

(1) Number of pages _____

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(3) Initials of the Referencer _____

MADRAS RECORD OFFICE.**Government of Madras.***Public works* **DEPARTMENT.**

G.O. No.	558	Press
1-2.		Mis.
Dated	4-3	1872.

Not to be folded or roughly handled

18

*Proceedings of the Madras Government, Public Works Department,
1st March 1872.*

No. 1. Read the following letter from the Inspector-General of Hospitals, Indian Medical Department, to the Secretary to Government, Public Works Department, dated Fort St. George, 11th January 1872, No. 8:—

In continuation of my letters marginally noted, I have the honour to submit to His Excellency the Governor in Council a report by Assistant Surgeon Nicholson "on the best plan of water-supply for Bangalore," including a supply for all military purposes.

2. Assistant Surgeon Nicholson points out that the populous parts of Bangalore "suffer under great dearth of water," and that the wells in these localities are loaded with sewage products; and he mentions that, on the Mysore Government recognizing the necessity of providing a larger and purer supply, the Chief Engineer of the province put forward a scheme to meet the want, which has received the sanction of the Supreme Government and will be carried out so soon as funds are available. In that sanctioned scheme it is proposed to collect and store in a tank, at a distance from the town, the rainfall on an area of $2\frac{1}{2}$ square miles, to filter the water as it is drawn from the tank, and finally to convey and distribute it by a system of pipes to the various parts of the town.

3. To this project Assistant Surgeon Nicholson offers several objections, which he briefly summarizes as follows, and which it may be thought desirable to communicate to the Mysore Government:—

- "a. Far too favourable data as to the yield of the gathering ground.
- "b. Insufficient allowance for the loss of level between the issue of the water from the tank and its entrance into the Cantonment.
- "c. Insufficient estimate for filtering beds."

4. In support of the first objection he contrasts the actual supply of water, which enters the Ulsoor tank from a nearly corresponding area of gathering ground, with that which is anticipated by the Chief Engineer in his scheme from a surface of $2\frac{1}{2}$ square miles, and he is of opinion that the calculations of the latter on this point require re-consideration.

5. While fully recognizing the importance of Assistant Surgeon Nicholson's suggestions, he does not give sufficient prominence to the fact that the Ulsoor tank only receives, as its supply from the town valley, the portion diverted from the sewers—mechanical arrangements providing for such diverting. Slight showers and the first part of heavy rain being allowed to pass through the sewers, and a large amount of its supply of water is obtained from the water-shed on the south-west and west of the tank and town.

6. Assistant Surgeon Nicholson then briefly sketches another project, by which he proposes to supply both the troops and the civil population of Bangalore with water from the Ulsoor tank and Dhobies' wells. It is, in effect, that if pipes be laid from the Dhobies' wells to the Ulsoor works, the engines could raise from the wells 20,000 gallons of water per diem, and as the existing filter beds would yield, on repair, 60,000 gallons, the total probable yield would be 80,000 gallons a day from the tank and wells. He calculates that the demands for military purposes

would amount to about 35,000 gallons per diem, and that the remaining 45,000 gallons might be disposed of to the Municipality.

7. This scheme, as compared with the other, has no doubt the recommendation of economy; but before arriving at a definite conclusion as to eligibility, it appears to me that the engineering part of the question requires further and careful consideration.

8. Also, as regards the quality of the water of the Ulsoor tank, and the propriety of drawing the entire supply for the troops and civil population from it and the Dhobies' wells, I refrain from offering any opinion until I have had the opportunity of seeing the report which the Chemical Examiner was directed to submit in paragraph 2 of G. O., No. 2,178, of 24th August 1871.

9. The concluding part of Assistant Surgeon Nicholson's report urges care over the Ulsoor tank, and points to the necessity of keeping up this source of water-supply, and, so long as the Bangalore community continue to draw their supplies from this tank and from the wells which it feeds, it is of undoubted importance that every care should be had of the tank and its waters. I already submitted this subject,* but orders on it were deferred. Assistant Surgeon Nicholson here repeats his recommendations, and it seems desirable that steps should be taken to give effect to his former recommendations, those which he now makes being summarized on the margin.

* No. 242 of 24th July 1871, No. 285 of 29th August 1871.

1. Stock it with water plants.
2. Annually dredge the shallow parts.
3. Place it in the charge of the Superintendent, Ulsoor Water Works.
4. Attend to the Bederhully Valley feeders.

10. If, however, Colonel Sankey's scheme of storing the water from the area around the Muntapum be carried out by which the community will be supplied from a level above instead of, as now, from one below, then I consider that the salubrity of the town of Bangalore would be greatly improved by breaking down the Ulsoor tank bund and allowing all the valley water at once to be drained off.

Report on the best plan of water-supply for Bangalore.

It may be taken for granted that the populous parts of Bangalore suffer under great dearth of water. The wells in these parts are loaded with the products of sewage contamination, and the yield even of this bad water is exceedingly precarious. A municipal water-supply is urgently required. I am, however, given to understand that the Municipal funds do not admit either of any considerable outlay of capital or of a large annual expenditure on this item.

The question was taken up by the Engineers of the Mysore Government, and a scheme, originated by Colonel Sankey, has been sanctioned by the Government of India, and, when funds are available, the work is to be commenced.

The following is a sketch of the scheme:—

The rainfall round the Muntapum hill for a space of $2\frac{1}{2}$ miles is to be collected by channels and impounded in a tank near the 3rd milestone on the Toomkoor road. It is calculated that the quantity collected by the smallest possible rainfall will be $63\frac{1}{2}$ millions cubic feet, and that the tank will be able to supply 47 millions cubic feet per annum—the quantity required for 80,000 people at 10 gallons a head per diem.

The tank will enclose a surface of 2,700,000 square feet (62 acres) at the highest level; it is purposed to draw off water down to a level 15 feet below this, the space between the two levels

containing $29\frac{1}{2}$ millions of cubic feet. The water is to be drawn off through a water tower enclosing between two concentric walls a layer of gravel to act as a coarse filter. The outer is to be at a level of 90 feet (above the station datum), and if the water should fall below the two small engines are to be run out on rafts to pump water into the tower. The water passes out into two storage basins large enough to hold twelve days' supply (approximate dimensions 250 feet $\times$ 250 feet by 12 feet deep). After settling it flows into two filter beds, each 80 feet square, containing 4 feet 2 inches of filtering material. The filtered water passes out into narrow basins (83 feet $\times$ 3 feet) covered by stone slabs, thence it passes at once by two 12-inch mains to the Cantonment. At the Ooperhully ridge a tunnel will have to be made; this will be lined with masonry, forming a distribution reservoir 850 feet long by 20 broad with a semicircular roof.

From this reservoir, the floor of which is to be at 83 feet level, two mains proceed: one of 9-inch to St. John's Hill along a comparatively low level, the other of 18-inch has to pass along the Infantry road at a level gradually declining from a maximum of 86 feet; it is to be laid $4\frac{1}{2}$ feet below the surface. It divides into a 10-inch main for the Infantry road and bazaar, and an 8-inch main crossing the parade-ground to Shoolay. Neither the high ground nor the pettah will be supplied. The service pipes lead to masonry cisterns provided with taps and regulated by ball cocks. The estimated cost is—

Rupees	1,03,903 for the impounding bund.
"	51,000 for two storage basins.
"	2,91,031 for iron mains.
"	1,23,323 for other charges, including compensation for land.
"	5,69,257

Estimated cost of service distribution to be borne by the Municipality, Rupees 72,702.

The current expenses are not estimated, or rather it is the distinctive feature of the project that there will be little or no annual expenses after the first outlay. Huts for two peons are the only sign of an establishment of any description.

Such is the project; but I find, after most attentive examination, that there are grave errors on three important points:—

- 1st.—Far too favourable data as to the yield of the gathering ground.
- 2nd.—Insufficient allowance for the loss of level between the issue of the water from the tank and its entrance into the Cantonment.
- 3rd.—Insufficient estimate for filtering beds.

I feel considerable diffidence at criticizing the scheme on purely engineering points, but the present case is a rather peculiar one, appertaining quite as much to the province of the Hydrologist as to that of the Engineer; I will, therefore, proceed to detail my objections to the scheme:—

(1.) The Chief Engineer of Mysore has taken the rainfall at the average of that of the lowest two successive years. But he has taken the surface yield of the gathering ground at 37 of the total rainfall, a proportion which, I submit, is largely in excess of what may be expected. It is admitted that very low proportions of yield must be taken "from such extremely friable and porous soil as that of the Bangalore water-shed;" yet a number is taken which I believe to be at least three times too large.

The Ulsoor tank has a gathering ground for storm waters of five square miles. I will, however, take only half of this, $2\frac{1}{2}$ square miles, the same as in the proposed water project; the gathering ground is of much the same character, sharply inclined, with good channels. I propose to compare the yield of this gathering ground during the year 1871 with that estimated in the gathering ground of the projected tank. I find that, though rain fell in thirty-two weeks of the year, in thirteen weeks only was there any perceptible rise of the tank (nothing under $\frac{1}{4}$ -inch of rise or fall being recorded), and that the sum of the total rises observed amounted to an average of 1.55 inch for each inch of rainfall, showing that the vast gathering ground of the tank yielded

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1st March 1872.*

little more than half of the water obtained from the rainfall on the surface of the tank; while in the proposed scheme the gathering ground is estimated to yield nearly thirty times as much as the actual rainfall on the tank. I find that so far from the total rainfall being admissible as a datum in the calculation, only 12 inches out of the total 29 yielded to the tank more than 1 inch for every inch of rainfall. I may divide the value of the rain as follows:—

12 inches, falling in showers, had individually no appreciable effect on the tank.

5 inches, falling in heavy showers, gave the tank five inches of rain in separately appreciable quantities.

12 inches, falling in heavy connected showers, gave the tank 33 inches of rain, or 21 inches from the gathering ground and 12 from direct rainfall.

Thus the whole profit from the annual rainfall on the gathering ground was 21 inches of rain. The tank being taken at 100 acres in extent, this gives a gain of 7,635,600 cubic feet from the gathering ground. Taking the latter at the low extent of $2\frac{1}{2}$ square miles, 12 inches of rain would give 69,813,200 cubic feet of rainfall on the surface.

From these figures, approximate it is true, but well within the limits of fair estimation, it may be concluded that the gathering ground of the Ulsoor tank yielded as surface drainage $\cdot 109$ of the heaviest showers, and nothing of other $\frac{1}{2}$ of the annual rainfall.

As an example of the absorbent powers of the soil for all but the heaviest rainfall, I will give the following:—

On July 8th there had been no rain for a week beyond a shower of $\cdot 035$ inch on that date.

In the ensuing weeks rain fell thus—	July 9th	
	„ 10th	 $\cdot 080$
	„ 11th	 $\cdot 720$
	„ 12th	 $\cdot 885$
	„ 13th	 $\cdot 020$
	„ 14th	 $\cdot 365$
	„ 15th	 $\cdot 975$, tank risen $2\frac{1}{2}$ inches.
	„ 16th	 $\cdot 020$
	„ 17th	
	„ 18th	 $\cdot 115$
	„ 19th	 $\cdot 030$
	„ 20th	 $\cdot 320$
	„ 21st	
	„ 22nd	 tank fallen 1 inch.

Total... 3.530

Thus, a total rainfall of $3\frac{1}{2}$ inches raised the tank $1\frac{1}{2}$ inch (evaporation during rainy weather is at the rate of $1\cdot 20$ inch a week); and the first week, in which there was heavy rain for four days, raised the level of the tank only $2\frac{1}{2}$ inches for upwards of 3 inches of rainfall.

I think these calculations prove that $\cdot 37$ is too favourable a fraction except for the heaviest possible rains, and that the amount of surface-yield from a given area cannot be foretold as it depends not upon the total rainfall, but upon the proportion of rainfall which comes down in heavy showers. Nothing under $1\frac{1}{2}$ inch of rain in 24 hours can, I consider, yield an appreciable proportion of surface drainage.

(1.) The evidence that the proposed tank would fill in a rather short rainy season seems, therefore, to be very unsatisfactory. I have shown that the Ulsoor tank derived, from $2\frac{1}{2}$ square miles (at the lowest computation) of gathering ground, little over $7\frac{1}{2}$ millions cubic feet of water. It does not, therefore, seem likely that the same extent of gathering ground can be relied on to yield annually the $61\frac{1}{2}$ millions cubic feet, which is the first element in the proposed water scheme.

(2.) Insufficient account has been taken of the loss of level of water during storage and filtration. The loss of head during storage in basins 12 feet deep cannot be less than 10 feet.

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Beside this, the loss of head in filtration is admitted to be 5 feet, and the fall in the mains 5 feet more, yet the outlet pipe being at 90 feet level, the floor of the tunnel through the Ooperhully ridge is to be at 83 feet level.

(3.) The filtering beds are 12,800 feet in surface, and it is calculated that filtration at the rate of 70 gallons in 24 hours through each square foot of filtering surface will yield the quantity of water required. The experience of the Ulsoor works, however, shows that the turbid water of Mysore tanks filters so slowly that each square foot yields little more than five gallons per 24 hours. The filter beds would have therefore to be made as least ten times larger than estimated, unless it can be shown that the water will be less turbid than that of the Ulsoor tank. The cost of working these filter beds would be very large.

These defects are so serious that the project as it now stands is impracticable; modifications might make it practicable but not without such an increase in the cost that would notably diminish its value, considering that its cheapness both in outlay and in working expenses is its chief recommendation.

In lieu of this I beg to submit the following project in which the outlay will be little (perhaps 10,000 Rupees) beyond the cost of municipal service pipes, and the working expenses reduced to a small sum per 1,000 gallons of water supplied.

I may premise that it is the application of the Ulsoor works to the water-supply of the Cantonment.

The Ulsoor water works extension project.—If pipes were laid from the Ulsoor works to the Dhobies' wells the engine could draw from them 20,000 gallons of water per diem. The filters, after repair of the leaky compartment, could filter 60,000 gallons—total possible yield at present 80,000 gallons.

The European troops require the following amount of water for all purposes:—

	Men.	Family people.	Horses.
Cavalry	450	180	450
Artillery	400	160	370
Infantry	900	360	...
	1,750	700	820

Total force to be supplied 3,270, at the rate of ten gallons a head per diem. And considering the small amount of water used by family people, it may be taken that 35,000 gallons per diem is a liberal estimate. This would leave 45,000 gallons available for the use of the Municipality.

The number of people to be provided for in the Cantonment probably does not exceed at present 50,000 in those populous districts to which water would be laid, i. e., the Cantonment bazaar, Shoolay, and Ulsoor, but 70,000 is a maximum estimate. I think that considering the habits of these people, three gallons a head for every man, woman and child is very liberal, and therefore the quantity supplied should be as near 200,000 gallons daily as is possible; nevertheless two gallons a head, or 140,000 gallons a day, would supply the people with the quantity strictly required for all cooking and drinking purposes.

I propose to build another filter at the Ulsoor works, capable of filtering 100,000 gallons per diem; there is ground available for the purpose. The expense I cannot estimate.

This is, however, not absolutely necessary. If the Ulsoor tank were restocked with water plants from Millers' and Koramunglum tanks, I believe that its present turbid condition would gradually cease, and the yield of the filters would increase from 60,000 gallons up to 240,000 gallons at least (ordinarily clear water would pass at the rate of 420,000 gallons). In the meantime I propose to allow the Municipality to take, by metre, at one anna per 1,000 gallons, from the barrack cisterns any quantity of water that can be spared; this I have estimated at 45,000 gallons daily. This would be sufficient at present for the supply of Ulsoor (from the Royal Horse Artillery cistern), and of Shoolay (from the Race course cistern). The Cantonment bazaar, including the Native Infantry, should be supplied for the next two or three years from the upper series of tanks. The

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capacity of these is 14 millions cubic feet, they might easily furnish six millions cubic feet annually, which would be at the rate 100,000 gallons per diem; they might even give double this quantity. The water is very clear and of good quality; a filter of small size (about 2,000 square feet) would render it perfectly fit for use, and it might be pumped up by a small engine (4-horse power) to the cistern about to be built at the Government Bakery. The outlay would be that necessary for—

- A filter bed 50 feet square.
- A small engine (portable).
- An engine-house of small dimensions.
- Laying one mile of 6-inch pipe (most of it in stock).

The establishment would be inexpensive. One European and a native stoker under the supervision of the Engineer in charge of the Ulsoor works. The monthly cost would be about Rupees 100, which would be at the rate of half an anna per thousand gallons of water.

As the Ulsoor tank water improved, this establishment would become unnecessary; it might however be kept up for the supply of water to the high ground, public offices, etc.

In conclusion, I may draw attention to the neglect in which the Ulsoor tank is fallen, and the necessity of keeping up this valuable source of water-supply. It should be stocked with water-plants, and the shallow parts dredged annually. For this purpose it should be put entirely under the charge of the Superintendent of the Ulsoor water works, who should be supplied with a dredging machine. The feeders along the Boderhully Valley require attention as they also are silting up, and the water does not come down so well as it might do.

BANGALORE,
18th December 1871.

(Signed) E. NICHOLSON, Assistant Surgeon,
Analyst of Waters, Mysore.

No. 2.

ORDER THEREON, 1st March 1872, No. 558.

MILITARY WORKS, No. 1.

As it is still a matter of uncertainty whether the water of the Ulsoor tank and the Dhobies' wells will suffice to meet the requirements of the troops throughout the year, the Government are not at present prepared to entertain the proposal to allow the Municipality to participate in the supply from those sources.

(True Extract.)

(Signed) J. CARPENDALE, Colonel, R.E.,
Secretary to Government.

To the Inspector-General of Hospitals, Indian Medical Department.

„ Superintending Engineer, 5th Division.

„ Military Department.

„ Public Dept.

Exd. S. T. Augustin.

N^o 8
Office of Inspector General M.D.
Fort Saint George 11 Jan'y 1872

From
The Inspector General of Hospitals
Indian Medical Department

To
The Secretary to Government.
Public Works Department

Sir,
In continuation of my letters

N^o 242 of 24th July 1871. N^o 285 of 29 August 1871. marginally noted, I have the honor to submit to His Excellency the Governor in Council a report by Assistant Surgeon Nicholson, on the best plan of water supply for Bangalore, including a supply for all military purposes.

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the necessity of providing a larger and purer supply, the Chief Engineer of the Province put forward a Scheme to meet the want, which has received the sanction of the Supreme Government, and will be carried out so soon as funds are available. In that sanctioned Scheme it is proposed to collect, and store in a tank, at a distance from the town, the rainfall on an area of $2\frac{1}{2}$ square miles, to filter the water as it is drawn from the tank, and finally to convey and distribute it by a system of pipes to the various parts of the town.

3 To this project Assistant Surgeon Nicholson offers several objections, which he briefly summarizes as follows, and which it may be thought desirable to communicate to the Mysore Government:

"a. Too low an estimate to the yield of the gathering ground."

"b. Insufficient allowance for the loss of level between the issue of the water from the tank and its entrance into the town."

"c. Insufficient estimate for filtering beds"

4 In support of the first objection, he contrasts the actual supply of water which enters the Ulsoor tank from a nearly corresponding area of gathering ground, with that which is anticipated by the Chief Engineer in his Scheme from a surface of $2\frac{1}{2}$ square miles, and he is of opinion that the calculations of the latter, on this point, require reconsideration.

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with water from the Nilsoor Tank and Rhobies wells. It is in effect that if pipes be laid from the Rhobies wells to the Nilsoor works, the Engines could raise from the wells 20000 gallons of water per diem, and as the existing filter beds would yield, on repair, 60000 gallons, the total probable yield would be 80000 gallons a day from the tank and wells. He calculates that the demands for military purposes would amount to about 35000 gallons per diem, and that the remaining 45000 gallons might be disposed of to the Municipality.

7. This scheme as compared with the other, has no doubt the recommendation of Economy, but before arriving at a definite conclusion as to eligibility, it appears to me, that the Engineering part of the question requires further and careful consideration.

8. Also, as regards the quantity of the water of the Nilsoor tank and the propriety of drawing the entire supply for the troops and civil population from it and the Rhobies wells, I refrain from offering any opinion until I have had the opportunity of seeing the report which

118-3
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- 2 Annually dredge the shallow parts
- 3 Place it in the charge of the Dept of water works
- 4 Attend to the Pederhully valley feeder

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Salubrity of the town of Bangalore
would be greatly improved by breaking
down the Ulsoor tank bund, and
allowing all the Valley water at
once to be drained off.

I have the honor to be

Sir

Your most Obedient Servant

C. W. Balfour Esq. General
Inspector of Hosp. and med. Dept.

Pro 24 Aug 72 R 325-327
" 8 Sept " 129-130

P. 7. 1872 Report
Proc of Govt March
No 169.

From.
The Inspector General
of Hospitals & M.
Departments

Dated 11th } Jan'y/72
Recd of 12th }
En: 1. No 8.

Forward report by and
Surg. Kishore on the
plan of water supply
for Bangalore.

No 1

No 558. 1st March/72

R.C. 20 Jan 1872 R 122
617 Jan 72 R 19m

Public Works Department
Proceedings of the Madras Government
No 558. 158
Read the following

From
The Inspector General
of Hospitals Indian
Medical Departt } (H.C. No 8 of 11 Jan'y/72)

As it is still a
matter of uncertainty
whether the water of the
Ulsoor Tank and the
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quirements of the Troops
throughout the year,
the Govt are not at
present prepared to
entertain the proposal
to allow the Municipality
to participate in the
supply from those sources,
nor do they consider it
at all expedient to
adopt

Walter Owen
Secy

adopt the suggestions
of the Inspector General
of Hospitals to break
down the Ulsoor Tank
bund and to allow all
the valley water to be
drained off.

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Inspector G. of Hospitals
Indian Med. Dept.
Repos Engrs 5th Bn
Mys Dept
Public Dept

Desp. 4/3/72

Letter from the Inspector General
of Hospitals, Indian Medical Department
dated 11th January 1872, with report from
Assistant Surgeon Nicholson, dated 18th
December 1871.

I think we should not
encourage the project. The Ulsoor
Tank is still of doubtful quality. The
hills are not very productive. Both
sources of supply are quite small
drips alone.

I would not account the
Municipality up to a share in
the Ulsoor Tank project until
we find that the locality is
suitable for the growth of crops
the year. There is some doubt
as to the plan proposed by S. H. H. H.
in the last para of his letter under
all conceivable circumstances.

The foregoing papers
are circulated in con-
nection with the
plans and estimates
for the Ulsoor and
Shobier Wells projects
now in circulation.

Jan: 15th

[Signature]

1/2/69

G.O. of 1872 Madras.

PUBLIC WORKS.

To The Inspector-General of
Hospitals Indian
Medical Dept.

Dated

Recd.

Encl. 1

G. O. of 1872 No. 558.

Nos. 1 & 2

Uleer Tank & Dohies Well

The proposal to allow the
Municipality of Bangalore
to participate in the supply
of water from the
Uleer Tank & Dohies
Wells, declined.

Recd. 1/2/69 22nd
1/2/69 1/2/69