally be connected to a branch sewer by surface drains. This shews that a large majority of the houses of the town is of a very low class and such as would be unable to afford house connections if these are not provided for them.

18. The water supply of Cuddapah is capable of supplying 10 gallons per head per diem. It was obviously necessary to design a system of sewers which would carry off considerably more than this, though the system whether designed for 10 gallons or 15 gallons does not matter to any great extent from a financial point of view as nothing less than 6" pipe sewers can be used.

19. But the question of the water supply affects the drainage question in this way that it renders it almost impossible to design sewers which will be self cleansing.

20. To illustrate this difficulty the following examples are given and it will be seen that though the sewers are proposed to be laid at very good gradients & to have velocitie

when

when flowing full or half full of from 2.517 to 5. 12 feet per second, the flows from the population to be served will simply be dribbles at the bottom of the sewers with a hardly calculable velocity.

21. The calculations following are based on these figures.

4 persons per house (average is little over 5)

10 gallons per head per diem (half flowing in six hours)

A length of 40 feet of street per house determined thus-

$$\frac{\text{Length of Branch Sewers}}{\text{No. of Houses}} = \frac{75470}{1900} = 40 \text{ feet per house.}$$

Example.I

Yedala Vencatachellun street

B.S. $\frac{15}{D}$ on plan- Surface Drain $\frac{\text{B.S.15}}{d}$ $\frac{\text{Grade}}{\frac{1}{162}}$

Sewers & Street ----------1600 feet long

Surface Drains flowing to sewer---------- $\frac{2550}{2}$ = 1175 "

2775 feet

This figure is also the flow per 12 hours because

$$\frac{2775 \times 4 \times 10}{40} = 2775 \text{ gallons per 12 hours.}$$

2775 gallons per 12 hours = 5.854 gls per minute

= .0642 gls per second

= .010272 c.ft

A 6" pipe at a grade of 160 (which is nearly the same grade) when full carries 0.5425 c.ft per second with a velocity of 2.76 feet per second , so that the flow is only $\frac{1}{54}$ of the capacity of the pipe equal to a depth of $\frac{3}{4}$ of an inch & a velocity of 1.4 feet per second.

Example.II. Gaddy Bazaar Street ---------- Grade $\frac{1}{122}$

B.S. No. 11 on plan ------1970 feet

B.S. on (B.S. No.11)---- 2780

S. Drain on B.S.No.11

flowing to sewers--- $\frac{1560}{2}$ = 780

5530

This

This figure 5530 as already shewn represents 5530 gls in 12 hours

" 7.68 gls per minute

.128 gls per second

.02048 c.ft. "

A 6" sewer falling $\frac{1}{120}$ or nearly the same grade and flowing full has a velocity of 3.127 feet per second and carries .6305 c.ft per second so that the sewer in this case has a discharge at maximum flow of only $\frac{2}{63}$ or $\frac{1}{31}$ of its capacity equal to ¾" in depth with a velocity of 1.62 feet per second.

22. Take finally Bellary Road- one of the most favourable examples- into which many branch sewers discharge and dealing with it similarly , it is found that it will carry as maxima on its various portions between one branch sewer junction and another as follows:-

				Depth of flow.	Velocity per sec.
(1)	.07998 c.ft	per second	$\frac{7}{45}$ of capacity-	1¾	1.80
(2)	.09075	"	$\frac{9}{45}$ "	1¾	1.80
(3)	. 10689	"	$\frac{10}{45}$ ..	2	1.92
(4)	.15945	..	$\frac{15}{45}$ ..	2½	2.04

It has a fall of $\frac{1}{225}$ and will discharge when full 0.4535 c.ft per second with a velocity of 2.517 feet per second so that the following proportions of its capacity in use are obtained:- $\frac{7}{45}$; $\frac{9}{45}$; $\frac{10}{45}$; $\frac{15}{45}$; this latter figure is $\frac{1}{3}$ and this is probably the most favorable result in the whole scheme.

23. The velocities of the flow, it will be observed, are ordinarily extremely small and it may therefore be asked why not increase the slope of the sewers. A reference to the plans will shew that the sewers have very good gradients as a rule and that the main intercepting sewer even now is at a great depth and will be extremely expensive and hence pumping will also be expensive. Again if the sewers were given greater grades the result would be a very much decreased depth of flow & hydraulic mean depth and the advantage gained in one way would be lost in another while the velocities would be hardly perceptibly increased.

24. Thus the undersigned thinks, after giving the subject a good deal of consideration, that under the present circumstances of the water supply in Cuddapah it would be most injudicious to adopt any under drainage scheme. The design accompanying, if sufficient water could be supplied, would be suitable and sufficient for the needs of Cuddapah as regards the disposal of sewage. The main reason however for the desire for an underground system has been the subsoil drainage of Cuddapah and as the undersigned has already shewn that it is improbable that any system of subsoil drainage will be effectual because the subsoil water does not and cannot rise towards the surface and any rainfall falling on the surface cannot penetrate far below it and hence must run off quickly. Hence the scheme will not remove malarial conditions nor is it believed that any scheme of this nature ever will do so. Whether the other members of the late Sanitary Board would have arrived at this opinion it is impossible to say but the very strong reasons adduced should have considerable force in requiring a reconsideration of the views formerly expressed, which after the investigation and a consideration of the actual facts the undersigned has been obliged to withdraw from.

25. The scheme drawn up will now be described. As already stated the population of Cuddapah consists of 17,121 persons living in 5,289 houses (Census figures) distributed over an area of about .625 of a square mile or 400 acres; thus the average per acre is only 43 and in each house on an average there are (a fraction over) three persons.

26. The design is based on a water consumption by a population of 20,000 people of 15 gallons per head half flowing off in 6 hours-that is 30,000 gallons in 12 hours or 42o gallons per minute. This is what would be received (under the conditions stated)at the lower end of the Main Intercepting Sewer or by the Pumping station.

E The present works can supply only 10 gallons per head per diem & the supply cannot be increased even if more water was available because of the size of the pipes.

27. In the portfolio of plans accompanying this report will be found:-

Sheet No. 1--General plan of part of Cuddapah shewing sewers & surface drains & houses.

" No. 2--Skeleton plan of part of Cuddapah shewing sewers & surface drains & streets only.

" No. 3--General plan of the same portion shewing important sewers & houses.

" No. 4--General plan of portion of Cuddapah shewing sewers, surface drains & houses, sites of pumping station & sewage farm.

" Nos. 5,6 & 7-Section of Main Intercepting sewer.

" Nos. 8,9 & 10-Section of Main branch sewers.

" No. 11--Details of manholes.

" No. 12--Designs for house connections - flush holes -surface drain connections with sewer.

" No. 13--Flushing tanks - sewage & water.

" No. 14--Catch pit above pumping station.

" No. 15--Pump house & pump well.

" No. 16--Collecting tank at sewage farm.

" No. 17--Cross section of sewage farm.

" No. 18--Proposed water latrines.

28. The main intercepting sewer is located on the right bank of the Booga and below the Jail on the right bank of the existing channel (now disused)to the Patha Cuddapah tank. After crossing the Bellary road it continues along the same channel, crosses underneath it and follows the course of the surplus from this channel passing on until it arrives at the pumping station which is to the south of land lying along the Booga where it is proposed to form a sewage farm. The sewer begins at the surplus channel of the Dongal Cheruvu Tank; here it receives the drainage from part of Yerumukapally village and at 2140 on section the sewage of the remaining portion- from this point the sewer follows the river in a northerly direction passing behind the Police Station, the Church & the Executive

¤ The section begins at Railway at 0 and the sewer begins at 1667 on section.

Engineer's

Engineer's office along Dhobie Gate Road. These places it is not proposed to connect with the sewer but they can be so; it leaves the road again near the Judge's house and next receives at 6852 on section the sewage of the village of Nagarajapet. The sewer then passes behind the District Court along the river to the Jail and between the Jail and the channel feeding or which used to feed the Patha Cuddapah tank. It is proposed to take down and rebuild the Jail wall- provision for this is made in the estimate. From this point the sewer follows the right bank of the channel & between the Jail & the Bellary Road receives & collects most of the sewage from Cuddapah by means of the branch sewers joining between these two points. The sewer crosses the end of the surplus weir of the Patha Cuddapah channel, collects the sewage south & north of the Bellary Road & finally enters the catch pit well at a distance of 15910 . The sewer is therefore 15910- 1667 or 14243 feet or about $2\frac{3}{4}$ miles in length.

29. The sewer at its commencement consists of a 6" pipe and is 7 feet below ground; from this point it falls with a gradient of 1 in 300. At 8,253 on section the size is increased to 9" diameter and this portion has a grade of 1 in 400. The depth below ground of the 9" sewer at its beginning is 12 ft. and at its end is 19.7 feet . From this latter point the sewer is 12" in diameter and has a grade of 1 in 600- this portion of the sewer extends from 12,258 to the catchpit at 15,910 where the sewer is 20 feet below ground. The velocity of the various portions of the sewer when running full are as follow:-

6"---------- $\frac{1}{300}$ ---- 1.97 feet per second.

9"---------- $\frac{1}{400}$ ----- 2.10 " "

12" ---------- $\frac{1}{600}$ -----1.97 " "

but the actual flow at the end of each portion will be with the velocities undernoted:-

Diameter of sewer.	Velocity due to actual immediate flow of 10 gallons per head.
6"----------	1.80 feet per second.
9"----------	1.87 feet per second.
12"----------	1.84 feet per second.

50. All the branch sewers are 6" in diameter. They cannot be of less size as 4" is a limit for the diameter of the house connections; they are in all cases ample and more than ample to take any flow which can possibly come through them.

51. It has been already shewn that the flow through them will be small and that therefore there is great likelihood of deposit and of the sewage sticking to their sides & bottom. To obviate this as far as possible provision has been made for a flush hole at the upper end of each sewer and there will be in all 112 flush holes flushing 42,470 feet of branch sewers; there will also be 19 flush tanks flushing 33,000ft. of branch sewers. On the main intercepting sewer there will be 10 flushing tanks for about each 1,500 feet of sewer. In addition to these there will be five sewage flush tanks automatically worked by sewage flowing from high level branch sewers to the lower level Main Intercepting & Bellary Road Sewers. For details of these sheets Nos. 12 & 13 may be consulted.

52. It is quite unnecessary to detail the position of the proposed branch sewers; generally they run along the main streets of the town and receive the drainage from smaller streets by other branch sewers and by surface drains which are chiefly used for short lengths and where good grades for under ground sewers were not available - the surface drains are also generally designed to carry the sewage from parcherries or irregular blocks of buildings without proper roads. The position of these branch sewers & surface drains are clearly marked on sheets Nos. 1 to4. The levels of the proposed sewers are given at the beginning and end of each branch and the ground level is also marked at the same point. There are manholes at every junction of one sewer with another, and all bends and not further than 500 feet apart (additional manholes being added when necessary). Details of manholes will be found on sheet No. 11.

53. All the sewers are proposed to be stoneware pipe sewers -they are intended to be laid on a bed of 6" of concrete and as shewn on sheet No. 12.

34. As recommended by the Sanitary Board gravel filling above the sewers in the sewer excavation has been allowed over all sewers which are more than 6 feet below ground; over the Intercepting Sewer, the gravel is calculated for a height equal to that to which water rises when the subsoil water is tapped- on the branch sewers which are at a much higher level, gravel is allowed for from the top of the sewer to a height which is 6 feet below the surface. Branch sewers less than 6 feet below ground have no gravel filling allowed. In few places in Cuddapah as shewn by the borings is the subsoil water found so near the ground as 6 feet though it rises when tapped and therefore during the execution of the work, some of the gravel, it may be possible to omit.

35. The cuttings for the sewers when they are below water level will undoubtedly open up a passage for the water to rise but as already pointed out this subsoil water would not rise if a bore or a cutting be not made down until it is reached and therefore while the use of the gravel above the sewers will undoubtedly aid in taking off the subsoil water (which the Works will practically produce) and allow it to rise to the surface perhaps at times, yet if the sewers were not constructed the water below would remain undisturbed. It is therefore a very important point to consider whether the very execution of the works will not tend to increase the dampness of the soil at any rate in the vicinity of all the sewers because the gravel can never be dried even with extensive pumping & the adjacent ground will therefore always be damp; hence the malaria will increase and the sewers will thus produce the very opposite effect to that for which they are intended; the opinion of the undersigned is that the construction of the sewers would be fraught with danger -- in this respect and that such a work ought not to be lightly undertaken.

36. Returning again to the Main Intercepting sewer this ends in a catch pit of special design. The design has been made in view to collect separately the subsoil water (which will come down the gravel filled cuttings) and the sewage &

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from the catch pit two separate pipes- one the subsoil and the other the sewage- pass to two separate pump wells.

37. The sewage will be screened in the catchpit sufficiently to prevent any damage to the sewage pumps and the arrangements at the catchpit are such as to permit of it being cleaned at any time because the sewage can be passed through either of the two screens as required. The subsoil water does not pass into the screening chamber at all. It is collected in the first portion of the catchpit by means of 4 pipes placed at different levels & passing from the catchpit into the gravel cutting adjoining.

38. As already stated there are two pumpwells; one at either side of the Pumphouse. This arrangement is necessary because in the drier weather there will be little subsoil water coming in and in wet weather a large quantity. It is therefore economical to have two sets of steam plant for pumping purposes, because otherwise one set of large plant would have had to be provided which would have had to work at a small percentage of its power and thus most expensively during a large portion of the year; again if the two supplies were joined together the total would have had to be disposed of on the sewage farm area and a larger area thus required.

39. The spring water will enter its pumpwell at a level of 390.00 and the lift will be to floor level 20.46 feet. The sewage water will enter its well at a level of 385.00 and the lift to floor level will be 25.46 feet. The subsoil water can be discharged into any adjacent water course or used for irrigation; there may be a revenue from this source; this is a detail however which is reserved for consideration- when the scheme comes to be carried out . The sewage water will be raised some 8 or 10 feet higher than the floor of the engine to allow of its flowing into the sewage tank at its maximum level, Viz 419. The total maximum lift will therefore be about 54 feet.

40. Taking a population of 30,000 people at 30 gallons per head, the horse power required for pumping sewage would be

$$\frac{\text{people} \times \text{gal} \times \text{lbs.} \times \text{ft.}}{24 \times 60 \times 33{,}000} = \frac{30{,}000 \times 15 \times 10 \times 54}{24 \times 60 \times 33{,}000} = 3\tfrac{1}{2} \text{ horse power effective.}$$

Q = Copy

For an engine of 2½ horse power effective, the indicated horse power would be about 6 H.P. for six hours during the day, double this power would be required or 12 H.P. but as the calculation has been made on the basis of 15 gallons for an increased population, it will be sufficient to estimate at present for 2 engines of 6 H.P. each. One is likely to be able to do the work for some time and the other can be in reserve.

41. The determination of the quantity of spring water which will have to be pumped is much more difficult.

42. The Sanitary Board's recommendation was that the amount of pumping power to be provided should be taken as that necessary to raise the quantity falling over double the town area or say over 5 square miles - that is of course the whole area not only thickly populated but suburban far beyond the area the sewers will reach, which is only .625 square miles.

43. The average annual rainfall in Cuddapah is 25 inches; the annual maximum is about 50 inches. The rainfall is spread over about 8 months; say 5 inches as an average and 6 inches as maximum monthly.

44. From the two areas mentioned the daily discharge from such rainfall would be respectively as follows:-

$$\frac{\text{Sq.m}}{30}\ \frac{\text{mil.c.ft}}{\text{mil.c.ft}} \quad \frac{3" \times 5 \times 2.52}{30} = 1.161. \quad ; \quad \frac{6" \times 5 \times 2.52}{30} = 2.52$$

$$\frac{3" \times .625 \times 2.52}{30} = 0.145 \quad ; \quad \frac{6" \times .625 \times 2.52}{30} = 0.290$$

To pump the least quantity of 0.145 mill.c.ft. or 145,000 c.ft per diem would require 5 H.P. effective or say 8 H.P indicated (working 24 hours)and one engine in reserve would be required or say 16 H.P in all, and this is what has been provided in the estimate. If the maximum were allowed for over the five square mile area as recommended by the Sanitary Board, the H.P of each engine required would be sixteen times more or 80 H.P effective or say 90 H.P indicated and for a greater part of the year this machinery would be lying idle. It must be remembered that even with this power the maximum monthly (about 15") or hourly rainfalls, it would still be impossible to be coped with and the assumed fall of 5 inches a month is only one-fifth of the maximum monthly fall.

45. But from what has been already stated in the report the undersigned feels assured that the two engines of 8 H.P. provided will more than cope with ~~with~~ all the subsoil flow to the pumping station and the only rainfall which will be received at the station by means of the gravel trenches will be due to that falling on an area very little greater than the trenches themselves.

46. The pumping station as designed will therefore contain two Worthington Engines & Pumps of 6 H.P.(indicated) each for sewage and two Engines of 8 H.P. (indicated) each for subsoil water with the necessary boilers(one of each engine)&c.,&c.,

47. The engine and boiler house is a perfectly plain building adapted to the accommodation required and does not need description; the plans sufficiently shew the character of the structures proposed.

48. From the pumping station the sewage will pass by a closed pipe 12" in diameter to the sewage collecting tank - the capacity of this will allow sewage to be stored to the extent of one days' discharge(171,810 gallons) and it allows the sewage to be discharged on to the land as required and is arranged so that it discharges automatically when full so that pumping can go on all night if desirable.

49. The position selected for the sewage farm is shewn on sheet No. 4 of the drawings. It lies at some distance from the pumping station which is situated however in the centre of the land which may be eventually required for sewage farming. The portion proposed to be acquired at present is dry waste land and its cultivation under sewage will not affct any villages as these are at some distance and above the sewage farm in regard to surface drainage and also subsoil drainage.

50. The extent of land shewn on plans to be acquired is 36 acres. The present population is 17,121 but taking 30,000 people with a daily discharge of 10 gallons per head the number of people per acre would be 550 giving 5500 gallons per acre; if 15 gallons per head the daily discharge would be 300000 gallons and the receipt per acre about 8250 gallons. The undersigned believes that an area of 10 acres would meet present demands fully in India thus providing an acre for each

2000 people but it is understood that the Sanitary Commissioner is of opinion that a much less population per acre is desirable; hence the figures adopted above.

51. The sewage farm will be graded and provided with tile drain carriers, 5" subsoil drains for the escape of purified sewage and 2inch lateral (herring bone) drains for under drainage laid 50 feet apart. The beds will have slopes of about 1.50 towards subsoil drains and the smaller drains will themselves have a slightly less grade- the subsoil drains will be laid 3 feet deep.

52. Such is the scheme for the drainage of Cuddapah- drawn up as far as possible in accordance with the recommendations of the late Sanitary Board. It is a scheme which if the water supply were sufficient, would carry off effectively the sewage of the population but under present circumstances the undersigned cannot recommend its execution nor does he believe that any effective design for the purpose can be prepared until the water supply is much more ample than it is . As to the scheme benefiting the health of the people by rendering the subsoil drier , the undersigned believes it will have the opposite effect and he does not believe that any subsoil drainage scheme for a town standing on a great depth of clayey soil is likely to be effective in reducing the dampness of the soil which must be caused by the rainfall alone & does not penetrate into the underlying clay- any more than the water in the quartzite rocks and Cuddapah flags would rise up through the clay towards the surface.

The estimate.

53. A large and extensive scheme of drainage for a small town amounts to a great deal per head and in this instance the total cost for 20000 people will be over 5,40,000 rupees or say 27.0 rupees per head. The only other mofussil town for which an underground system of sewers has been designed by this department is Negapatam and there the cost works out to Rs 13/-per head. The reasons for this difference are (1) that Negapatam is a much more compact town with double the populatio

(2) that the Engine House & Sewage farm there were designed to be quite close to the town (3) that there is no gravel over the sewers in the Negapatam design (4) that the sewers are deeper as a rule & the soil is much harder to work in Cuddapah than Negapatam though there would be more water to deal with in the latter than the former (5) that the amount of machinery provided is larger and other reasons might be given - it is moreover more than probable that the estimate for Negapatam would have to be revised if it was ever intended to carry out that work.

54. The following is an abstract of the estimate for Cuddapah Drainage.

Abstract of Estimate.

(1) Main Intercepting Sewer----------	69,407-0-0
(2) Erecting temporary Jail wall, demolishing & rebuilding----------	2900- 0-0
(3) Planking & shutting for Main Intercepting Sewer ditch 3000 ft. long----	26,000-0-0
(4) Branch Sewers----------	1,68,058-1-0
(5) Planking for 3000 ft. of Branch Sewers (average depth 11 ft. planking 5 ft only)----------	9670- 0- 0
(6) House Connections----------	75222- 8- 0
(7) Surface Drains on Branch Sewers------	43480-10- 0
(8) Catch pit above Pumping station------	7,400-0- 0
(9) Pump wells----------	3,358-0- 0
(10) Engine & Boiler House----------	8,404-0- 0
(11) Engines & Boilers for Pumping Sewage, and Spring water----------	61, 880 -0- 0
(12) Collecting Tank at the Sewage Farm----	1, 300-0- 0
(13) Forming Sewage-Farm ----------	22,617-0- 0
(14) Syphon on Main carrier at crossing of Surplus Channel----------	1,600-0- 0
(15) 10 Latrines.----------	11,500-0- 0
(16) Contingencies, tools & plant- 5%----	27,202-13-0
Total----	5,40,000-0-0

55. The following points may be noticed in regard to the above figures.-

Intercepting Sewer. Provision is made for constructing a length of 3000 feet in progress at one time - One thousand feet of excavation will be being strutted, one thousand feet will be under construction & from one thousand feet the struts & planking will be under removal. The rates for excavation in this and in the branch sewers are based on work actually done in Madras plus expected cost of pumping in the lower levels. It will be noticed also that provision for removal of surplus soil is not equal to the amount of gravel to be substituted- this is because there is plenty of land available at the sewer on which to place surplus soil.

Branch Sewers. The detailed estimates for these sewers are clear and shew the works to be done in connection with each particular branch sewer.

House Connections. These are also fully detailed in connection with the Branch Sewers into which they will flow. Each connection will be trapped and can be flushed. There are only 1900 houses so that it may be said that at most 5700 people will benefit by these direct connections & that it would be inequitable to charge the cost Rs 75222/- to the whole population - but unless these connections are laid as part of the scheme they will never properly be so and they really form just as much part of the scheme as the surface drain which will carry the sewage away from ~~for~~ parcherries & block of huts.

Surface Drains. These are proposed to be of a superior pattern to that which has been hitherto used in any town drainage. They will be formed of glazed Stoneware Tiles laid in concrete. All surface will be 6" deep - as their individual length never exceeds 200 to 300 feet.

Engine House &c. The rates are the usual rates for this class of building in Cuddapah. The rate per H.P. for the Engines is based on what has been paid hitherto exchange being taken at Rs 17/- per £1/- sterling.

Sewage Farm &c. The cost of the land for this has been

based

based on figures received from the Collector's Office at Cuddapah.

56. The following notes give some further details in regard to the items included in the estimate under its various heads.

(1) Main Intercepting sewer. This has already been described and will be constructed of 6", 9" & 12" pipes laid on Surki concrete with cement joints- For the purpose of construction sufficient planking and strutting has been provided for 3000 feet , so that a considerable length can be proceeded with at one time. One portion will be planked while the pipes for a second portion are being laid and on a third the planks will be under removal . The flush tanks have been already referred to ; the cost of manholes is shewn for the various depths or heights entered. Provision is made for remetalling all the roads broken up by excavation for sewers. As the sewer passes close to the Jail wall provision has been made for building of a temporary wall for the Jail, removing the existing wall and its restoration and for removing the temporary wall.

Branch sewers. These will be all 6 inch stoneware pipes laid and jointed as described for the main sewer. Trapped flush holes are provided for at the head of each sewer and these will be flushed by barrel water carts or by leading a hose through them from some main. There will be automatic flush tanks on some of these sewers as shewn on drawings and detailed in estimates; these have already been referred to.

House Connections . Provision has been made as stated in para 16 for a connection for each house along the line of the sewers; these form a very necessary portion of the scheme ; this point has been already referred to in connection with the estimates.The connections with the sewers will be made in all cases from the outside of the houses.The design is one based on one received from the Sanitary Commissioner.There will be no chance of sewer gas entering a house;each opening to the sewer outside a house is trapped;the method of forming these connections will be found on sheet No. 12.It is believed that it will be possible to obtain all these traps,bends &c in India.

Surface drains. The design for these drains will be found on sheet No. 9 of the drawings; they will be mostly in Parcherries and among irregularly built blocks of houses & will end in a gulley as shewn on sheet No. 13. It may be noted that no interference is intended with any existing open drains which at present carry off surface water.

Catch pit. This work has already been fully described.

Pumping Station. The estimate provides for Worthington engines as already stated in para. 46 & ordinary loco. boilers. There will be nothing special about the plant which is one of small power.

Collecting Tank.

~~Sewage~~ -This will be formed of earth & lined with clay -it will contain as already stated 1,76,400 gallons of sewage or over one day's receipt.

Sewage Farm.-This has been already referred to & does not need further description.

Latrines.-This item has not yet been referred to it is the estimated cost of 10 latrines as per design in the portfolio of plans sheet No. 13. If a sewage scheme is introduced into Cuddapah the existing latrines should be gradually replaced by latrines on the water principle. It is proposed to build 10 of these at first.

Maintenance charges.

57. It is understood that it was the intention of Government to provide the whole funds for this work & the following is an approximate estimate of the possible charges for maintenance only. These charges are not based on any past or present actuals, but the larger ~~amounts~~ items will be somewhat near the mark.

Flushing sewers.

		Rs A P
10.	Carts & drivers per month at Rs 30 ----------	300-0-0
15.	Flushers at Rs 7 ----------	105-0-0
2.	Turncocks for automatic flush tanks ------	16-0-0
		Rs 321-0-0

Rs
321x 12 = 3,852

Pumping

B.T. Ro. 3,852

Pumping station.

		Each	
All night work--1 Chief driver	at Rs 40	40	
3 Asst. do	at Rs 25	50	
3 Firemen	at Rs 15	45	
6 Coolies	at Rs 7	42	
		177x12 =	2124
Fuel(1)6 H.P. Engine -26 tons at 6/-/- =			1872
(1) 8 H.P. Engine 35 tons at 6/-/- =			2520
Oil, sundries &c to 6 H.P. ----			400
——— Do. ——— 8 H.P.			530
			11,298

Sewage tank.

2 peons or turncocks at Rs 7-/-/- = 168

Sewage farm.

1-farm maistry	Rs 40-/-/- =	480
13-coolies	Rs 6 = 72-/-/-	864
		12810

The total maintenance charge will thus amount to Rs 12810, & if to this be added a valuation of the cost of the grant of the entire amount to the Municipality the charge would be Rs 44,018

58. It is of course a matter for Government to decide whether it is desirable to expend such an amount on this town where the probable results are of so very doubtful a character but the sum of Rs 5,40,000 would build a good many Cutcherries & Courts elsewhere and the population would no doubt follow the officials.

Office of the Sanitary Engineer to Govt
Fort St. George, 28 May 1897

Sanitary Engineer to Govt.

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Government of Madras.

SANITARY BOARD OFFICE.

3149/M

PROCEEDINGS OF THE SANITARY BOARD, No. 6208, DATED 3rd September 1897

Disp^d 3.9.97.

READ the following :—

From the Sanitary Engineer, No. 959, dated 28th May 1897.

Resolution.

With his letter read above the Sanitary Engineer submits plans and estimates for the drainage of the town of Cuddapah. The report accompanying these documents gives the history of the Project and some interesting details as to the strata (now disclosed by borings) underlying the town. The diagrams showing the borings and the natural flow of the subsoil water might be printed. They will be useful for future reference. The investigations made lead the Sanitary Engineer to the conclusion that no scheme of subsoil drainage will have the slightest effect on the level of the subsoil water, and that it is quite incorrect to base the rise and fall of the subsoil water on the rise and fall in the wells, the thick and compact beds of clay met with effectually preventing any rise of water from below. The dampness of soil, therefore, apart from surface water due to rainfall, cannot be affected to any great extent by the small amount of subsoil water found at 8 or 10 feet below the surface. The scheme is thus, in the Sanitary Engineer's opinion, "not likely to affect

and much less determine the malarial conditions at present existing".

2. The scheme must therefore be looked at, the Sanitary Engineer says, as one simply for the removal of the ordinary sewage and a portion of the surface rainfall from the town. Even for this purpose it will scarcely be effective. The large expense involved in its execution cannot therefore well be justified, more especially as the heavy death rate from fever is not likely to be diminished by carrying it out.

3. In paras 13 to 24 of the report are given the reasons why the scheme must prove ineffective.

4. The scheme is described in detail in paras 25 to 52. It has, as explained in the last mentioned para, been drawn up in accordance with the recommendation of the (late) Sanitary Board; but for the reasons there summarised, it is not one which the Sanitary Engineer can recommend. Nor does he believe that any effective scheme for carrying off the sewage can be designed until the water supply is much more ample than it is.

5. The estimate amounts to Rs 5,40,000 which works out, for a population of 20,000, to Rs 27 per head. In Nagapatam, the only other mufassil town for which an underground system of sewers has been designed, the cost comes to Rs 13 per head. The reasons for this great difference are given in para 53.

6. The maintenance charges come to Rs 12,810 per annum which capitalised at 4 per cent would amount to Rs 3,20,250. The total

cost of the scheme may thus be taken at 8½ lakhs in round figures, and for this sum all the public buildings required, if the head quarters of the District were removed to Madanapalle, Koyacholi or elsewhere, could be erected.

7. The question thus remains whether, looking to the costliness of the works, and the inefficiency of the scheme, the project is one which it is desirable to undertake.

8. As a scheme to remedy the malarial character of Cuddapah, the Sanitary Board cannot recommend it.

(True Extract)

K. Narasimha
Secretary, Sanitary Board.

Kd.

To The Secretary to Government,
Local and Municipal Department.
with papers in original.

Local & Munl. (1898.) Department.

CURRENT No. 1955 M

UNDER SECY TO GOVT
7 JUN 98

From The Sanitary Commissioner for Madras.

Order

No. 1276/S

Dated 4th June 1898

Received

Registered

Enclosures 1 Bk. & 1 book of plans

Spare copies.

SUBJECT.

Forwarding a Memorandum on the Cuddapah Drainage Scheme.

BACK PAPERS.

G.O.	No.	Department.	Date.

FURTHER PAPERS.

G.O.	No.	Department.	Date.

[2,000—18-2 98.]

61/66

No. 1276/S

OFFICE OF SANITARY COMMISSIONER,

Fort St. George, 4th June 1898.

LOCAL & MUNICIPAL DEPT.
CURRENT No. 1955 M

From

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

SANITARY COMMISSIONER FOR MADRAS,

To

THE Secretary to Government
Local & Municipal Dept

Enclosure.

SIR,

With reference to your endorsement No. 1298 dated 13th December 1897, I have the honor to forward herewith a memorandum on the Cuddapah Drainage Scheme.

I have the honor to be
Sir
Your most obedt servt

W. King
Lieut.-Col.,
Sanitary Commissioner.

I.C. No 6304/98

Memorandum by the Sanitary Commissioner for Madras.

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1 In a report embodied in G.O. No: 869 dated 12th Septmr 1891, Rev., the Sanitary Engineer wrote a Sanitary report on the condition of Cuddapah. He held that, because certain areas in this Presidency are much irrigated and are not malarious, the fever in Cuddapah had nothing to do with the irrigation of the land. In this conclusion, he ignored the fact that certain tracts of country only contain the malarial germ and that, whilst irrigation will not produce malaria ab nuvo, it will, as a result of moisture, enable existing malarial germs to increase and multiply. His recommendations amounted to the cutting of a channel at a cost of, I think, Rs 23,000, so as to intercept the surface irrigation water and sub-soil water on its way towards the town.

In my report embodied in G.O. No 182 dated 7th February 1895 2 Rev, I held that the trend of the country was such as to render the suggested channel of no utility. Referring to this report, dated the Sanitary Engineer takes exception to the following description by me of the soil

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In my report embodied in G.O. No 182 dated 7th February 1895 I held that the trend of the country was such as to render the suggested channel of no utility. Referring to this report, the Sanitary Engineer takes exception to the following description by me of the soil

soil of Cuddapah:—

"The soil is chiefly of red gravel, having below in some parts a blackish alluvial deposit, followed by clay, and subsequently the imperfect clay known by natives as "sowd" and lime kunkur. The average sub-soil water fluctuation is from thirteen to six feet. Above the town is a tract of land which is rich in springs evidently having their source in the distant hills, as they burst forth on the surface after a period of subterranean flow, without the occurrence of local rain." × × × ×

"The town has been long notorious for being highly malarious. Following the depression which probably occurred in the sub-soil water-level of the town, owing to the small amount received during the south-west and north-east monsoons in 1891 and 1892, there ensued during 1893, as might be expected, on the access of a normal amount of rain securing a rise of the sub-soil water (or, at least, a greater depth of soil moistened) a marked increase of malarial fever".

This estimate of conditions was formed from the only available method, namely, by inspection of well cuttings and corresponds with Dr. King, the

geologist's, description fairly well, and if my "gravel" be excluded (the absence of which may be accounted for by Mr. Jones' borings being almost entirely by the side of the "Bugga") I do not see that it departs materially from the character as stated in the borings. In this Report, I held that the total fluctuation of the sub-soil is from 6 to 13 ft. After describing the various conditions securing retention of moisture in the soil, I added:— "It is conceivable that, whilst no one condition can be pointed to as to the sole cause of the favoured growth of the malarial germ in Cuddapah, this combination does afford the conditions required". The recommendations ~~offered~~ offered were:— "To render Cuddapah habitable, I would therefore advise that the Pattha Cuddapah tank be breached so completely as to offer no obstruction to surface drainage in all directions, and the supply of the fields below be effected by irrigation from the canal direct— that the bed of the Pattha Cuddapah tank be effectually cultivated, and, if necessary, sub-soil drained; the Bugga anicut should be breached, and the Bugga bed be correctly trained — the old Bugga channel being left open, or, if filled,

being

being supplied with sub-soil drains throughout its length before being so".

I then pointed out to the necessity of keeping the soil dry in the town area by stopping wet cultivation within inhabited areas and removing a most important cause of sub-soil moisture, namely, the introduction of sewage into the soil by cess-pools. Then followed the recommendation to have a sewage system and take advantage of putting down a pipe system, by using side by side with it a sub-soil drainage scheme.

2. The Sanitary Engineer, since the date of the Report, has had the opportunity of making a detailed survey of Cuddapah. He makes no objection to the removal of the Bugga anicut, but states that the bed of the Bugga cannot be much lowered. The lowering of the whole bed was not contemplated. What is required is the getting rid of obstructions along its bed, which would not necessarily involve a departure from its present gradients.

3. As to the borings made by the Sanitary Engineer, I consider these have been ill-conceived for exhibiting the state of the town site. I find not a single boring within the inhabited area. They follow chiefly

the line of the Bugga having been made primarily with the object of ascertaining the state of the sub-soil in regard to laying the main sewer. On the basis of facts thus ascertained, the Sanitary Engineer considers the whole scheme for the improvement of Cuddapah falls to the ground. Most of his remarks are made under considerable mis-apprehension. To understand this, it is first necessary that I point out that the use of the word "sub-soil" water, both by Mr. Jones and the Sanitary Board, is absolutely misleading. Sub-soil water as usually understood, is that water which is supported by the first not readily permeable layer. The water which Mr. Jones constantly alludes to as "sub-soil water" is "subterranean" or "deep-seated water". Having started off with this incorrect interpretation, Mr. Jones at once assumes most unusual theories as facts. His sub-soil water being below the first impermeable stratum at once leads him to ignore the existence of any water in the sub-soil. Any water that reaches the sub-soil can, he maintains, be only the rain-fall, but he admits, without any survey showing the limits, that this rainfall may be equivalent to the amount falling upon a five mile area, although in his report above

above alluded to, he enlarged upon the ~~expense~~ greater expanse of the area draining towards Cuddapah as of no small importance. He states "the rain fall falling on the surface cannot penetrate far below and hence must run off quickly." Rain passing through sub-soil till arrested by a stratum not readily permeable would be to all other persons "sub-soil water" whether it flowed off quickly or not. On what data, does Mr: Jones conclude that the sub-soil water flows off "quickly"? Not a drop of rainfall penetrates the soil that has not to undergo the opposition to its entrance of friction caused by the particles of earth between which it penetrates, and this means, under fair conditions for its flow towards a natural outlet, a rate of about 15 feet per day. If the gradient is very marked, of course, its flow will be more rapid, but to dispose of the question of sub soil water by imagining that it will flow off as if from the roof of a house, because it happens to be supported by a stratum of clay, is not tenable. The conditions found in Cuddapah as revealed by the borings are of the most common type. A pervious soil stands upon a stratum of clay. This stratum must support all rainfall penetrating the soil, and is "ground water" or "sub soil water". Below the clay, in this instance, is water under pressure derived presumably from a "foreign area". Now, if an agriculturist were confronted in Britain with the condition of affairs, I do not think it would alarm him, or make him abandon any preconceived idea of proceeding with sub-soil drainage, had he reason to believe that the soil was unduly moist for his purpose. He would drain the sub-soil proper by ordinary methods, and the sub-terranean water he would deal with by wells or auger holes, so as to cut off the water as received under pressure and lead it in a high level drain. I do not say that it would pay the agriculturist, ~~to a suitable outlet~~ for his special purpose, to interfere in this special case, having regard to the depth of the clay stratum, but otherwise conditions are analogous. The agriculturist would remember that the clay is highly retentive of water, even if it is not readily permeable and that by capillary attraction his sub-soil would be rendered damp, so long as the level of the springs below the clay was high. This fact I have alluded to in my report above mentioned thus:— "The chief factor is undoubtedly the presence of moisture in the unsaturated soil; hence, drainage is the remedy which is universally acknowledged should be [i.e with the malaria germ] first

to a suitable outlet

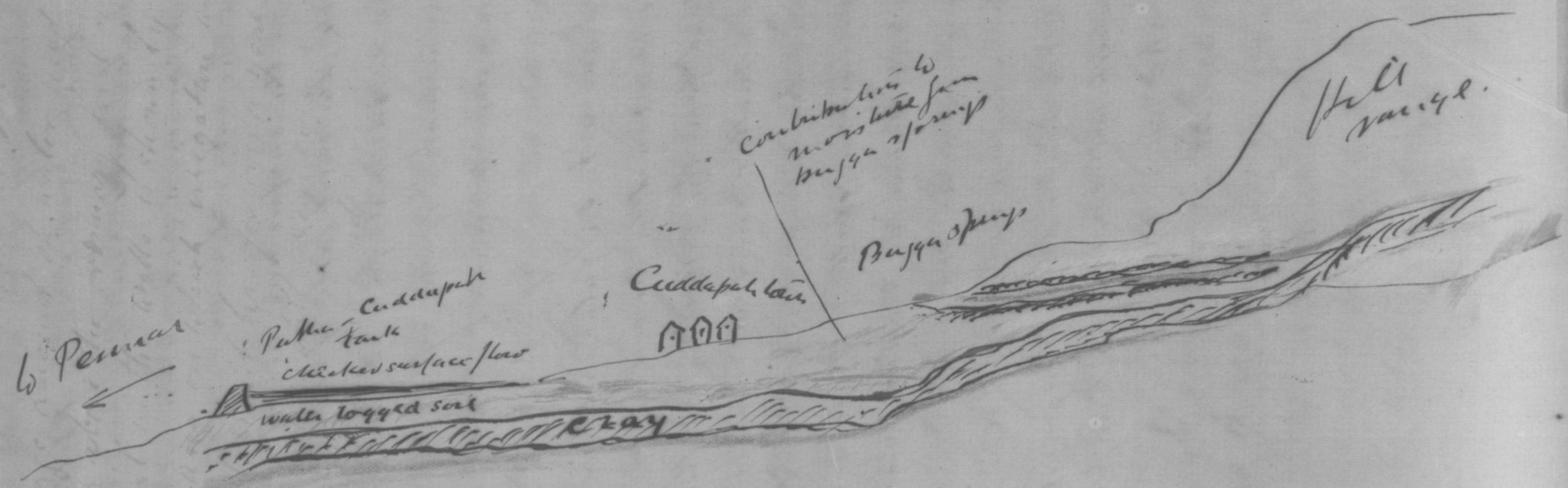
iron tool for boring holes

first aim of sanitary effort. In considering how best this can be applied, it is of little utility to estimate possible results of pressure on one direction causing a rise of a few inches on another. If the sub-soil water be within a short distance of the surface and the soil above it be permeable, the great factor of capillary attraction, the ascensional force of evaporation, and effects of fluctuation of the ground air circulation must all be regarded as important factors".

4. That I am not singular in considering that moisture is retained in the soil of Cuddapah town is evident from the following excellent example of the actually observed condition given by Mr. Jones in his report alluded to in my para 1:- "The alluvium itself will also have a considerable influence in producing malarial fevers, because under the somewhat sandy surface soils we have a calcareous clayey drift which is favourable to the lodgment of water and which will contain up to 20 per cent of water. Parkes says that such soils are always to be regarded with suspicion, as water neither runs off nor runs through them, and as alluvial soils generally contain a large amount of organic matters, their dampness adds to its decomposition, and such soils, though not rich in organic matters, may be malarious. ~~That~~

malarious. That the soil does contain a large amount of water held in suspension far above the ordinary level of the subsoil level in the wells is shown by the fact that the area on which irrigation within municipal limits has for over a year been discontinued is still green even at this date and after long continued drought."

Diagram


Cultivation
Hill range.
Cuddapah
Cuddapah
Pallikonda
Clinker surface flow
water logged soil
Clay strata
Subterranean water
Subsoil water.

No.

NOTE by the Sanitary Commissioner for Madras, dated

Now, Mr. Jones' former observation of facts, as conveyed in the last and most remarkable sentence, is of even more value than his inference from the recent borings. If his facts be correctly stated, the indication for subsoil drainage is obvious — whether deep seated water exists or not. What the borings have revealed solely is, that under the clay stratum are springs under pressure. It is by no means certain that the water thus revealed is from the springs that discover themselves at the Bugga. Indeed, the Chances are still that these do loose themselves in the true subsoil of Cuddapah and that the springs now discovered by borings really come from the same source as the Bugga springs, but have entered below the clay at a more distant point; or at least have not been brought to the surface to again disappear below the clay which otherwise could be the only possible explanation.

In short, there is nothing in Mr. Jones borings to upset the theory that the partly visible Bugga springs do enter the soil above the Town and thus add to the moisture and the subsoil water due to the ordinary cause — rain. But whether there the water from a "foreign area" above the clay stratum

or

or not, the fact remains that the clay (which will absorb water to the extent of 51-66 percent of its volume) in consideration of its small depth from the surface suffices to keep the soil damp by the capillarity of the latter, so much so that many of the houses in Cuddapah, at my inspection, were found to be exceedingly damp both as to the walls and floors. In short, as it will be noticed throughout my report embodied in G. O. No. 182 M dated 7th February 1895 Lth, I do not lay stress upon sheets of water, but upon the possibility of retention of moisture in the soil, and this being obtained from the underlying clay; the fact that this clay has below it water under pressure but aggravates this condition.

5. Mr. Jones makes use in this para of a diagram (No. 1) given by me, and shows that far from the subsoil being impeded as to its exit by the Pathak Cuddapah tank, it really passes below the tank. I need only say that the confusion as to what is subsoil water has influenced Mr. Jones's opinion. I now use the same diagram and show how both conditions may exist. But, as a fact, my diagram is no fancy matter. It was prepared by a competent overseer by taking levels of the wells in a line back from the Pathak Cuddapah tank. This diagram happens also to illustrate how little effect the supposed anti-clinal position of the stratum effects the level of the subsoil water, at seasons when it reaches the levels there shown. Diagram No. 2 which Mr. Jones presents to compute the influence of Pathak Cuddapah is an illustration of how completely he has confused the question of subsoil and subterranean water. Because the water level in bore No. 12 is higher than in No. 8, he at once assumes that the direction of what he calls the subsoil water is lateral as to the tank. Now, even if he had been dealing with subsoil water, this would have been a most rash conclusion — as a boring beyond the tank in a straight line with bore No. 17, might have revealed that the lateral tendency of No. 8 was a mere local matter and did not effect the general trend. The only boring made beyond the tank, but in an unsuitable position No. 10 would favour such an opinion. But, as a matter of fact, as the subterranean water which Mr. Jones dealt with is under pressure, the difference of head may be simply due to physical conditions modifying the pressure between the two points. As to the lateral diversion, it is extraordinary to find that in diagram No. 2 the exhibits lateral diversion of the

Subsoil

subsoil water, and in diagram No 1 makes the special remark, "the water is not backed up by the tank but escapes under it," which would imply that no lateral diversion existed. That the subterranean water does flow below the tank notwithstanding his attempt to show its lateral flow, I think is practically certain. In any case, this has nothing to do with the subsoil water, which my diagram No 1 shows can be backed up. It could not possibly be otherwise than that the mass of saturated subsoil represented by the 640 acres of this tank should impede the exit of the subsoil water it towards the Permar Valley – its natural outlet, having regard to the existence of a permeable subsoil above the clay stratum. The fact is one that can be demonstrated bright by an inspection of the surrounding area, when the tank is fairly full.

6. I see no reason whatsoever to change my views on account of the revelations made by the borings, except in so far that I would utilize the information by modifying the mode of subsoil drainage. Mr Jones' dread that by tapping the clay a worse condition might be secured, is not consistent with the known effects of tapping clay substrata for agricultural purposes under exactly the same conditions.

The Sanitary Engineer's Scheme

7. That Cuddapah requires a sewerage scheme as part of the effort towards securing a dry soil, is undubitable. The Sanitary Engineer now advocates an open drainage scheme, such as up to date disfigures Madras (Black Town). I consider an "open drainage scheme" absolutely unfit to fulfil, in proportion to expenditure upon it, Sanitary requirements. This is a well worn subject, and I will not weary Government with a repetition. The fact that Madras is now going to have an underground sewerage system, suffices to show that the principle has been acknowledged in this Presidency. Not only do "open" schemes not fulfil sanitary requirements correctly, but they are far from economical, in respect to sludge – disposal, and night soil conservancy. If, then Cuddapah is to have a sewerage scheme, for sanitary and economical reasons it certainly should be an underground

get rid of Mr. Jones objection with only

8. If it be an underground scher add that why should not advantage of the fact be at a and have also a subsoil drainage system? The question must, I think, be answered simply in the score of expense. 5½ lakhs or Rs 27 per hed, seems a sum that should be avoided if possible But, it is worth while ascertaining if the Sanitary Engineer could excogitate a cheaper scheme. It is a town with a slope, according to Mr. Jones, (vide report above mentioned) of about 1 in 400 towards the Pennar Valley. Could it not have been possible to have found a point of discharge further down the valley, and thus have dispensed entirely with all necessity for pumping, even if the outlet main became a heavy item? Was it absolutely necessary to adopt what is practically a low level scheme, by running the intercepting sewer along the Bugga channel? Could not other main lines have been taken up, that would have economized the head available? Thus, rather than start from the village of Yenakapally with the pipe 7 feet below ground could not some head have been saved, as even horse cart traffic can safely be conducted over stone ware pipes at a less depth? If this were possible, why not have omitted all main sewers ~~down to that is beyond the judges house~~ up to the village beyond the judges' house to the point marked 434, and have Col the paracherry of Yenakapally be content with a

subs

speci scheme of ? With the head thus
by [illegible] mised, at least the engine left would prove
less expensive. If the borings reveal subterra-
nean waters below the clay stratum on which
rests the soil of Cuddalapah, why not attempt
to cut it off at some point above the town, by
sinking wells filled with stones and allowing it
to appear on a channel, and thus divert it.

Q. Provided it be impossible to secure
a point of discharge by gravitation, by extending
the outlet sewer to a point further removed
towards the Pennar (that is, if it be understood
that a pumping scheme is essential) why not,
in the face of the scattered condition of the
villages composing the Municipality, and the
difficulty of adjusting the pumping power to the
variable amount of subsoil water to be received,
employ the Shone pneumatic system? This could
be arranged so as to receive at certain points,
and varying levels, both subsoil water or
subterranean water, and thus supplement the
flushing powers. The power used could be adjust-
ed to work required as by no other means
throughout the sewerage system, as well as for lifting sub-
soil waters at the outlet. Conservancy could be
worked by pail depôts to perfection, and thus
economy under the head of transport and plant
could be effected by the Municipality. This
utilization of subsoil or subterranean water

already made through is by wells on main soil drain

[L. & M. 3,000—12-2-25.]

Loca

ould effectually get rid of Mr. Jones objection
to making a pipe system in a town with only
10 gallons per head; although I would add that
the experience of Ahmedabad shows that a
pipe system with this amount is perfectly
feasible.

10. I think a comparative estimate —
should be made of the cost of using ordinary
tile drains and gravel for conveying subsoil
water. Whilst concrete may be advisable
for foundation for the house drains up to junc-
tions with sewers, it may well be questioned
whether this would be necessary for the main
sewers laid on clay. If sinking of the pipe be feared —
the only reason for this expenditure — at least, the
use of special jointed pipes such as Stanford's
or Doulton's might overcome the difficulty cheaper

11. Finally, I would point out that whilst
the Sanitary Engineer presents an very expensive —
scheme for sewerage by the pipe system and —
advises in lieu of the "open drain" method, he
gives no idea of the comparative cost. Unless
be in the matter of engines owing to greater
I believe from data I some years back worked
out carefully, that if he makes a scheme co
exactly the same area and streets, and allows
all improvements for altering levels of streets
lines of houses necessary in an "open drain sc
he is very unlikely to be able to show a sa

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11. I therefore do not change my views, I still think that the subsoil of Cuddapah requires being freed of moisture; the borings simply show there is more scope for working out a suitable scheme by the Sanitary Engineer. There has been ample practical proof that failure of monsoons and an unusually dry soil means both for the district and town of Cuddapah immediately improved health. It is in the power of the Sanitary Engineer to evolve a scheme that will artificially imitate this result.

W. Ross.

Lieut. Col.
Sanitary Commr. for Madras.
4/6/98.

[L. & M. 2,000—12-3-95.]

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