[L. & M. 5,000—5-4-97.]

8/12/13

Local & Munl. (1898) Department.

MISCELLANEOUS.

G.O., No. 1031/98.

DATED 8-6-98

[Despatch Abstract.]

Tuticorin Water Supply Scheme.—

Stating with remarks that Government can do nothing with regard to the——— until its financial position is clearer and requesting the Sanitary Engineer to State what progress has been made in the preparation of the cheap granulation Scheme referred to in his letter No 2741 of 4th Sept 1896

Sanitary Engineer to Government

BACK PAPERS.

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

FURTHER PAPERS.

G.O.	No.	Department.	Date.	G.O.	No.	Department.	Date.
Circ 2042 in/98							
Circ 2627 in/98							

[L. & M., 1,000—28-10-96.]

Local & Munl. (1896) Department.

CURRENT No. 3174 M

Order

From The Sanitary Board.

No. 2638

Dated 21-11-96

Received 26-11-96

Registered 26-11-96

Enclosures 16

Spare copies

SUBJECT.

Regarding Interim Water Supply scheme.

BACK PAPERS.

G.O.	No.	Department.	Date.
[illegible]	1698	[illegible]	[illegible]-96
[illegible]	1571	[illegible]	[illegible]-96
[illegible]	1537	[illegible]	[illegible]-96
[illegible]	1277	[illegible]	[illegible]-96
[illegible]	998	[illegible]	[illegible]-96
[illegible]	847	[illegible]	[illegible]-96
[illegible]	436	[illegible]	[illegible]-96
[illegible]	435	[illegible]	[illegible]-96
[illegible]	25	[illegible]	[illegible]-96
[illegible]	1622	[illegible]	[illegible]-95

FURTHER PAPERS.

G.O.	No.	Department.	Date.
[illegible]	180	[illegible]	6-2-95
[illegible]	1025	[illegible]	3-6-94
[illegible]	919	[illegible]	17-7-94
[illegible]	1061	[illegible]	10-8-94
[illegible]	159	[illegible]	16-2-94
[illegible]	1705	[illegible]	9-12-93
[illegible]	155	[illegible]	1-9-93
[illegible]	1498	[illegible]	16-9-92
[illegible]	842	[illegible]	17-5-92
[illegible]	718	[illegible]	21-4-92
[illegible]	622	[illegible]	29-3-92
[illegible]	25	[illegible]	6-1-92
[illegible]	773	[illegible]	16-5-90

Tanbaram Scheme

Abstract of Detailed Estimate No. 9, dated 27th July 1893, for the construction of Water Works for the town of Tuticorin.

Quantity.	Description of Work.	Rate. Rs.	A.	P.	Per	Amount. Rs.	A.	P.	Total. Rs.	A.	P.
	Constructing double Pipes and Valve house at the head of Masonry Conduit										
46,657	C.ft. Earthwork in opening and closing the bunds	4	10	..	c.ft. 1000	216	..	..			
880	.. .. Concrete in surki	12	..	..	100	106	..	..			
5603	.. .. Brick in surki	24	4	..	..	1359	..	..			
557	.. .. Brick in chunam	22	4	..	..	124	..	..			
23	.. .. Archwork in chunam	25	..	..	..	6	..	..			
1508	Sq. ft. Plastering with cement	12	10	..	Sqre	190	..	..			
728	.. .. .. chunam 2 coats	3	8	..	..	26	..	..			
43	.. .. Cut stone work	2	..	..	c.ft.	86	..	..			
45	.. .. Teakwood wrought & put up	3	10	..	..	163	..	..			
140	Sq.ft. Roofing with Mangalore tiles and teak reepers	24	8	..	Sqre	34	..	..			
30	.. .. Doors, batten with frames hinges, bolts &c complete	1	8	..	S.ft.	45	..	..			
22	.. .. Windows with glazed and venetianed shutters iron bars &c complete	1	12	..	..	39	..	..			
100	L.ft. Ornamental barge board	1	4	..	R.ft.	125	..	..			
104	S.ft. Painting with Carson's Oak paint 2 coats	3	..	..	Sqre	3	..	..			
500	.. .. Wood oiling 2 coats	1	8	..	..	8	..	..			
1	No. Wooden finial	5	..	..	Each	5	..	..			
	Carried on					2535	..	..			
									Grand Total of Estimate ..		

Office of Sanitary Engineer to Government,
Fort St. George, 1893.

Sanitary Engineer to Government.

Abstract of Detailed Estimate No. 9, dated 27th July 1893, for the construction of Water Works for the town of Tuticorin.

Quantity.	Description of Work.	Rate. Rs.	A.	P.	Per	Amount. Rs.	A.	P.	Total. Rs.	A.	P.
	Brought forward					2535	..	..			
4	Nos. Iron finials	5	..	..	each	20	..	..			
1	.. Wooden trap door with iron fittings &c complete to fix on the top of the rear cistern				Sum	35	..	..			
704	C.ft. Puddling	3	8	..	c.ft 100	25	..	..			
5	Tons. Cast Iron Pipes	113	..	..	Ton	565	..	..			
	L.ges Laying and jointing				Sum	100	..	..			
7½	Cwts Bends	10	4	..	Cwt	77	..	..			
4	Nos. 18" Valves including fixing charges	330	..	..	each	1,320	..	..			
1	Special casting of cast Iron stand pipes with branches complete as per drawing				Sum	500	..	..			
3	Lifting gearing for 18" sluice valves including stand post &c complete	200	..	..	each	600	..	..			
	Demolishing the existing sluice				Sum	200	..	..			
	Ring bund and baling during construction				..	500	..	..			
	Petty charges				..	128	..	..			
									6605	..	..
	Masonry conduit										
183705	C.ft Earthwork in excavation	4	10	..	c.ft 1,500	849	..	..			
	Carried over					849	..	..	6605	..	..

Grand Total of Estimate ...

Office of Sanitary Engineer to Government,
Fort St. George, 27 - 7 - 1893.

Sanitary Engineer to Government.

Abstract of Detailed Estimate No. 9, dated 27th July 1893, for the construction of Water Works for the town of Tuticorin.

Quantity.	Description of Work.	Rate. Rs.	A.	P.	Per	Amount. Rs.	A.	P.	Total. Rs.	A.	P.
	Brought forward					849	..	..	6605	..	..
123098	C.ft. Concrete in Surki mortar	13	..	..	C.ft. 100	16003	..	..			
54541	" — Brick in Surki mortar	26	..	..	"	14181	..	..			
121550	S.ft. Plastering with cement ½" thick	6 8 / 10 5	..	..	Sqre	12535	..	..			
42	Nos. Cuddapah slabs 1'x1'x4" set in Surki	-	12	..	each	32	..	..			
	Petty charges					872	..	..			
									44472	..	..
	Clear water Reservoir										
180925	C.ft. Earthwork in excavation and filling in	2 12 / 6 ..	..	..	C.ft 1000	1086	..	..			
24477	" — Concrete in cement	45	..	..	100	11015	..	..			
11000	" — Bricks ordinary, in Surki	26	..	..	"	2860	..	..			
12245	" — Archwork ganged brick in Surki	28	..	..	"	3429	..	..			
64	" — Cut Stone work	2	..	..	c.ft	128	..	..			
25700	S.ft. Plastering with cement	6 8 / 12 ..	..	..	Sqre	3084	..	..			
8	Nos. Iron covers to manhole	35	..	..	each	280	..	..			
8	" — Ventilators	7	..	..	"	56	..	..			
8	" — Iron ladders 12 ft. long	24	..	..	"	192	..	..			
4	" — 14" Sluice valves	200	..	..	"	800	..	..			
2	" — 6" Sluice valves	52	..	..	"	104	..	..			
4	Tons Cast Iron Pipes	110	..	..	Ton	440	..	..			
	Carried over					23474	..	..	51077	..	..
	Grand Total of Estimate ..										

Office of Sanitary Engineer to Government,
Fort St. George, 27-7-1893.

Sanitary Engineer to Government.

Abstract of Detailed Estimate No. 9, dated 27th July 1893, for the construction of Water Works for the town of Tuticorin.

Quantity.	Description of Work.	Rate. Rs.	A.	P.	Per	Amount. Rs.	A.	P.	Total. Rs.	A.	P.
	Brought forward					23,474	"	"	51,077	"	"
58	L. yards Laying and jointing	2	"	"	L.yd	116	"	"			
2	Nos Equilibrium Valves	360	"	"	each	720	"	"			
1.75	Tons 6" Cast Iron Pipes to connect with the Stoneware pipe drain	110	"	"	Ton	193	"	"			
50	Lineal yards Laying and jointing 6" cast Iron pipes	1	"	"	L.yd	50	"	"			
5	Cwts Cast Iron Specials	10	"	"	Cwt	50	"	"			
2	6" Scour Valves	52	"	"	each	104	"	"			
800	Lineal feet Stone-ware pipe for drains from reservoir and including laying	1	"	"	L.ft	800	"	"			
2	Covers for overflow pipes	100	"	"	each	200	"	"			
	Petty charges					512	"	"			
									26,219	"	"
	Carried over								77,296	"	"

Grand Total of Estimate ..

Office of Sanitary Engineer to Government,
Fort St. George, 27-7-1893.

Sanitary Engineer to Government.

Abstract of Detailed Estimate No. 9 , dated 27th July 1893, for the construction of Water Works for the town of Tuticorin

Quantity.	Description of Work.	Rate. Rs.	A.	P.	Per	Amount. Rs.	A.	P.	Total. Rs.	A.	P.
	Brought forward								77296	-	-
	Engine and Boiler House										
205	c. yds Earthwork in excavating pump well in excavation	1	8	-	c. yd	308	-	-			
173	" in excavation in walls of the building	-	3	-	"	32 33	-	-			
67	" in filling basement	-	2	-	"	8	-	-			
476	c. ft concrete in cement	45	-	-	c. ft 100	214	-	-			
1053	" " in surki	14	-	-	"	147	-	-			
1395	" Brick ordinary in cement	45	-	-	"	628	-	-			
55	" Ganged brick in cement	50	-	-	-	28	-	-			
4408	" Brick ordinary in chunam	24	-	-	-	1058	-	-			
95	" Ganged brick in chunam for archwork	27	-	-	"	26	-	-			
	Carried over					2449 2450	-	-	77296	-	-
									Grand Total of Estimate ..		

Office of Sanitary Engineer to Government,
Fort St. George, 27-7- 1893.

Sanitary Engineer to Government.

Abstract of Detailed Estimate No. 9, dated 27th July 1893, for the construction of Water Works for the town of Tuticorin

Quantity.	Description of Work.	Rate. Rs.	A.	P.	Per	Amount. Rs.	A.	P.	Total. Rs.	A.	P.
	Brought forward					2449 2450	..	..	77,296	..	..
112¼	C.ft Cut Stone work	2	..	..	C.ft	225	..	..			
1800	S.ft Plastering with cement 2 coats	12	..	..	Sqre	216	..	..			
2300	" " " "										
	of chunam	3	..	..	..	69	..	..			
16¼	" Flooring with Burn & Co's patent chequered tiles over 6" concrete	87	8	..	..	1422	..	..			
2800	" Roofing with mangalore tiles and teak reepers	24	..	..	..	672	..	..			
200¼	C.ft Teak wood wrought and put up	3	8	..	C.ft	701	..	..			
208	S.ft Batten doors with frames, hinges, bolts & complete	1	12	..	S.ft	364	..	..			
441	" Venetianed doors and windows with frames hinges, bolts & complete	2	..	..	..	882	..	..			
245	R.ft Eaves board	..	8	..	R.ft	123	..	..			
110	" Stencil painting	..	8	..	..	55	..	..			
2,100	S.ft Wood oiling	1	8	..	Sqre	31 52	..	..			
2700	" Painting 2 coats	3	..	..	..	81	..	..			
4	Nos Finials	10	..	..	each	40	..	..			
	Baling during construction				Sum	500	..	..			
	Petty charges					156	..	..	7987	..	..
	Wood and Store Shed					2000	..	..	2000	..	..
	Carried over								87,283	..	..

Grand Total of Estimate ..

Office of Sanitary Engineer to Government,
Fort St. George, 27-7- 1893.

Sanitary Engineer to Gov

Abstract of Detailed Estimate No. 9 , dated 27th July 1893 , for the construction of Water Works for the town of Tuticorin

Quantity.	Description of Work.	Rate. Rs.	A.	P.	Per	Amount. Rs.	A.	P.	Total. Rs.	A.	P.
	Brought forward								87,283	..	..
	Compensation Fencing &c										
6.00	acres compensation for land for Engine House &c	200	..	..	Acre	1,200	..	..			
600	L.ft Forming Road				Sum	500	..	..			
	Fencing the compound of Engine House &c				Do	1,000	..	..			
									2,700		
	Engine, Pumps and Boilers										
18 HP	Two Worthington Engines of 9 H.P each with pumps boilers &c including erection	1,700	..	..	H.P each	30,600	..	..			
									30,600	..	..
	Supply and Delivery of Pipes										
474	Tons of Cast Iron pipes turned and bored, Spigot and faucet	110	..	..	Ton	52,140	..	..			
172	Cwts Bends	10	..	..	cwt	1,720	..	..			
138	— Do — Branches	10	..	..	Do	1,380	..	..			
26	— Do — Taper pipes	10	..	..	Do	260	..	..			
19	— Do — collars	10	..	..	Do	190	..	..			
	Valves, Stop cocks, hydrants and Stand pipes &c					4,501	..	..			
10	Nos Two lips pillar fountains	150	..	..	each	1,500	..	..			
18	Nos Single Wall lips Fountains	97	..	..	Do	1,746	..	..			
	Carried over					63,437			120,583		

Grand Total of Estimate ..

Office of Sanitary Engineer to Government,
Fort St. George, 27-7-1893.

Sanitary Engineer to Government.

Abstract of Detailed Estimate No. 9, dated 27th July 1893, for the construction of Water Works for the town of Tuticorin.

Quantity.	Description of Work.	Rate. Rs.	A.	P.	Per	Amount. Rs.	A.	P.	Total. Rs.	A.	P.
	Brought forward					63437	-	-	120583	-	-
10	Nos Double wall tap Fountains	204	-	-	each	2040	-	-			
110	Nos Surfaces boxes					728	-	-			
	Extras, Pipe and fittings					1914	-	-			
	Petty charges					1361	-	-			
									69480		
	Laying and jointing pipes										
	Excavation for cast Iron pipes (3740?) Lft.					3528	-	-			
	— do — do W. I pipes (2004) L. ft.					24	-	-			
11220	L. yds of Laying and jointing C. I. turned and bored pipes					5176	-	-			
1249	L. yds of — do — C. I Spigot and faucet pipes					1011	-	-			
668	L. yds of — do — W. I pipes					167	-	-			
	Fixing complete with masonry 44 Sluice valves on mains and branches					664	-	-			
	— do — 19 hydrants with valves, branches &c					494	-	-			
	— do — 2 - 2½" air valves — do —					74	-	-			
	— do — 5 - 1¼" — do —					105	-	-			
	Carried over					11243	-	-	190063		
	Grand Total of Estimate ..										

Office of Sanitary Engineer to Government,
Fort St. George, 27-7-1893.

Sanitary Engineer to Government.

Abstract of Detailed Estimate No. 9, dated 27th July 1893, for the construction of Water Works for the town of Tuticorin.

Quantity.	Description of Work.	Rate. Rs.	A.	P.	Per	Amount. Rs.	A.	P.	Total. Rs.	A.	P.
	Brought forward					11,243	-	-	190063	-	-
18	Nos erecting Single Water tap fountains					990	-	-			
10	Nos. — do — double — do —					680	-	-			
10	Nos — do — Pillar — fountains					820	-	-			
	Petty charges					267	-	-			
									14000	-	-
									204063	-	-
	Contingencies at 15% including cost of establishment								30607	-	-
	Grand Total of Estimate ..								234670	-	-

Office of Sanitary Engineer to Government,
Fort St. George, 27-7- 1893.

Sanitary Engineer to Government.

Sanitary Engineer to Government.

Partial Scheme

Abstract of Detailed Estimate No. 9, dated 27th July 1893, for the Construction of Water Works for the town of Tuticorin.

Quantity.	Description of Work.	Rate. Rs.	A.	P.	Per	Amount. Rs.	A.	P.	Total. Rs.	A.	P.
	Constructing outlet pipes and Valve house at the head of masonry conduit					6605	..	..			
	Masonry conduit					44472	..	..			
	Clear Water Reservoir					26219	..	..			
	Engine and boiler house					7987	..	..			
	Wood and storeshed					2000	..	..			
	Compensation for Land fencing &c					2700	..	..			
	Engines, Pumps and Boilers					30600	..	..			
	Supply and delivery of pipes					69480	..	..			
	Laying and Jointing pipes					14000	..	..			
	Contingencies at 15 %					30607	..	..			
									234670		
	Grand Total of Estimate ..					234670	..	..			

Office of Sanitary Engineer to Government,
Fort St. George, 27-7- 1893

Sanitary Engineer to Gover

Partial Scheme

Enclosure to Letter No. 1538 Dt. 893

GOVERNMENT OF MADRAS.

SANITARY ENGINEER'S DEPARTMENT.

Abstract ~~Specification and Detailed~~ Estimate No. 9

of 1893-94 of the cost of constructing

Water Works

for the town

of Tuticorin

Amount of Estimate No. 9

Rs. 2,34,670.

Covering letter No. 1538 dated 27th July 1893,

Tuticorin Water Supply Scheme.

Abstract of Detailed Estimate No. 8 , dated 27:7-93 , for the

Details ~~construction~~ of Cast Iron Pipes & Valves.

Quantity.	Description of Work.	Rate. Rs.	A.	P.	Per	Amount. Rs.	A.	P.	TOTAL. Rs.	A.	P.
	Inc. ewk										
70-4	14" C.I. pipes . 1,300 feet										
75-19	12" do 2,202 "										
29-18	10" do 1170 "										
53-17	9" do 2,331 "										
3-12	8" do 201 "										
23-13	7" do 1471 "										
32-11	6" do 2,176 "										
18-13	5" do 2,085 "										
34-3	4" do 5211 "										
91-10	3" do 13,120 "										
3-8	2½" do 756 "										
437-8	Total										
14-15	Add for deviation in weight.										
21-17	Add 5% for breakage										
474-4	Total	110	-	-	Ton	52,140	-	-	52,140	-	-
2c. 2	4" sluice valve, double-faced	200	-	-	Each	400	-	-			
1	12" do do	150	-	-	"	150	-	-			
1	10" do do	110	-	-	"	110	-	-			
1	9" do do	90	-	-	"	90	-	-			
2	7" do do	65	-	-	"	130	-	-			
2	6" do do	52	-	-	"	104	-	-			
2	5" do do	40	-	-	"	80	-	-			
3	4" do do	35	-	-	"	105	-	-			
30	3" do do	25	-	-	"	750	-	-			
21	2½" (a) do do	22	-	-	"	462	-	-			
					Carried over	2,381	-	-			

Tuticorin Water Supply Scheme.

Abstract of Detailed Estimate No. 8, dated 27-7-93, for the ~~construction~~ Details of Cast Iron Pipes & Valves.

Quantity.	Description of Work.	Rate. Rs.	A.	P.	Per	Amount. Rs.	A.	P.	Total. Rs.	A.	P.
	Brought forward					2,381	-	-			
Nos.											
38	2" (b) Gun metal stop cocks	35	-	-	Each	1330	-	-			
6	1¼" (c) Stop ferrules with covers	14	-	-	"	70	-	-			
5	1¼" Air valves	6	-	-	"	30	-	-			
2	2½" Air valves	17	-	-	"	34	-	-			
19	2½" Hydrants with Surface box attached	25	-	-	"	474	-	-			
2	2½" copper stand pipes with 10 feet of hose & one brass coupling complete	81	-	-	"	162	-	-			
									4501	-	-
	Grand Total of Estimate ..										

Office of Sanitary Engineer to Government,
Fort St. George, 27-7-1893.

Sanitary Engineer to Government.

Abstract of Detailed Estimate No. 8 , dated 27 - 7 - 93 , for the construction of Water Works for the town of Tuticorin.

Quantity.	Description of Work.	Rate. RS.	A.	P.	Per	Amount. RS.	A.	P.	TOTAL. RS.	A.	P.
	Constructing outlet pipes & Valve house at the head of Masonry conduit.										
46,657	cft. Earthwork in opening & closing the bund	4	10	-	1000 cft	216	-	-			
879	cft. concrete in durki	12	-	-	100	106	-	-			
5,603	" Brick in durki	24	4	-	"	1,359	-	-			
557	" Brick in chunam	22	4	-	"	124	-	-			
23	" Archwork in chunam	25	-	-	"	6	-	-			
1,508	sft. Plastering with cement	12	10	-	Sqre	170	-	-			
728	" Plastering with chunam 2 coats	3	8	-	"	26	-	-			
43	cft. Cut Stone work	2	-	-	cft	86	-	-			
45	" Teakwood wrought & put up	3	10	-	"	163	-	-			
140	sft. Roofing with Mangalore tiles & teak reepers	24	8	-	Sqre	34	-	-			
30	" Doors batten with frames hinges, bolts &c complete	1	8	-	Sft	45	-	-			
22	sft. Windows with glazed & venetianed shutters, iron bars &c complete	1	12	-	"	39	-	-			
100	Lft. Ornamental barge board	1	4	-	Rft	125	-	-			
104	sft. Painting with Carson's oak paint, 2 coats	3	-	-	Sqre	3	-	-			
500	" Wood oiling, 2 coats	1	8	-	"	8	-	-			
1	No. Wooden finial	5	-	-	Each	5	-	-			
4	" Iron finials	5	-	-	"	20	-	-			
	Carried over					2,555	-	-			
	Grand Total of Estimate ..										

OFFICE OF SANITARY ENGINEER TO GOVERNMENT,
Fort St. George, 27 - 7 - 1893.

Sanitary Engineer to Government.

Sanitary Engineer to Government.

Abstract of Detailed Estimate No. 8, dated 27-7-93, for the construction of *Water Works* for the town of *Tuticorin*.

Quantity.	Description of Work.	Rate. Rs.	A.	P.	Per	Amount. Rs.	A.	P.	Total. Rs.	A.	P.
	Brought forward					2,533	-	-			
1	1st Wooden trap door with iron fittings &c complete to fix on the top of the pear cistern				Sum	35	-	-			
704	Sqft. Pudding	3	8	-	Cft 100	25	-	-			
5	Tons. Cast Iron pipes	113	-	-	Ton	565	-	-			
	Lyds: Laying & Jointing				Sum	100	-	-			
7½	cwts. Bends	10	4	-	cwts	77	-	-			
4	Nos: 18" Valves including fixing charges	330	-	-	Each	1320	-	-			
1	Special casting of C.I. Stand pipes with branches complete as per drawing				Sum	500	-	-			
3	Lifting Gearing for 18" sluice valves including stand post &c complete	200	-	-	Each	600	-	-			
	Demolishing the existing sluice				Sum	200	-	-			
	Ring bund & baling during construction				"	500	-	-			
	Petty charges					130 128	-	-	6,605	-	-
	Alterations to the existing Irrigation Sluices.										
942	Sqft. Brick in Surki	24	4	-	100 Sqft	228	-	-			
240	Sqft. Plastering with cement	12	10	-	Sqyd	30	-	-			
	Carried over					258	-	-	6,605	-	-
	Grand Total of Estimate ..										

Office of Sanitary Engineer to Government,
Fort St. George, 27-7-1893.

Sanitary Engineer to Government.

Sanitary Engineer to Government.

Abstract of Detailed Estimate No. 8 , dated 27 - 7 - 93 , for the construction of Water Works for the town of Tuticorin.

Quantity.	Description of Work.	Rate. Rs.	A.	P.	Per	Amount. Rs.	A.	P.	Total. Rs.	A.	P.
	Brought forward					258	-	-	6605	-	-
900	Cft. Rough stone work	10	-	-	Cft 100	90	-	-			
10,760	" Earthwork in raising bund	4	10	-	1000	50	-	-			
3	Tons C.I. Pipes 18"	113	-	-	Ton	339	-	-			
1	18" Valve including fixing charges	330	-	-	Each	330	-	-			
	Dismantling the rear wing and cistern				Sum	25	-	-			
	Wooden cover to valve pit 3 3				"	35	-	-			
	Laying & Jointing pipes				"	50	-	-			
	Petty charges				"	23	-	-	1,200	-	-
	Constructing the Irrigation Sluice										
46685	Cft. Earthwork in excavation	4	10	-	Cft 1000	216	-	-			
717	" Concrete in surki	12	-	-	100	86	-	-			
3538	" Brick in surki	24	4	-	"	858	-	-			
61	" Cut stone work	2	-	-	Cft	122	-	-			
1109	Sft. Plastering with Surki	5	-	-	Sqre	55	-	4			
68	Cft. Arch work (brick in surki)	26	-	-	Cft 100	18	-	-			
195	" Rough stone work	10	-	-	"	20	-	-			
1845	" Puddle wall	35	-	-	"	65	-	-			
1	No. Teak wood plug with lifting gearing &c complete				Sum	100	-	-			
1	No. Teak wood shutter with lifting rod &c complete					50	-	-			
	Rig bund & baling during construction					500	-	-			
	Petty charges					57	-	-	2,147	-	-
	Carried over								9,952	-	-

Grand Total of Estimate ..

Office of Sanitary Engineer to Government

Fort St. George, 27 - 7 - 1893.

Sanitary Engineer to Government.

Abstract of Detailed Estimate No. 8 , dated 27 - 7 - 93 , for the construction of Water Works for the town of Tuticorin.

Quantity.	Description of Work.	Rate. Rs.	A.	P.	Per	Amount. Rs.	A.	P.	Total. Rs.	A.	P.
	Brought forward								9,952	-	-
	Reserve Tank.										
1617030	Cft. Earthwork in excavating the tank and forming embankment	6	8	-	Cft. 1000	10,524	-	-			
1617030	Cft. Sectioning, shaping, forming & levelling embankment	2	5	-	"	3,119	-	-			
181710	Cft. Puddle wall	3	8	-	100	6,367	-	-			
259000	Sft. Turfing slopes including watering for 3 months	-	12	-	Sqre	1,943	-	-			
	Petty charges					450	-	-	23028 22,403	-	-
	Outlet pipes & valve house in the Reservoir Tank.										
2,977	Cft. Earthwork in excavation	4	10	-	Cft. 1000	14	-	-			
647	" Concrete in work	12	-	-	100	78	-	-			
4060	" Brick in work	244	-	-	"	985	-	-			
557	" Brick in chunam	224	-	-	"	124	-	-			
23	" Arch work in chunam	25	-	-	"	6	-	-			
1,080	Sft. Plastering with cement	12	10	-	Sqre	136	-	-			
728	" Plastering with chunam 2 coats	3	8	-	"	26	-	-			
43	Cft. Cut stone work	2	-	-	Cft	86	-	-			
45	" Teak wood wrought & put up	3	10	-	"	163	-	-			
140	Sft. Roofing with Mangalore tiles & teak reepers	24	8	-	Sqre	34	-	-			
30	Sft. Doors batten with frames hinges, bolts &c complete	1	8	-	Sft	46	-	-			
	Carried over					1697	-	-	32,980 32,365	-	-

Grand Total of Estimate ..

Office of Sanitary Engineer to Government,
Fort St. George, 27 - 7 - 1893.

Sanitary Engineer to Government.

Abstract of Detailed Estimate No. 8 , dated 27 - 7 - 93 , for the construction of Water Works for the town of Tuticorin.

Quantity.	Description of Work.	Rate. Rs.	A.	P.	Per	Amount. Rs.	A.	P.	Total. Rs.	A.	P.
	Brought forward					1,697	-	-	32,355	-	-
									32980		
22	Sft. Windows with glazed & venetianed shutters, iron bars &c complete	1	12	-	Sft	39	-	-			
100	Lft. Ornamental barge board	1	4	-	Lft	125	-	-			
104	Sft. Painting with Lorbond's oak paint, 2 coats	3	-	-	Sqre	3	-	-			
500	Sft. Wood oiling; 2 coats	1	8	-	"	8	-	-			
1	No. Wooden finial	5	-	-	Each	5	-	-			
4	" Iron finials	5	-	-	"	20	-	-			
3·5	Tons. C.I. Pipes	113	-	-	Ton	395	-	-			
	Laying & jointing pipes				Sum	100	-	-			
7½	Cwts. Bends	10	4	-	Cwt	77	-	-			
4	No. 18" valves including fixing	330	-	-	Each	1,320	-	-			
1	Special casting of Cast Iron standard pipes with branches complete				Sum	600	-	-			
3	Lifting gearing for for 18" sluice valves including standard post &c complete	200	-	-	Each	600	-	-			
	Petty charges					88	-	-	4,977	-	-
	Masonry Conduit										
183,705	Cft. Earthwork in excavation	2 14	4	10	-	Cft 1000	847	-	-		
123,098	" Concrete in surki mortar	12 13	-	-	-	100	16,003	-	-		
54,541	" Brick in surki mortar	26	-	-	-	"	14,181	-	-		
121,550	Sft. Plastering with cement ½" thick	6 3	10	5	-	Sqre	12,535	-	-		
	Carried over						43,568	-	-	37,332	-
										37957	
	Grand Total of Estimate ..										

Office of Sanitary Engineer to Government,
Fort St. George, 27 - 7 - 1893.

Sanitary Engineer to Government.

Abstract of Detailed Estimate No. 8 , dated 27-7-93 , for the construction of Water Works for the town of Tuticorin.

Quantity.	Description of Work.	Rate. Rs.	A.	P.	Per	Amount. Rs.	A.	P.	Total. Rs.	A.	P.
									37,957		
	Brought forward					43,568	-	-	37,332	-	-
42	Nos. Cuddapah slabs 1x1'x4" set in surkhi	-	12	-	Each	32	-	-			
	Petty charges					872	-	-	44,472	-	-
	Filter Bed										
209,602	Cft. Earthwork in excavation	-	6	-	1000 cft	1,258	-	-			
5,771	" Puddle ~~wall~~ work	3	8	-	100	202	-	-			
23032	" Concrete in cement	45	-	-	"	10,364	-	-			
23430	" Brick in surkhi	26	-	-	"	6,092	-	-			
168	" Archwork in surkhi	28	-	-	"	44	-	-			
192	Sqrs. Plastering with cement 3/4" thick	12	-	-	Sqre	2,304	-	-			
112	" " " 1/2 thick	7	2	-	"	840	-	-			
5420	Rft. Drainage tiles	1	-	-	Rft	5420	-	-			
15709	Cft. Gravel filling	6	-	-	100 cft	943	-	-			
10505	" Coarse sand filling	3	-	-	"	315	-	-			
21222	" Fine sand filling	3	-	-	"	637	-	-			
560	Sft. Copper wire netting screen	1	-	-	Sft	560	-	-			
8	Nos. 10" Valves including fixing	110	-	-	Each	880	-	-			
10	Tons. Cast Iron pipes	110	-	-	Ton	1,100	-	-			
52.32	Cwts. Bends V, branches	10	-	-	Cwt	523	-	-			
4	Nos. 6" Sluice valves	52	-	-	Each	208	-	-			
276	Lyds. Laying & jointing	2	-	-	Lyd	552	-	-			
	Petty charges					644	-	-	32,886	-	-
									115315		
	Carried over								114,690	-	-

Grand Total of Estimate ..

Office of Sanitary Engineer to Government,
Fort St. George, 27-7-1893.

Sanitary Engineer to Government.

Abstract of Detailed Estimate No. 8 , dated 27 - 7 - 93 , for the construction of Water Works for the town of Tuticorin.

Quantity.	Description of Work.	Rate. Rs.	A.	P.	Per	Amount. Rs.	A.	P.	Total. Rs.	A.	P.
	Brought forward								1,14,690	-	-
	Clear-water reservoir								115315		
180,725	Cft. Earthwork in excavation & filling in	6	-	-	Cft 1000	1086	-	-			
24,477	" Concrete in cement	45	-	-	100	11,015	-	-			
11,000	" Bricks ordinary in Surki	26	-	-	"	2860	-	-			
12,245	" Archwork gauged brick in Surki	28	-	-	"	3429	-	-			
64	" Cut stone work	2	-	-	Cft	128	-	-			
25,737	Sft. Plastering with cement	12	-	-	Sq.re	3088	-	-			
8	Nos. Iron covers to manhole	35	-	-	Each	280	-	-			
8	" Ventilators	7	-	-	"	56	-	-			
8	" Iron ladders 12 ft. long	24	-	-	"	192	-	-			
4	" 14" Sluice valves	200	-	-	"	800	-	-			
2	" 6" sluice valves	52	-	-	"	104	-	-			
4	Tons. Cast Iron pipes	110	-	-	Ton	440	-	-			
56	Lyds. Laying & Jointing	2	-	-	Lyd	116	-	-			
2	Nos. Equilibrium valves	360	-	-	Each	720	-	-			
1·75	Tons. 6" C.I. Pipes to connect with the stoneware pipe drain	110	-	-	Ton	193	-	-			
50	Lyds. Laying & Jointing 6" C.I. pipes	1	-	-	Lyd.	50	-	-			
5	cwt. C.I. Specials	10	-	-	cwt	50	-	-			
2	Nos. 6" scour valves	52	-	-	Each	104	-	-			
	Carried over					24704	-	-	1,14,690	-	-

Grand Total of Estimate ..

Office of Sanitary Engineer to Government,
Fort St. George, 27 - 7 - 1893.

Sanitary Engineer to Government.

Abstract of Detailed Estimate No. 8 , dated 27-7-93. , for the construction of Water Works for the town of Tuticorin.

Quantity.	Description of Work.	Rate. Rs.	A.	P.	Per	Amount. Rs.	A.	P.	Total. Rs.	A.	P.
	Brought forward					24711			115315		
800	Lft. Stoneware pipe for drains from reservoir & including laying	1	"	"	Lft	800	"	"			
2	Nos. Covers for overflow pipes	100	"	"	Each	200	"	"			
	Petty charges					512	"	"	26223 26219	"	"
	Engine & Boiler House										
205	byds. Earthwork in excavating pump well	1	8	"	Cyd	308	"	"			
173	" Earthwork in excavation in walls of the building	"	3	"	"	33	"	"			
67	" Earthwork in filling basement	"	2	"	"	8	"	"			
476	Cft. Concrete in cement	45	"	"	100cft	214	"	"			
1,053	" ——— " ——— in Surki	14	"	"	"	147	"	"			
1,395	" Brick, ordinary, in cement	45	"	"	"	628	"	"			
55	" Gauged brick in cement	50	"	"	"	28	"	"			
4,408	" Bricks, ordinary, in chunam	24	"	"	"	1,058	"	"			
95	" Gauged brick in chunam for archwork	27	"	"	"	26	"	"			
112¼	Cft. Cut stone work	2	"	"	Cft	225	"	"			
1,800	Sft. Plastering with cement	12	"	"	Sqre	216	"	"			
2,300	" " with 2 coats of chunam	3	"	"	"	69	"	"			
16¼	Sft. Flooring with Burn & Co's patent chequered tiles over 6" concrete	87	8	"	"	1422	"	"			
	Carried over					4,382	"	"	1,40909 141528	"	"

Grand Total of Estimate ..

Office of Sanitary Engineer to Government,
Fort St. George, 27-7-1893.

Sanitary Engineer to Government.

Abstract of Detailed Estimate No. 8 , dated 27 - 7 - 93 , for the construction of Water Works for the town of Tuticorin.

Quantity.	Description of Work.	Rate. Rs.	A.	P.	Per	Amount. Rs.	A.	P.	Total. Rs.	A.	P.
	Brought forward					4,382	-	-	1,40,909	-	-
2,800	Sft. Roofing with Mangalore tiles and teak reepers	24	-	-	Sq.rs.	672	-	-			
200¼	Cft. Teak wood wrought & put up	3	8	-	Cft.	701	-	-			
208	Sft. Batten doors with frames hinges, bolts &c complete	1	12	-	Sft.	364	-	-			
441	Sft. Venetianed doors & windows with frames, hinges &c complete	2	-	-	"	882	-	-			
245	Rft. Eaves board	-	8	-	Rft	123	-	-			
110	" Stencil painting	-	8	-	"	55	-	-			
2,100	Sft. Wood oiling	1	8	-	Sq.re	31	-	-			
2,700	" Painting, 2 Coats	3	-	-	"	81	-	-			
4	Nos. Finials	10	-	-	Each	40	-	-			
	Piling during construction				Sum	600	-	-			
	Petty charges					156	-	-	7,987	-	-
	Wood & store shed										
	Wood & store shed								2,000	-	-
	For land compensation, fencing &c										
31.54	Acrs. Compensation for land for reserve tank	300	-	-	Acre	9,462	-	-			
6.00	" " for Engine house	200	-	-	"	1,200	-	-			
	Rft. Forming roads (600 Rft)				Sum	500	-	-			
	Fencing the compounds of Engine house				"	1,000	-	-	12,162	-	-
	Carried over								1,63,058	-	-

Grand Total of Estimate ..

Office of Sanitary Engineer to Government,
Fort St. George, 27 - 7 - 1893.

Sanitary Engineer to Government.

Abstract of Detailed Estimate No. 8 , dated 27-7-93 , for the construction of Water Works for the town of Tuticorin.

Quantity.	Description of Work.	Rate. Rs.	A.	P.	Per	Amount. Rs.	A.	P.	Total. Rs.	A.	P.
	Brought forward								1,63,687		
	Engine, Pumps & boilers								1,63,058		
180 H.P.	Two Worthington Engines of 90 H.P. each with pumps, boilers &c including erection	1,700	-	-	H.P.	30,600	-	-	30,600	-	-
	Supply & delivery of pipes										
474	Tons. C.I. pipes turned & bored, Spigot & faucet	110	-	-	Ton	52,140	-	-			
172	Cwts. Bends	10	-	-	Cwt	1,720	-	-			
138	" Branches	10	-	-	"	1,380	-	-			
26	" Taper pipes	10	-	-	"	260	-	-			
13	" Collars	10	-	-	"	130	-	-			
	Valves, stopcocks, hydrants & Standpipes &c					4,501	-	-			
10	Nos. Two tap pillar fountains	150	-	-	Each	1,500	-	-			
18	" Single wall tap fountains	97	-	-	"	1,746	-	-			
10	" Double "	204	-	-	"	2,040	-	-			
110	" Surface boxes					728	-	-			
	Extra cast. pipes & fittings					1,914	-	-			
	Petty charges					1361	-	-	69,480	-	-
	Laying & Jointing										
37,407	Cyds. Excavation for C.I. Pipes					3528	-	-			
2,004	" do W.I. Pipes					24	-	-			
11,220	Lyds. Laying & jointing C.I. Pipes turned & bored					5,176	-	-			
	Carried over					8,728	-	-	2,63,168	-	-
									2,63,767		
	Grand Total of Estimate ...										

Office of Sanitary Engineer to Government,
Fort St. George, 27-7-1893.

Sanitary Engineer to Government.

Abstract of Detailed Estimate No. 8 , dated 27th July 1893 , for the Construction of Water Works for the town of Tuticorin.

Quantity.	Description of Work.	Rate. Rs.	A.	P.	Per	Amount. Rs.	A.	P.	Total. Rs.	A.	P.
	Brought forward				d	8,728	-	-	263138	-	-
1249	Lgths. Laying & Jointing C.I. spigot & faucet pipes					1011	-	-			
668	" do do W.I. Pipes					167	-	-			
	Fixing complete with masonry 44 sluice valves on mains & branches					664	-	-			
	do 19 hydrants with valves &c					474	-	-			
	do 2½" air valves					74	-	-			
	do 5-1¼" do					105	-	-			
18	Nos. Erecting single wall tap fountains					990	-	-			
10	" do double do					680	-	-			
10	" do pillar do					820	-	-			
	Petty charges					267	-	-	14,000	-	-
									277763 2,77,138	-	-
	Contingencies & cost of establishment at 15%								41663 41,572	-	-
	Grand Total of Estimate ..								319430 3,18,710	-	-

Office of Sanitary Engineer to Government,
Fort St. George, 27th July 1893.

Sanitary Engineer to Government.

Abstract of Detailed Estimate No. 8 , dated 27th July 1893 , for the construction of Water Works for the town of Tuticorin.

Quantity.	Description of Work.	Rate. Rs.	A.	P.	Per	Amount. Rs.	A.	P.	Total. Rs.	A.	P.
	Constructing outlet-pipes & Valve house at the head of Masonry conduit					6,605	-	-			
	Alterations to the existing Irrigation Sluice					1,200	-	-			
	Constructing the Irrigation Sluice					2,147	-	-			
	Reserve Tank					22,403	-	-			
	Outlet-pipes & Valve house in the Reserve Tank					4,977	-	-			
	Masonry conduit					44,472	-	-			
	Filter bed					22,886	-	-			
	Clear-water reservoir					26,219	-	-			
	Engine & Boiler house					7,987	-	-			
	Wood & Store shed					2,000	-	-			
	Compensation for land, Fencing &c					12,162	-	-			
	Engines, Pumps & Boilers					30,600	-	-			
	Supply & delivery of pipes					69,480	-	-			
	Laying & Jointing pipes					14,000	-	-			
	Contingencies & Cost of establishment					41,572	-	-			
	Grand Total of Estimate ..								3,18,710	-	-

Office of Sanitary Engineer to Government,
Fort St. George, 27th July 1893.

Sanitary Engineer to Government.

Enclosure to letter No. 2 1538 dated 27 July 893

GOVERNMENT OF MADRAS.

SANITARY ENGINEER'S DEPARTMENT.

Abstract
~~Specification and Detailed~~ Estimate No. 8
of 1893-94 of the cost of constructing

Water Works

for the town
of Tuticorin
Amount of Estimate No. 8

Rs. 3,18,710

Covering letter No. 1538 dated 27th July 1893,

Encl 1
/635

Dr 3116

8

Supply Scheme.

tween the schemes for 15 and 10 gallons per head.

arison between nns 2 & 6		Amount of Scheme for 10 gallons per head with the fillers & reservoir omitted with pumping	Comparison between columns 9 & 6		Amount of Scheme for 10 gallons per head with fillers & reservoir omitted & pumping omitted (Gravitation Scheme)	Comparison between columns 12 & 9		Remarks
	Less		More	Less		More	Less	
7	8	9	10	11	12	13	14	15.
	Rs	Rs	Rs	Rs	Rs	Rs	Rs.	
	"	6605	"	"	6605	"	"	
00	"	1360	"	"	1360	"	"	
"	"	2147	"	"	2147	"	"	
672	"	52700	"	"	52700	"	"	See report
"	"	4977	"	"	4977	"	"	
240	"	7240	"	"	7240	"	"	⊗
"	"	44472	"	×	42070	"	2402	× No reduction in size possible ⊗ Due to shorter length of conduit
"	9726		"	23160		"	"	×Telescopic pipe omitted. Gills arrangement introduced. × Proposed to be omitted at present
360	"		"	11360		"	"	× May be omitted
"	2013		"	24210		"	"	×Reduction in size × Proposed to be omitted as present.
"	"	7987	"	"		"	7987	× No reduction in size possible
"	"	2000	"	"		"	2000	× do
136	"	20298	"	"	17598	"	2700	× do ⊗ Due to omission of site for Engine House & fencing.
"	"	"	"	"	600	600	"	
"	1200	29400	"	"	"	"	29400	× These were underestimated previously hence small reduction only.
"	6150	63330	"	"	60925	"	2405	× Reduced size of piping ⊗ Due to shorter length of main and omission of ry drain to tr.
"	540	13460	"	"	68400	54940	"	× Laying reduced length of piping ⊗ Due to duplo excavation for laying pipes.
"	"	6179	"	1468	6689	510	"	
"	26369		"	"	"	"	"	Vide G.O. No 847 M dated 10th May 1896.
"	"	6179	"	1468	6689	510	"	
568	45998	268334	"	61666	278000	56560	46894	
998	"				268334	46894		
570					9666	9666		

× This is the cheapest scheme as maintenance inclusive of interest is Rs 3870 less than that in col 9 vide note

Sanitary Engineer to Government

Tuticorin Wat

Comparative Statement shewing the difference

Particulars	Amount of Scheme for 15 gallons per Head	Amount of Scheme for 10 gallons per Head	Comparison between columns 2 & 3		Amount of Scheme for 10 gallons per head increasing the capacity of Reserve Tanks	Re
			More	Less		
1	2	3	4	5	6	
	Rs	Rs	Rs	Rs	Rs	
Butler and Valve House at the Head of Conduit	6605	6605	"	"	6605	
Alteration to the existing Sluice	1200	1360	160	"	1360	1
Constructing new Irrigation Sluice	2147	2147	"	"	2147	
Reserve Tanks	23028	23028	"	"	52700	29
Outlet pipe & Valve House in Reserve Tanks	4977	4977	"	"	4977	
Connecting Sluices between the Reserve Tanks & between each of those & conduits	"	"	"	"	7240	7
Masonry Conduit	44472	44472	"	"	44472 ×	
Filter Bed	32886	25000	"	7886	23160	
Chambers for Gills arrangements for filters	"	"	"	"	11360	11
Clear water Reservoir	26223	24210	"	2013	24210 ×	
Engine and Boiler House	7987	7987	"	"	7987 ×	
Wood and Store shed	2000	2000	"	"	2000 ×	
Compensation for land fencing &c	12162	12162	"	"	20298 ×	8
Inlet & Outlet arrangements at the Existing Reservoir	"	"	"	"	"	1.
Engine, Pumps & Boilers	30600	29400	"	1200	29400 ×	
Supply and delivery of pipes &c	69480	63330	"	6150	63330 ×	
Laying and jointing	14000	13460	"	540	13460 ×	
Tools and Plant 2½ %	"	6501	"	"	7647	
Establishment	41663	Nil	"	28661	Nil	
Contingencies 2½ %	"	6501	"	"	7647	
Total	319430	273140	160	46450	330000	56
Deduct	273140	"	"	160	319430	4
	46290			46290	10570	10

Office of Sanitary Engineer to Govt
Fort St. George, 11 September 1896

Luticorin Water Supply Scheme.

Comparative Statement showing the difference between the 2 Schemes for 15 & 10 gallons per head.

Particulars.	2 Amount of scheme for 15 gallons per head.	3 Amount of scheme for 10 gallons per head.	4 None.	5 Less.	6 Amount of scheme for 10 gallons per head in excess of Revenue Receipts.	7 More	8 Less	Remarks
Deduct—	66,05	66,05			66,05			
	27,3140			160	21,5,430	45,998		
	46,290			46290	10,570	10,570		

Sanitary Engineer to Government.

Tuticorin Water Supply Scheme.

Comparative statement showing the difference between the Schemes for 15 & 10 gallons per head.

Particulars.	Amount of scheme for 15 gallons per head.	Amount of scheme for 10 gallons per head.	More.	Less.	Amount of scheme for 10 gallons per head, investigating the effect of Reservoir &c.	More	Less	Remarks
	2	3	4	5	6	7	8	
Outlet & valve houses at the head of conduit	6,606	6,605	"	"	6,606	"	"	
Alteration to the existing Sluice	1,200	1,360	160	"	1,360	160	"	
Constructing new Irrigation Sluice	2,147	2,147	"	"	2,147	"	"	
Reserve Tanks	23,028	23,028	"	"	52,700	29,672	"	See report.
Outlet pipe & valve house in Reserve Tanks	4,977	4,977	"	"	4,977	"	"	
Connecting Sluices between the Reserve Tanks & between each of those & the conduits	-	"			7,240	7,240	"	
Masonry Conduit	44,472	44,472	"	"	44,472	"	"	No reduction in size possible
Filter Bed	32,886	25,000	"	7,886	23,160	"	9,726	Telescopic Pipe omitted Gillis' arrangement introduced
Chambers for Gillis' arrangement & for Filters	"	"	"	-	11,360	11,360	"	may be omitted
Clear Water Reservoir	26,233	24,210	"	2,013	24,210	"	2,013	Reduction in size.
Engine & Boiler House	7,987	7,987	"	"	7,987	"	"	No reduction in size possible
Wood & Store shed	2,000	2,000	"	"	2,000	"	"	" " "
Compensation for lands, fencing &c	12,162	12,162	"	"	20,298	8,136	"	" " "
Engines, Pumps, & Boilers	29,600	29,400	"	1200	29,400	"	1,200	There were underestimated for pumping hence small reduction now
Supply & delivery of pipes	69,480	63,330	"	6150	63,330	"	6,150	Reduced size of pipes
Laying & Jointing	14,000	13,460	"	540	13,460	"	540	" " "
Tools & plant 2½%		6,501			7,647			
Establishment	41,663	Nil	"	26,661	Nil	-	26,369	* Vide G.O. No. 847 M dt 10-5-1896.
Contingencies 2½%		6,501			7,647			
Total	2,19,430	2,73,140	160	46,460	2,30,000	56,568	45,998	
Deduct	2,73,140			160	2,19,430	45,998		
	46,290			46290	10,570	10,570		

Surv. &

GOVERNMENT OF MADRAS.

SANITARY ENGINEER,

7th April 1896.

Jones

Govt.

servant,

S. E. 25-2-96- 1,000.
6.

GOVERNMENT OF MADRAS.

No. 1185

OFFICE OF SANITARY ENGINEER,

Fort St. George, 17" April 1896.

From

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

SANITARY ENGINEER TO GOVERNMENT,

To

The Superintending Engineer ,

VI Circle, Trichinopoly.

SIR,

I have the honor to forward herewith a copy of a statement received from Major Badelley in 1893 in reference to the Korampullum Tank near Tuticorin.

2. In view to some modification desirable in the scheme for the water supply of Tuticorin I have the honor to enquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under cotemplation , the tank would hold water for a longer period & at a higher level.

3. It isproposed to have a storage tank outside the Korampullum tank which will be filled when the Korampullum tank isfull & be indented on only when water is no longer obtainable from the main tank, what we there fore wish to determine is, how many months supply for the population of Tuticorin must this subsidiary storage tank hold?

4. An early reply will much oblige.

I have the honor to be,

Sir,

Your most obedient servant,

(True copy)

(Sd) J.A.Jones

Sany: Engr: to Govt.

Sanitary Engineer to Govt.

S. E. 6.—25-2-96—1,000.

No. 1312

GOVERNMENT OF MADRAS.

OFFICE OF SANITARY ENGINEER,

Fort St. George, 29" April 1896

From

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

SANITARY ENGINEER TO GOVERNMENT,

To

The Superintending Engineer ,

VI Circle, Trichinopoly.

SIR,

I have the honor to invite your attention to my No. 1183, dated 17th. April 1896, & request that you will be good enough to favor me with a reply thereto.

I have the honor to be,

Sir,

Your most obedient servant,

(Sd) J.A.Jones

Sanitary Engineer to Govt.

(True copy)

Sanitary Engineer to Government.

No. 505 T.N

Office of the Superintending Engineer
6th Circle

Trichinopoly, 14th May 1896

From

W. Hughes Esq

Superintending Engineer, 6th Circle.

To

The Sanitary Engineer

to Government, Madras.

Sir,

I wished to have the statement received with your letter No. 1183 dated 17th April 1896 carried down to date but as it appears from your reminder that you wish for a reply at once I give you what information I can now.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddely had in view unless it was something connected with the more efficient working of the surplus sluice*. The rules regarding the level

(* Travelling crane was provided in 1894)

vel to which water may be retained are
(1) that it is to be limited to 6 ft on the
ll to 15th December: (2) to 7 ft from 15th December
: 1st January, after which the tank may be
illed to 8 ft or full supply level. I am not now
repared to propose any alterations in these
ules as I find the discharging capacity
f the escape has never been ascertained and
bservations of high floods have also been
endered of little use through the breaching
f the tank.

The experience of 1890 and 1892
oes to show that I can not depend on
etting a supply when the South West
onsoon fails. There must always be
me supply in the North East monsoon
n. I should be inclined to say that as long
s water is freely issued for irrigation it
ould be difficult to guarantee even four
onths supply to Tuticorin.

Although the tank has now been
years in existence the loss from natural
causes

causes is excessive. On my inspection in
August last I made the following notes.

"The supply to the town ceased this year
in the middle of March but the registers
show that it may cease much earlier
in the year. It was resumed towards the
end of April and again ceased in the
beginning of July although no water had
been issued for irrigation except a trifling
quantity for seed beds. The water was 4½ ft
on sluice floor in middle of May. The level
fell pretty regularly .10 ft per day and as
the issues will probably not account for more
than half of this the loss by evaporation and
leakage seems to be about 1½ ft per month
An exact calculation could be made if we
had a contoured survey of the North end
of the tank". The high tank bed between
the north part front of the tank and the escape
is 5 or 6 ft above the Tuticorin sluice floor s
that from the time water falls to this leve
an exact account could be made our of

the

the quantity used and lost. Do you find it necessary for your purposes to make such a survey I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tanks however is made up and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

I have &c

(Sd) W. Hughes

Supt.g Engr VI circle

(True Copy)

Secy: Exptr to Govt

Reminder

S. E. 6.—25-2-96—1,000.

No. 1412

GOVERNMENT OF MADRAS.

OFFICE OF SANITARY ENGINEER,

Fort St. George, 7th May 1896.

From

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

SANITARY ENGINEER TO GOVERNMENT,

To

The Superintending Engineer,

VI Circle, Trichinopoly.

SIR,

I have the honor to acknowledge & thank you for your No. 505 T.N., of 4th. May 1896.

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin , that tank must contain at least eight months supply . I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korumpullum tank during the months the tank usually receives or supplies so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank .

3. If theKorumpullum tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 30,000,000 C.ft., or should some level less than the full tank level be adopted .

I have thehonor to be,
Sir,
Your most obedient servant,
(Sd) J.A. Jones
Sanitary Engineer to Government

(True copy)

Sanitary Engineer to Govt.

2nd. Reminder

S. E. 6. 25-2-96- 1,000.

No. 2095

GOVERNMENT OF MADRAS.

OFFICE OF SANITARY ENGINEER,

Fort St. George, ~~7th.~~ July 1896.

From

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

SANITARY ENGINEER TO GOVERNMENT,

To

The Superintending Engineer,

VI. Circle, Trichinopoly.

SIR,

I have the honor to invite your attention again to my No. 1412 dated 7th. May 1896 and request the favor of your furnishing the information as early as possible.

I have the honor to be,

Sir,

Your most obedient servant,

(Sd) J.A. Jones.

Sanitary Engineer to Government.

(True Copy)

Sanitary Engineer to Government.

50

Local & Municipal Department.

PROCEEDINGS OF THE MADRAS GOVERNMENT.

Read the following paper:-

From the Sanitary Engineer to Government, dated 28th. May 1896, No.1638, informing that the revised plans regarding Tuticorin Water supply are under preparation & the plans cannot be ready for some months yet.

ORDER No. 998M.Mis., dated 13th. June 1896.

As the need for an improved system of Water Supply for Tuticorin is stated to be very pressing , the Sanitary Engineer will be requested to expedite the submission of the revised estimates.

(True extract)

(Sd) C.R.Scovell

Under Secretary , P.W.D.,

for ChiefSecretary .

(True copy)

Sanitary Engineer to Government.

S. E. 6. 25-2-96- 1,000.

No. 1913 URGENT

GOVERNMENT OF MADRAS.

OFFICE OF SANITARY ENGINEER,

Fort St. George, 19" June 1896.

From

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

SANITARY ENGINEER TO GOVERNMENT,

To

The Superintending Engineer ,

VI Circle, Trichinopoly .

SIR,

I have the honor to inform you , that I regret, to have to request an early reply to my No. 1412, dated 7th. May 1896, but Government have again requested an early submission of the Tuticorin Project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

I have the honor to be,

Sir,

Your most obedient servant,

(Sd) J.A. Jones

Sanitary Engineer to Government

(True copy)

Sanitary Engineer to Government.

Superintending Engr's Office
VI th Circle
Trichinopoly, 8th July 18
Dated: 9-7-96.

From

W. Hughes Esqr.
Superintending Engineer,
6th Circle

To

The Sanitary Engineer to Govt.
Madras

Enc. 1

Sir,

With reference to your letter No. 1412 dated 7th May 1896, I have the honor to enclose a statement of average monthly levels of Koranipallam Tank between July & December for the last 10 years from which it would appear that a reserve tank for the supply of the town should contain at least 9 months' supply. The water level falls rapidly after

Dec

December except at the northern end there is very little water in the tank when the level falls below about M.S.L. +16.00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the South East Monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

I have the honor to be,
Sir,
Your most obed[t] Serv[t]
s/d W. Hughes
Supg: Engr: 6th Circle

(True Copy)
[illegible]
Engr to Govt

Statement of the average mean sea Levels of water in Trampolla Tank from 1886 to 1895.

Year	July	August	Septr.	Octr.	Nover.	Decr.	Remarks.
1886	12.94	12.71	15.54	15.42	15.35	14.67	
1887	"	"	"	15.43	14.97	16.38	
1888	13.23	11.83	"	15.95	16.00	16.86	
1889	12.50	12.62	15.06	16.78	16.20	14.96	
1890	"	"	"	14.65	14.30	16.83	
1891	13.98	12.93	12.10	15.56	17.25	18.34	
1892	12.30	"	"	"	"	"	
1893	12.72	"	"	14.50	16.50	18.00	
1894	"	"	"	11.55	14.85	14.30	
1895	12.14	"	"	16.49	17.79	18.29	

Sill level of Head Sluice of Fresh water Channel 11.40.
Head Sluice Sill level 19.40 M.S.L.
Tank Sill level 16.00 M.S.L.

s/d T. Whitehead
Sub 4th Officer

(True Copy)
s/d C. Mildred
Exec: Engr:
4-7-96

(True Copy)
s/d W. Hughes
Supg: Engr: 6th Circle
8-7-96

(True Copy)
[illegible]

55

27/July/1896

10 P

REPORT RE- TUTICORIN WATER SUPPLY.

____ooOoo____

THE Sanitary Board byresolution No: 558 of 24th.February advised Government that in order to reduce the cost of the proposedwater supply for Tuticorin the supply to be given might be reduced to IO gallons per head and the plans revised accordingly. Government in G.O.No:435M.Mis. dated I6th.March I896 requested the Sanitary Engineer to submitrevised estimate & theseare herewith sent for remarks to the Sanitary Board previousto submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised as it stood that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir & pipes to the IO gallon supply the reduction will be (including Rs2866I for establishmentnot now required)a total of Rs 46450(less a slight increase of RsI60). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs I8000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit; as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information & keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs 330000 or Rs10570more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank is under the existing conditions of the Korampallam Tank is too small under existing restriction in re-

Fort St. Geor

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'd to that tank which cannot meantime be altered.(Vide Superintending Engineer's No:505T.W.of 4th. May I896.) In th riginal design it was calculated that a reserve supply for3or4 nths would be sufficient & that the reserve tank could e filled up each year to a level of 19.40 because it was hoped that arrangements would be made in connection with the Korampallam Tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7.The Superintending Engineer(vide his No:80I T.W. of th.July I896) now states that though the restriction affecting he filling of the tank may not always be permanent,he advises that a supply for 9 months should be maintained in the reserve tank(the supply in other 3 months being obtained from the main tank);though the full tank level is 19.40, for calculation of storage the level cannot be assumed higher than I6.00(in certain years it did not rise to this) Vide statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months reserve only. The size required for 9 month's consumption, is shown on drawings.The tank is divided in three portions, each in connection with the conduit, so that I or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam Tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs 29,672(Bunds)+Rs 7240(Sluices)+ Rs8I56(Land&c).

9. The only other increase of importance in estimate is RsII560 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

Sanitary Engineer to Govt.

Evaporation has not been allowed for as scheme is for 54000 people whereas there are only 35000 to be provided for at

present &by the time the population increases to 54000, the condition of the Korampallam Tank may be altered&the proper full tank level obtainable.

Dany Engineer to Govt.

Fort St. Geo[illegible]

S E. 18 500—21-5-06.

Abstract of Detailed Estimate No. , dated

construction of Water Works for the Town of Tuticorin.

Quantity.	Description of work.	Rate. Rs.	A.	P.	Per	Amount. Rs.	A.	P.	Total Rs.	A.	P.
	Constructing outlet pipes & valve house at the head of Masonry conduit					6605	..	..			
	Alteration to the Existing Irrigation Sluices					1360	..	..			
	Constructing New Irrigation Sluices					2147	..	..			
	Reserve Tanks					32700	..	..			
	Outlet pipes & valve houses in the Reserve Tanks					4977	..	..			
	Connecting Sluices between Reserve Tanks &					7240	..	..			
	Masonry conduit					44472	..	..			
	Filter beds					23160	..	..			
	Chambers for Gills arrangement of gauges for filters					11360	..	..			
	Clear water Reservoir					24210	..	..			
	Engine and Boiler House					7987	..	..			
	Wood and Store shed					2000	..	..			
	Compensation for land fencing &c					20298	..	..			
	Engine Pumps & Boilers					29400	..	..			
	Supply & Delivery of Pipes					63330	..	..			
	Laying & jointing					13460	..	..			
									3,14706	..	..
	Tools & plant								7647	..	..
	Establishment								N.R.		
	Contingencies								7647	..	..
	Grand Total of Estimate								330000	..	..

Office of Sanitary Engineer to Government,

Fort St. George, 27th July 1906.

Sanitary Engineer to Government.

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S E.
18 500—21-5-96.

S E.
18 500—21-5-96.

Abstract of Detailed Estimate No. , dated , for the construction of Water Works for the Town of Tuticorin.

Quantity.	Description of work.	Rate. Rs.	A.	P.	Per	Amount. Rs.	A.	P.	Total. Rs.	A.	P.
	Constructing outlet pipes and Valve houses at the head of Masonry conduit.										
44667	Cft: Earthwork in opening and closing the bund	4	10	..	1000cft	216	..	..			
879	do Concrete in Surki	12	..	..	100cft	105	..	..			
5603	do Brick in Surki	24	4	..	do	1359	..	..			
557	do do in chunam	22	4	..	do	124	..	..			
23	do Archwork do	25	..	..	do	6	..	..			
1608	Sft Plastering with cement 3/4" thick.	12	10	..	Sqre	190	..	..			
728	do Plastering with chunam two coats	3	8	..	do	25	..	..			
43	Cft Cutstone work	2	..	..	Cft	86	..	..			
45	do Teakwood wrought and put up	3	10	..	do	163	..	..			
140	Sft Roofing with Mangalore tiles including laths reafers	24	8	..	do	34	..	..			
30	do Doors battens with laths frames hinges bolts &c complete	1	8	..	Sft	45	..	..			
22	do Teak framed venetian windows with iron bars glazed shutters &c complete	1	12	..	do	39	..	..			
100	Rft Ornamental barge board	1	4	..	Rft	125	..	..			
	Carried over					2517	..	..			

Grand Total of Estimate

OFFICE OF SANITARY ... TO GOVERNMENT,

S. E. 18 500—21-5-96.

Abstract of Detailed Estimate No. , dated , for the construction of Water Works for the Town of Tuticorin.

Quantity.	Description of work.	Rate. Rs.	A.	P.	Per	Amount. Rs.	A.	P	Total. Rs.	A.	P.
	Brought forward					2517	..	..			
104	Sft. Painting with two coats of Carsons oats paint	3	..	..	Sqe	3	..	..			
500	do Wood oiling two coats	1	8	..	do	8	..	..			
1	Nº Wooden finial	5	..	..	Each	5	..	..			
4	Nº Iron finials	5	..	..	do	20	..	..			
1	Nº Wooden hasp door with iron fittings &c complete to fix on the top of the rear cistern				Sum	35	..	..			
704	Rft: Embedding	3	8	..	100 cft	25	..	..			
5	Tons C. I. pipes	113	..	..	Ton	565	..	..			
	Lyds: Laying & jointing	..	..	..	Sum	100	..	..			
7½	Units: Bends	10	8	..	Unit	79	..	..			
4	Nº 18" Sluice valves including fixing charges	330	..	..	Each	1320	..	..			
1	do Special casting of C. I stand pipe with branches complete as per drawing				Sum	500	..	..			
3	do Lifting gear & 18" Sluice valves including stand posts &c complete	200	..	..	Each	600	..	..			
	Demolishing the existing sluices				Sum	200	..	..			
	Ring bund & baling during construction				do	500	..	..			
	Petty charges					128	..	..			
	Total								6,605	..	..
	Carried over								6,605	..	..

Grand Total Estimate

OFFICE OF SANITARY ENG[illegible] TO GOVERNMENT,

Abstract of Detailed Estimate No. , dated , for the construction of Water Works for the Town of Tuticorin

Quantity.	Description of work.	Rate. Rs.	A.	P.	Per	Amount. Rs.	A.	P	Total Rs.	A.	P.
	Brought forward								6605	..	..
	Alteration to the Existing Irrigation Sluice										
1353	Cft. Brick in Surki	24	4	..	100 cft.	338	..	..			
482	Sft. Plastering with cement	12	12	..	Sqre	61	..	..			
165	Cft. Concrete in surki	12	..	..	100 cft.	20	..	..			
900	No. Rough stone work	10	..	..	No	90	..	..			
10750	No. Earthwork in raising bunds	4	10	..	1000 cft.	50	..	..			
3	" C.I. pipes	113	..	..	Jam	339	..	..			
1	No. 18" Sluice valves including fixing charges	330	..	..	Each	330	..	..			
	Dismantling the rear wing and cistern					25	..	..			
	Wooden cover to valve pit					35	..	..			
	Laying a jointing pipes					50	..	..			
	Petty charges					25	..	..			
	Total								1360	..	..
	Constructing New Irrigation Sluice										
4615	Cft. Earthwork in excavation	4	10	..	1000 cft.	216	..	..			
717	No. Concrete in Surki	12	..	..	100 cft.	86	..	..			
3538	No. Brick No	24	4	..	No	858	..	..			
41	No. Cuttings work	2	..	..	Cft.	122	..	..			
1109	Sft. Plastering with surki	6	..	..	Sqre	58	..	..			
48	Cft. Archwork (brick in surki)	26	..	..	100 cft.	18	..	..			
196	No. Rough stone work	10	..	..	No	20	..	..			
1845	Cft. Puddle wall	3	8	..	No	65	..	..			
	Carried over					1440	..	..	7965	..	..

Grand Total of Estimate

Office of Sanitary Engineer to Government,

Fort St. George, 189 .

Sanitary Engineer to Government.

S. E. 18 500—21-5-96.

Abstract of Detailed Estimate No. , dated

Construction of Water Works for the town of Juticonin: , for the

Quantity.	Description of work.	Rate. Rs.	A.	P.	Per	Amount. Rs.	A.	P.	TOTAL. Rs.	A.	P.
	Brought forward					1440	..	..	7968	..	..
1	№ Teak wood plug with lifting gear &c complete				Sum	100	..	..			
1	№ Teakwood shutter with lifting rod &c complete				do	50	..	..			
	Ring bund & baling during construction					500	..	..			
	Petty charges					57	..	..			
	Total								2147	..	..
	Reserve Tank.										
868330	Sft: Earthwork in excavating the tank & forming embankment	6	8	..	1000 cft	2574	4	..			
868330	do Sectioning shaping forming & levelling embankment	2	8	..	do	8946	..	..			
434855	do Puddle wall	3	8	..	100 cft	16220	..	..			
313600	Sft Turfing slopes including watering for 3 months	..	12	..	Sqr	2352	..	..			
	Petty charges					1038	..	..			
	Total								52700		
	Outlet pipes & valve houses in the Reserve Tanks										
2977	Sft Earthwork in excavation	4	10	..	1000 cft	14	..	..			
647	do Concrete in curbs	12	..	..	100 cft	78	..	..			
4060	do Brick do	24	4	..	do	986	..	..			
557	do Brick in chunam	22	4	..	do	124	..	..			
23	do Archwork do	25	..	..	do	4	..	..			
	Carried over					1207	..	..	62812		

Grand Total of Estimate

OF SANITARY ENGINEER TO GOVERNMENT,
orge, 189 .

Sanitary Eng

o Government.

S.E. 18 50[illegible]

...ct of Detailed Estimate No. , dated ... the

Construction of Water Works for the Town of Trichinopoly.

Quantity.	Description of work.	Rate. Rs.	A.	P.	Per	Amount. Rs.	A.	P.	Total Rs.	A.	P.
	Brought forward					1207	..	..	62812	..	..
1080	Sft. Plastering with cement ¾" thick	12	10	..	Sqre	136	..	..			
728	Do Plastering with chunam 2 coats	3	8	..	Do	26	..	..			
43	Sft. Whitewashing work	2	..	..	Sft.	86	..	..			
48	Do Teakwood wrought & put up	3	10	..	Do	163	..	..			
140	Sft. Roofing with Mangalore tiles & teak rafters	24	8	..	Sqre	34	..	..			
30	Do Teak framed doors battens with hinges bolts &c complete	1	8	..	Sft.	48	..	..			
22	Do Teak framed venetian winn. doors with iron bars glazed shutters &c complete	1	12	..	Do	39	..	..			
100	Sft. Ornamental brass board	1	4	..	Sft.	125	..	..			
101	Sft. Painting with carbonic oil paint two coats	3	..	..	Sqre	3	..	..			
500	Do Wood oiling two coats	1	8	..	Do	8	..	..			
1	No. Wooden finials	5	..	..	Each	5	..	..			
4	Do Iron Do	5	..	..	Do	20	..	..			
3·5	Tons C. I. pipes	113	..	..	Ton	395	..	..			
	Laying & jointing				Sum	100	..	..			
7·5	Cwts Bends	10	8	..	Cwt.	77	..	..			
4	No. 18" Sluice valves including fixing	330	..	..	Each	1320	..	..			
1	Special casting of cast iron Standard pipes with branches complete				Sum	500	..	..			
3	Lifting gear for 18" Sluice valves inc. cluding Standard post &c complete	200	..	..	Each	600	..	..			
	Carried over					4889	..	..			

Grand Total of Estimate

Office of Sanitary Engineer to Government,

Fort St. George, 189 .

Sanitary Sanitary Engineer to Government

S. E. 18 500—21-5-96.

Abstract of Detailed Estimate No. , dated the

Construction of Water Works for the Town of Tuticorin.

Quantity.	Description of work.	Rate. Rs.	A.	P.	Per	Amount. Rs.	A.	P.	Total. Rs.	A.	P.
	Brought forward					1207	..	..	62812	..	..
1080	Sft. Plastering with cement ½" thick	12	10	..	Sqre	126	..	..			
728	Do Plastering with lime mortar	3	8	..	Do	26	..	..			
43	Sft. Cuttistone work	2	..	..	Sft.	86	..	..			
45	Do Teakwood wrought & put up	3	10	..	Do	163	..	..			
140	Sft. Roofing with Mangalore tiles & teak rafters	24	8	..	Sqre	34	..	..			
30	Do Teak framed doors battens with hinges bolts &c complete	1	8	..	Sft.	46	..	..			
22	Do Teak framed venetian windows with iron bars glazed shutters &c complete	1	12	..	Do	39	..	..			
100	Sft. Ornamental barge board	1	4	..	Sft.	125	..	..			
101	Sft. Painting with carbon oak paint two coats	3	..	..	Sqre	3	..	..			
5·00	Do Wood oiling two coats	1	8	..	Do	8	..	..			
1	Nº. Wooden finials	5	..	..	Each	5	..	..			
4	Do Iron Do	5	..	..	Do	20	..	..			
3·5	Tons C. I. pipes	113	..	..	Ton	395	..	..			
	Laying & jointing				Sum	100	..	..			
7·5	Cwts Do Lends	10	8	..	Cwt.	77	..	..			
4	Nº. 18" Sluice valves including fixing	330	..	..	Each	1320	..	..			
1	Special casting of cast iron standard pipes with branches complete				Sum	500	..	..			
3	Lifting gear for 18" Sluice valves including standard post &c complete	200	..	..	Each	600	..	..		..	..
	Carried to					4889	..	..			

Grand Total of Estimate

Office of Sanitary Engineer to Government,

Fort St. George, 189 .

Sanitary Sanitary to Government.

S. E.
18 500—21-5-96.

Abstract of Detailed Estimate No. , dated , for the

construction of Water Works for the town of Tuticorin.

Quantity.	Description of work.	Rate. Rs.	A.	P.	Per	Amount. Rs.	A.	P.	Total. Rs.	A.	P.
	Brought forward					4887	..	..	62812		
	Petty charges					88	..	..			
	Total								4977	..	..
	Connecting Shivaselinum Reservoir Tankbase										
2026	Cft Excavation	4	10	..	1000 cft	10	..	..			
419	do Concrete in sunki	12	..	..	100 cft	50	..	..			
1948	do Brick do	24	4	..	do	472	..	..			
609	Sft Plastering with cement ½" thick	12	10	..	Sqre	77	..	..			
1800	Cft Rough stone work	10	..	..	100 cft	180	..	..			
5	Tons C. I. pipes	113	..	..	Ton	565	..	..			
26	Lgth Laying and jointing	2	..	..	Lgth	52	..	..			
1	No 18" Sluice valve	330	..	..	Each	330	..	..			
1	No Wooden cover to valve pit	36	..	..	do	36	..	..			
	Petty charges					39	..	..			
						1810	..	..			
	For four Sluices								7240	..	..
	Masonry Conduit										
182705	Cft Earthwork in excavation	4	10	..	1000 cft	849	..	..			
123098	do Concrete in sunki	13	..	..	100 cft	16003	..	..			
54541	do Brick do	26	..	..	do	14181	..	..			
121550	Sft Plastering with cement ½" thick	10	5	..	Sqre	12533	..	..			
12	No Cud Cuddapah Slabs 1'x1'x4" set in sunki	..	12	..	Each	32	..	..			
	Petty charges					872	..	..			
	Total								44472	..	..
	Carried over								119501		

Grand Total of Estimate

Office of Sanitary Engineer to Government,
Fort St. George, 189 .

Sanitary Engineer to Government.

S. E.
18 500—41—5.96.

Abstract of Detailed Estimate No. , dated , for the construction of Water Works for the Town of Tuticorin.

Quantity.	Description of work.	Rate. Rs.	A.	P.	Per	Amount. Rs.	A.	P.	Total. Rs.	A.	P.
	Brought forward								119501	..	..
	Filter Beds.										
213431	Cft. Earthwork in excavation	6	..	..	100 cft.	1280	..	..			
4333	Do Puddle work	3	8	..	100 cft.	233	..	..			
20800	Do Concrete in Surki	14	..	..	Do	2912	..	..			
22365	Do Brick in Do	26	..	..	Do	5815	..	..			
79	Do Archwork Do	28	..	..	Do	22	..	..			
18011	Sft. Plastering with cement 3/4" thick	12	..	..	Sqr	2161	..	..			
9247	Do Do 7/8" thick	7	8	..	Do	694	..	..			
1472	Cft. Drainage tiles 4"	1	..	..	Cft	1472	..	..			
13955	Cft. Gravel filling	6	..	..	100 cft.	837	..	..			
9304	Do Coarse sand filling	3	..	..	Do	279	..	..			
18688	Do Fine sand filling	3	..	..	Do	561	..	..			
560	Sft. Copper wire netting screen	1	..	..	Sft.	560	..	..			
875	Sft. of Cuddapah slabs	..	4	..	Do	219	..	..			
16·59	Tons C.I. pipes	110	..	..	Ton	1825	..	..			
44·55	Cwts: Bends &c	10	8	..	Cwt.	478	..	..			
317	Cycle Laying and jointing	2	..	..	Cycle	634	..	..			
1	No 12" Sluice valve	165	..	..	Each	165	..	..			
4	No 8" Do	81	..	..	Do	324	..	..			
3	No 6" Do	50	..	..	Do	150	..	..			
8	Surface boxes to Sluice valves	15	..	..	Do	120	..	..			
	Sand washing box					1000	..	..			
	Screw well 8 ft in diameter including hand pump complete					1000	..	..			
	Petty charges					430	..	..			
	Total								23160	..	..
	Carried over								142661	..	..

Grand Total of Estimate

Office of Sanitary Engineer to Government,
Port St. George, 189 .

Engineer to Government.

S. E. 18 500—21-[illegible]26.

Abstract of Detailed Estimate No. , dated , for the
nt
construction of Water Works for the Town of Tuticorin.

Quantity.	Description of work.	Rate. Rs.	A.	P.	Per	Amount. Rs.	A.	P.	Total. Rs.	A.	P.
	Brought forward								142661	..	..
	Chambers for Gills arrangement of gauges for Filters										
7106	Sft Excavation & filling in	4	10	..	1000 sft	32	..	..			
793	.do Concrete in courses	12	..	..	100 sft	95	..	..			
3018	.do Brick in .do	26	..	..	do	785	..	..			
273	.do Archwork .do	28	..	..	do	76	..	..			
3	.do Entrance work	2	..	..	1000 sft	6	..	..			
3584	Sft Plastering with cement ½" thick	12	10	..	Sqrs	452	..	..			
580	.do Roofing with Mangalore tiles including teak rafters	24	..	..	do	139	..	..			
41	1000 sft Teakwood wrought & put up	3	8	..	1000 sft	144	..	..			
38½	Sft Teak framed doors and windows with hinges bolts & complete	2	..	..	Sft	77	..	..			
1030	Sft Painting with two coats of Carbons oak paint	3	..	..	Sqrs	31	..	..			
2	Nos Finials	5	..	..	Each	10	..	..			
1	Nos Reservoir Sluice valve	165	..	..	do	165	..	..			
	Pipe gauge with floatings complete				Sum	400	..	..			
2	Nos Sluice valves 12"	165	..	..	Each	330	..	..			
1	.do 6"	50	..	..	do	50	..	..			
	Petty charges					48	..	..			
						2840	..	..			
	Total for four chambers								11360	..	..
	Carried over								154021	..	..

Grand Total of Estimate

OFFICE OF SANITARY ENGINEER TO GOVERNMENT,
Fort St. George, 189 .

Engineer to Government.

Quantity.	Description of work.	Rate. Rs.	A.	P.	Per	Amount. Rs.	A	P	Total. Rs.	A.	P.
	Brought forward								154021	..	..
	Clear water Reservoir										
213982	Cft. Earthwork in excavation and filling in	6	..	..	1000 Cft.	1284	..	..			
17530	Cft. Concrete in Surki	14	..	..	100 Cft.	2454	..	..			
6656	Do in chunam	12	..	..	Do	799	..	..			
29768	Do Brick in Surki	26	..	..	Do	7736	..	..			
8804	Do Arch work Do including centering	30	..	..	Do	2641	..	..			
1007	Do Cutstone work	2	..	..	Cft.	2014	..	..			
23400	Sft. Plastering with cement 3/4" thick	12	..	..	Sqr.	2808	..	..			
3	Nos Covers to Manholes	35	..	..	Each	105	..	..			
2	Nos Surface boxes to sluice valves	15	..	..	Do	30	..	..			
7.5	Tons C. I. pipes	110	..	..	Ton	825	..	..			
38.15	Cwts Bends	10	8	..	Cwt.	401	..	..			
4	Nos 12" Sluice valves	165	..	..	Each	660	..	..			
2	Nos 6" Do	50	..	..	Do	100	..	..			
2	Nos 12" Equilibrium float valve	650	..	..	Do	1300	..	..			
111	Lyds Laying, and jointing	2	..	..	Lyd	222	..	..			
18	Nos Galvanized iron wire gauge screen with teak frames to air ventilators	10	..	..	Each	180	..	..			
5	Nos Iron ladder	35	..	..	Do	175	..	..			
	Petty charges					476	..	..			
	Total								24310	..	..
	Carried over								178231	..	..

Grand Total of Estimate

Office of Sanitary Engineer to Government,
Fort St. George, 189 .

Sanitary Engineer to Government

Office of Sanitary Engineer to Government,
St. George, 189

S. E.
18 500—21-5-96.

Abstract of Detailed Estimate No. , dated , for the

construction of Water Works for the Town of Tuticorin.

Quantity.	Description of work.	Rate. Rs.	A.	P.	Per	Amount. Rs.	A.	P.	Total Rs.	A.	P.
	Brought forward					5764	..	..	178231	..	..
208	Sft Teak batten doors with frames hinges bolts &c complete	1	12	..	Sft	364	..	..			
441	No Teak venetianed doors and windows with frames hinges bolts &c complete	2	..	..	No	882	..	..			
246	Rft Eaves board	..	8	..	Rft	123	..	..			
110	No Stencil painting	..	8	..	No	66	..	..			
2100	Sft Wood oiling	1	8	..	Sqr	32	..	..			
2700	No Painting with two coats of carsons oak paint	3	..	..	No	81	..	..			
4	Nos Finials	10	..	..	Each	40	..	..			
	Staling during construction				Sum	500	..	..			
	Petty charges					156	..	..			
	Total								7987	..	..
	Wood and store Shed										
	Wood and store Shed								2000	..	..
	Compensation for land fencing &c										
68-66	Acres Compensation for land for reserve Tanks	300	..	..	Acre	17698	..	..			
6-00	do for Engine House	200	..	..	do	1200	..	..			
	Forming road at the site of Engine House (600 ft)				Sum	500	..	..			
	Fencing the compound of Engine House				do	1000	..	..			
	Total								202	..	..
	Carried over								20851	..	..

Grand Total of Estimate

OFFICE OF SANITARY ENGINEER TO GOVERNMENT,
Fort St. George, 189 .

Sanitary Engineer to Govern

S.E. 13 500—21-5-96.

Abstract of Detailed Estimate No. , dated , for the construction of Water Works for the Town of Tuticorin.

Quantity.	Description of work.	Rate. Rs.	A.	P.	Per	Amount. Rs.	A.	P.	Total Rs.	A.	P.
	Brought forward								208516	-	-
	Engine Pumps and Boilers										
12	H.P. Worthington Engines of 6 H.P. each with pumps boilers &c including erection	2450	-	-	H.P.	29400	-	-	29400	-	-
	Supply and Delivery of Pipes										
436.6	Tons: C.I. pipes Turned & bored spigot and faucet	110	-	-	Ton	48026	-	-			
80.35	Cwt: Bends	10	8	-	Cwt	844	-	-			
108.07	do Branches	10	8	-	do	1134	-	-			
17.11	do Taper pipes	10	8	-	do	180	-	-			
16.4	Collars	10	8	-	do	162	-	-			
	Valves, Stop cocks, hydrants					4421	-	-			
	Sluice pipes &c					1100	-	-			
10	Nos Two tap pillar fountains	110	-	-	Each	1476	-	-			
18	Nos Single wall tap fountains	82	-	-	do	2040	-	-			
10	Nos Double do	204	-	-	do	792	-	-			
83	Nos Surface boxes					1914	-	-			
	Extra pipes & fittings					1241	-	-			
	Petty charges								63330	-	-
	Total										
	Laying and Jointing										
14960	Cyds Excavation for C.I pipes					3049	-	-			
724	do for W.I. pipes					103	-	-			
	Carried over					3151	-	-	301246	-	-

Grand Total of Estimate

Office of Sanitary Engineer to Government,
Fort St. George, 189.

Sanitary Engineer to Government.

ct of Detailed Estimate No. , dated , for

construction of Water Works for the Town of Tuticorin

Quantity.	Description of work.	Rate. Rs.	A.	P.	Per	Amount. Rs.	A.	P	Total. Rs.	A.
	Brought forward					3161	"	"	30124	6
1005'4	Lds Laying & jointing lined and bored with cement joints					4826	"	"		
2495	do do Spigot and faucet with lead joints					1831	"	"		
468	do W. I. pipes					167	"	"		
	Fixing complete with masonry,									
	38 Sluice valves on mains & branches					554	"	"		
	do 19 hydrants with valves &c					494	"	"		
	do 2½" air valves do					74	"	"		
	do 1¼" do					108	"	"		
18	Nos Erecting Single wall kaja fountains					990				
10	Nos do Double wall kaja fountains					680	"			
10	do Pillar fountains					820				
	Petty charges					268				
	Total									
	Tools and plant 2½%									
	Contingencies									

Grand Total

Office of Sanitary Engineer to Government,

Fort St. George, 27 - 7 - 1896.

S. E. 18 600-21-

S. E. 33. 500—30-10-95

SANITARY COMMISSIONER Register No. 268 of 1896 29 JUL. 96 WITH THE GOVERNMENT OF MADRAS.

GOVERNMENT OF MADRAS,

Office of Sanitary Engineer to Govt.,

Fort St. George, 27 July 1896.

OFFICE NOTE

BY

THE SANITARY ENGINEER.

Revised plans for the Water Supply of Tuticorin with a report thereon are herewith circulated to the Members of the Sanitary Board. The requested matter may be included respectfully vide G.O. 998 Ms dated 13th June 1896.

Receipt contains all the information necessary supplementary of the revised estimates (vide comparative statement).

27.7.96

SC
Asst SE

16
31-7-96 Copies

Government of Madras.

Sanitary Board Office

LOC... CIR... D. t. 3174 M.

Proceedings of the Sanitary Board

No. dated

Read the following:-

G.O. No. 75. M. Mis: dated 16 January 96
" " 435 M. Mis: dy 16 March 96
" " 998. M. Mis: dy 13 June 96
" " 1277 M. Mis: dy 31 July 96
Report by the Sanitary Engr: dy 27 July 96

Tuticorin Water Supply Scheme.

Resolution

128

In July 1893, the Sanitary Engineer submitted to Govt: a pumping scheme for providing for a supply of 15 gallons per head and estimated to cost Rs 319,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 95 two gravitation schemes, one proposed by the Chairman, Municipal Council, Tuticorin and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks.

The

e board holding the pumping scheme to
decidedly preferable to the gravitation
hemes, proposed to Government that
fore the gravitation schemes were ex=
mined in detail, it should be ascertained
ether the municipality could or could
ot undertake the pumping scheme.
The Government, however, pronounced
the pumping scheme as one beyond the
means of the municipality & consequently
impracticable. The Sanitary Board, thereupon,
took into consideration all the schemes
propounded, including the pumping scheme,
and arrived at the conclusion that "it
is impossible to arrange a satisfactory
supply to Intecorin without pumping." The
Board accordingly recommended to Govt:
that the original scheme of the Sanitary
Engineer, viz, the pumping scheme,
might be revised by reducing the supply
per head from 15 to 10 gallons. This pro=
posal met with the approval of Govt:, & the
Sanitary Engineer was called upon to submit
revised estimates accordingly.

In pursuance of this order, the Sanitary
Engineer submitted for the approval of the
Sanitary Board in the first instance, two
schemes, one for Rs 2,73,140 retaining the
design of the original scheme with minor
alterations but adapting dimensions of
filter, reservoir & pipes to the 10 gallon
supply; and the other for Rs 3,36,000 providing,
in addition to the modifications of the
original scheme referred to above, for
(1) Such an increase in the size of the
reserve tank as would render it
capable of holding 9 months' supply
of water, instead of only 4 months'
supply as originally intended, and
(2) Chambers for Gills' arrangements
for filters.

The President of the Sanitary Board
concurred with the Sanitary Commissioner
in thinking that it was quite useless to
submit to Govt: an estimate for Rs 3,30,000,
the Govt: having already decided that
the original estimate for Rs 319,430 was
impracticable for financial reasons.
He, therefore, suggested that if a cheaper
scheme could not be devised, the Sanitary
Engineer should report accordingly. The
Sanitary Engineer then proposed to reduce
the cost of his scheme to Rs 268,334 by
omitting filter beds and service reservoir.
Even this amount was considered excessive
by the President, Sanitary Board, who, therefore,
desired the Sanitary Engineer to say definite=
=ly whether it was impossible to prepare a
cheaper gravitation scheme.

The Sanitary Engineer now submits
a scheme of this kind, which, though
more expensive in first cost than the
pumping scheme which was estimated at
Rs 268334, is cheaper in annual cost; the
maintenance & working expenses being less.
In this scheme, the service reservoir, the

the filters, the pumping house & engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for ~~Rs~~ 319,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the municipality.

The following statement shews the cost, both capital & working, of each scheme proposed, so far as can be ascertained:—

Item	Scheme	Capital cost	annual working cost	Remarks.
A-	Pumping scheme for 15 gallons per head with 4 months supply in the reserve tank	319,430	18,000	That the working cost is Rs 1800 per annum appears from the Santy: Commrs: office note No 2070/6 d/18-11-95.
B-	—do— for 10 gallons per head —do—	273,140	16,720	The working cost has not been given by the Santy: Engr: The figures in the statement are based on Mr Jones's calculations in the case of schemes D & E.
C-	—do— do— with 9 months supply in the reserve tank	330,000	18,310	
D-	—do— do— (filters & service reservoir omitted)	268,334	14,970	
E-	Gravitation scheme for 10 gallons per head with 9 months supply in the reserve tank (filters, service reservoir & pumps omitted)	278000	11,100	Note The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O. 847. M d/10-5-96 referred to by Mr Jones in his comparative statement.
F-	Municipal Chairman's scheme	not known	not known	
G-	District Board Engineer's scheme	—do—	—do—	

14-2 8 8 16-1

The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

16-1

The Sanitary Commissioner notes as follows:— "as there can be no possible difference of opinion as to the Sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

After careful consideration of all the schemes presented the present Sanitary Board agree with Mr Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board, superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working - But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and Engines are all omitted. For each fountain is substituted a pu

so that the inhabitants must themselves pump all the water they require, and no hydrants can be used.

/True Extract/

R. Barton S.
Secretary

SECRETARY TO GOVERNMENT * 26 NOV. 1896 * LOCAL & MUNICIPAL DEPARTMENT

To
The Secretary to Govt;
Local & municipal dept:
with papers.

No. 227

Municipal Commissioners office
Inticonni 10th May 1898.

From
G. Z. Clevegar Esqre
Chairman & delegate
Municipal Commit
Inticonni

To
The Secretary to Government
Local and Municipal Department
Madras.

Sir.

Inticonni Water supply

I have the honour to bring the following points to your kind attention.

1st That his Excellency Sir Arthur Havelock and Several of his predecessors have given promise to expedite the water supply scheme of this town and that Government was graciously pleased to promise to Contribute a moiety of the outlay.

2: That in G. O. No. 1591 M. Mis. dated 16 September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3: That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop

of water during this present hot weather.

4°. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town - and would point out in conclusion, that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

I have the honour to be
Sir
Your most obe dt Servt

C. Fennessy
Chairman Delegate

[L. & M. 300—2-12-97.]

LOCAL AND MUNICIPAL DEPARTMENT.

Papers to be read in Proceedings:—

gain GO., No. , dated 189 .
Again G.O., No. , dated 189 .
Current No. 3174-m of 1896, dated 21st November 96 from the Sanitary Board
" " 1657-m, 1898, " 10th May 1898, " the Chairman M.C. Ootacamund
" " 189 , "

ORDER. No. 1031 M Misc 8-6-98.

As the adoption of any particular scheme of water supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the municipal council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the municipal council should do its best to improve the existing tanks and wells in the town.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No 2741 dated 4th September 1896.

A

In Con No 1571-m-97 16-9-98

3.

3. The Chairman's letter should have been submitted through the Collector as required in G.O. No 1162 M. dated 4th September 1893.

From orders

VR 4/11/98

B

Note – Para. 2 has been added to this draft with reference to the H.M.'s and H.E.'s Notes, dated 20th may 1898. C.

To

The Chairman. M.C. Lahicorin,
through the Collector of Tinnevel
.. Sanitary Board
.. Sanitary Engineer

Copied 10/16/98

Then given for copying ____
Copied ____
Examined ____ } 189
Signed ____

G.O., No. , DATED

CRO 3174 M—A

1657 M—A

Enclosure —A

Estimate —B

No. NWP —A

.. .. .. A A A A A A A A

TO.

BEING MEANT FOR DESPATCH

Number of pages 17 8 (not 1-18 P)

Will have been sent herewith VR 11/9/10

y in full.
to be copied
Abstract only.
Heading only.

For approval

Please see queries

14.10.07

27-9-07

LOCAL AND MUNICIPAL DEPARTMENT.

NOTES CONNECTED WITH G.O., No. 1031 M., DATED 8TH JUNE 1898.

[SUBJECT.—*Tuticorin water-supply scheme.*]

From the Sanitary Board, dated 21st November 1896, No. 263-S.

The history of the schemes for the water-supply of Tuticorin originally proposed by the Sanitary Engineer, is given in the note for orders stitched with G.O., No. 75 M., dated 16th January 1896. In that order the pumping scheme approved by the Sanitary Board was declared to be impracticable on financial grounds and the Board was requested to consider the two gravitation schemes estimated to cost Rs. 1,00,000 and Rs. 1,61,850 respectively, proposed by the Chairman of the Municipal Council and the Local Fund Engineer. On this, however, the Sanitary Board in its resolution No. 538, dated 24th February 1896, came to the conclusion that it was impossible to arrange for a satisfactory supply of water to Tuticorin without pumping and recommended that the original pumping scheme of the Sanitary Engineer might be revised by reducing the supply per head from 15 to 10 gallons. This recommendation of the Sanitary Board was approved by Government and in ~~its~~ their order No. 435 M., dated 16th March 1896, the Sanitary Engineer was requested to submit revised estimates. The Municipal Council in its resolution thereon expressed the opinion that even on sanitary grounds 10 gallons per head would be quite insufficient and that fully 15 gallons would be required for each person in the town and as it still thought that pumping might with advantage be dispensed with, the Government ~~was~~ were requested to reconsider ~~its~~ their decision in the matter. But this letter was recorded in G.O., No. 1277 M., dated 31st July 1896, pending receipt of the revised estimate called for from the Sanitary Engineer.

2. With reference however to the Government Order of March 1896 quoted above, the Sanitary Engineer in the first instance submitted for the approval of the Sanitary Board, two schemes, one for Rs. 2,73,140 retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply and the other for Rs. 3,30,000 providing in addition to the modifications of the original scheme referred to above for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended, and

(2) chambers for Gill's arrangements for filters.

The Sanitary Board, however, considered these two schemes as impracticable for financial reasons and asked the Sanitary Engineer to state if a cheaper scheme could not be devised. On this, the Sanitary Engineer proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoirs. As this amount was also considered by the Board to be large, the Sanitary Engineer submitted a gravitation scheme, which though more expensive in the first instance than the pumping scheme costing Rs. 2,68,334, involved a cheaper annual cost. In this scheme the service reservoir, the filters, the pumping house and engines are all omitted.

3. The following statement given by the Sanitary Board shows the cost and working charges of the several schemes above referred to :—

Items.	Scheme.	Capital cost.	Annual working charges.	Remarks.
		Rs.	Rs.	
A.	Pumping scheme for 15 gallons per head with four months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office-note No. 2070-S., dated 18th November 1895.
B.	Pumping scheme for 10 gallons per head with four months' supply in the reserve tank.	2,70,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in statement are based on Jones' calculations in the case of schemes D and E.
C.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank.	3,30,300	18,310	
D.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	*Note.*—The capital cost in each of the schemes B and C does not include provision for "establishment." The omission appears to be authorized by G.O., No. 847 M., dated 10th May 1895 referred to by Mr. Jones in his comparative statement.
E.	Gravitation scheme for 10 gallons per head with nine months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	....
F.	Municipal Chairman's scheme	1,00,000	Not known	....
G.	District Board Engineers	1,61,850	Do.	....

4 After a careful consideration of all the schemes the Sanitary Board agrees with the Sanitary Engineer in recommending scheme D, if Government considers scheme C too expensive.

5 If scheme D, being the cheaper of the two schemes approved by the Sanitary Board, is undertaken and if the Government makes a grant to the Council of half the cost as already promised and lends the balance at $4\frac{1}{4}$ per cent. interest, the amount required to liquidate the loan in 30 years would be Rs. 7,996, which together with the working charges of Rs. 14,970 represents an annual expenditure of Rs. 22,966. This would however be reduced by Rs. 596, if a sum of Rs. 10,000 out of the current balance reserved for the water-supply scheme is deducted from the loan now required.

6 In the existing state of affairs this sum is beyond the means of the Municipality; but if the proposal to raise the rates of the taxes on houses and lands and the water-tax from $7\frac{1}{2}$ to $8\frac{1}{2}$ and 4 to 8 per cent. respectively is passed into law and if the tax on arts is extended to all the classes of the schedule, then the additional income which may be expected would be—

	Rs.
Water-tax	15,799
House and land tax	4,443
Arts tax	585
Total ..	20,827

Thus the total amount available from all the sources will be Rs. 20,827 or Rs. 1,543 less than the amount required by the Municipal Council. Leaving altogether out of account the annual income expected from the South Indian Railway Company, the above deficit can easily be met by thoroughly revising the taxes on buildings and lands—*vide* the notes stitched with G.O., No. 180 M., dated 6th February 1895.

7. In these circumstances it is submitted that the Sanitary Board's recommendation to undertake scheme D may be approved.

V. RAGHAVA CHARLU—16-1-97.

Scheme C should, if possible, be approved. I have always been of opinion that Tuticorin is very much underassessed all round: but I do not believe we shall have the assessment properly imposed unless (as I suggested when I was Collector of Tinnevelly) a special officer is deputed to do the work.

2. Would it not also be reasonable to ask Port funds to make a contribution?

G. S. FORBES—18-1-97.

I don't find any report of the Sanitary Engineer's forwarding scheme and explaining the estimated cost of maintenance, under that scheme, of Rs. 11,100. I should like further information, for I don't understand why that scheme should be so summarily rejected. Nor, I may say, do I comprehend the intrinsic superiority of a pumping to a gravitation scheme, which seems to be assumed as a fact.

2 Why have schemes F and G not been examined?

No. 1031 M., 8TH JUNE 1898.

3 Please send up some sort of plans by means of which I may be able to understand the various schemes.

4 Also please state whether, in view of the fact that, as I understand, the Korampallam tank has just breached, it is worth while to go on with any of these schemes. My impression is that the Korampallam tank or the channel supplying it breaches every two or three years. If so, why shouldn't Mr. Jones' proposed nine months' supply tank breaches also and all the proposed expenditure be wasted? Mr. Hughes probably knows more about all these matters than any one else. Please consult him personally and let me know what he thinks.

5 It is all very well to say that the assessments at Tuticorin might be brought to a much higher standard if a special officer were put on. I daresay they might be. But it would not, I think, be safe to sanction a scheme for the supply of Tuticorin on the chance.

H. W. B[LISS]—19-1-97.

Draft demi-official to Mr. Hughes.

G. S. FORBES.

Please see draft demi-official put up.

V. RAGHAVA CHARLU—22-1-97.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated the 25th February 1897.

I received the plans of the Tuticorin water-supply scheme two days ago, but have not been able to examine them until to-day. I do not wish to offer any opinion on the proposed distribution works and confine my remarks to the works which concern me as an Irrigation officer, viz., the reserve tank and conduit.

2 At first Government charged for all the water issued from Korampallam tank but afterwards, for reasons into which I need not enter, it was conceded that only the water reaching the service reservoir should be charged for. I cannot say whether water is now paid for on measurement or otherwise. The quantity issued from the tank is about six times what reaches the town, and irrigation under the tank is carried on with much difficulty and greatly restricted owing to the large supply drawn off for Tuticorin and the system of giving the town the preference as long as the supply lasts. In this way I think Government loses Rs. 2,000 to Rs. 3,000 per annum. The construction of a water-tight conduit should have been insisted on long ago. The proposal now is to make a reserve tank, to be filled from the Korampallam tank and keep the water for use when the Korampallam supply gives out. The reserve tank is undoubtedly required if the town is to be supplied throughout the year and I have already expressed my opinion that it should be made large enough to contain nine months' supply. It will not however be filled every year but receive partial fillings during freshes and be filled at some time each year to the highest level reached in the Korampallam tank. Regarding the site of the reservoir I

A notice that it does not appear to have been taken into account that there is a bye-wash near the left flank of the Korampallam tank which is intended to discharge when there is a higher flood than the Oopar oday dam can dispose of or when there is danger to the bund. The water from this goes past Korampallam village and crosses the fresh water channel in the low ground not very far from the sluice. There should be a space of a few hundred feet left between the road and the

B reservoir bank. The next point is that the site is for the most part wet land for which no compensation is provided in the estimate. I do not know whether it is

C intended to make the bund of earth dug close by. The rate apparently provides for bringing earth from a good distance. In my letter of 4th May, which is in the file, I gave reasons for thinking that the waste by leakage and evaporation from the Korampallam tank is probably $1\frac{1}{2}$ feet a month. Mr. Jones has taken no notice of this but apparently adheres to his estimate of 5 inches a month loss from the new tank evidently expecting to stop all leakage by the puddle wall extending to 4 feet below the

There is notoriously great leakage.
G. S. FORBES.

D tank bed. Perhaps he has had excavations made and found a clay bed at that level. If he has not done so, I think a thorough examination of the place should be made, or a leaky tank would be useless, and if the matter cannot be placed beyond doubt in any other way a small tank might be made as an experiment and filled by baling from the fresh water channel.

3 Regarding the conduit which it is proposed to build in the bed of the fresh water channel, I think it might be found impossible to build the whole four miles in one season while the Korampallam tank is dry and in time to allow it to set before the supply begins. It will take 2,500 tons of bricks which have to be carted about

20 miles or railed 30 and carted 3, but of course they could be prepared in advance.

E | Why not have 15″ or 18″ cement or glazed earthenware pipe which could be laid in a very short time and would be stronger than and as water-tight as the culvert, while costing very much less.

I return the papers and plans.

Demi-official from G. S. Forbes, Esq., I.C.S., Secretary to Government, Local and Municipal Department, to the Sanitary Engineer to Government, dated the 26th February 1897, No. 22.

Please see Hughes' letter.

2. The Honourable Member asked me to consult him. Can you throw light on his difficulties—see specially points marked **A, B, C, D, E.**

Demi-official from J. A. Jones, Esq., Sanitary Engineer to Government, to the Secretary to Government, Local and Municipal Department, dated 1st March 1897, No. 406.

Herewith notes on Mr. Hughes' remarks as to Tuticorin water-supply scheme, which I think fully reply to his criticisms.

Tuticorin Water-supply.

1. **A**—Bye-wash near the left flank of the Korampallam tank.—There is a space of not less than 150 feet below the road and reservoir bund. The bund of the new tank is farther from the road than the channel so that there has been no interference with any course through which water may be discharged from the bye-wash. The crossing is evidently by the channel crossing the fresh water channel, and this has not been interfered with.

2. **B**—The site is for the most part wet land and for which no compensation is allowed in the estimate.—Compensation ~~of~~ land taken up for the reserve tank *is* provided in the estimate—*vide* Sanitary Engineer's estimate, page 12, dated 27th July 1896. Again look at paragraph 8 of report, dated 27th July 1896, where *an increased* allotment for land is referred to.

3. **C**—Whether it is intended to make the bund of earth dug close by.—In paragraph 19 of the Sanitary Engineer's letter No. 1538, dated 27th July 1893, embodied in G.O., Mis. No. 159 M., dated 14th February 1894, he says "The tank is proposed to be formed of simple banks without pitching, the slopes are $2\frac{1}{2}$ to 1 both inside and out with a puddle wall in the centre. The soil is very sandy and there is no economy to be obtained by making the banks with steeper slopes as sand hills and other excavations in the bed of the tank give the quantity of earth sufficient to make the banks of the section proposed. The banks will be *turfed* and the top of the tank will be 4 feet above the maximum water level of the tank.

The data for the rate of Rs. 6-8-0 per 1,000 cubic feet are—

	Rs.	A.	P.
One thousand cubic feet earthwork	2	12	0
One hundred and eighty yards lead at As. 6 for 20 yards	3	6	0
Two yards lift at As. 3	0	6	0
Total ..	6	8	0

4. **D**—Perhaps he (Sanitary Engineer) has had excavations made and found a clay bed at that level.—In estimating the area of the proposed tank, Sanitary Engineer in his report, dated 27th July 1896, says: "*Evaporation has not been allowed for, as scheme is for* 34,000 *people whereas there are only* 25,000 *to be provided for* at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable."

5. There is no evidence of any clay bed below the sandy soil, and it would be inexpedient to arrange for tank taking into account a high evaporation and leakage for 34,000 when only 25,000 will use water at first and will probably not use even 10 gallons, and when it may be the case that by the time 34,000 people have to be provided for, the Korampallam tank may be filled to its proper level. The area of the tank altered is based on only a level of 16·00 and not 19·40 which is the proper full tank level.

6. **E**—Why not have 15″ or 18″ cement or glazed earthenware pipe which could be laid in a very short time and would be stronger than and as water-tight as the culvert while costing very much less.—Mr. Hughes suggests a 15″ or 18″ pipe. A 12″ pipe or less might be similarly suggested, but what is required is a 21″ pipe or else the full quantity of water for 34,000 people will not be obtainable. And this is a portion of

the work which must be made full size at once. But even if an 18″ pipe was allowable the cost would be more than what is proposed—*vide* the following :—

The cost of 21″ masonry culvert for a length of 22,100 feet as estimated is Rs. 44,472 or, say, Rs. 2 a foot.

The cost per foot of cement and stoneware pipes is as below :—

	RS.	A.	P.
21″ cement pipes (laid)	3	0	0
21″ stoneware pipes, Burn & Co's. at Calcutta (exclusive of conveying charges and laying)	4	0	0
18″ stoneware pipes, Burn & Co's. (delivery at Calcutta exclusive of conveying charges and laying)	2	8	0
18″ Doulton's stoneware pipes (delivered at Bombay)	3	8	0
15″ do. do.	2	8	0

7. The above rates clearly show that cement or stoneware pipes cannot be substituted for a masonry conduit, so that even if the fall were increased and much expenditure incurred in excavation and extra cost for filter, for service reservoir, for engine and for pumping and pipes so small as 15″ used, there would be no economy but the reverse.

8. Bricks quite good enough for the conduit are obtainable 10 miles from Korampallam. The culvert would be built in lengths, the channel being replaced by iron pipes during the building of the lower portion so that the building might occupy any length of time and the supply still go on.

Demi-official from H. A. Sim, Esq., I.C.S., Private Secretary to His Excellency the Governor, to the Secretary to Government, Local and Municipal Department, dated 2nd March 1897, *No.* 39.

With reference to the enclosed, which please return, I shall be glad if you will send up the papers regarding the Tuticorin water-supply scheme for His Excellency's information.

ENCLOSURES.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Private Secretary to His Excellency the Governor, dated 16th February 1897, *No.* 97.

I beg to submit a copy of my motion and the resolution of the Municipal Council, dated 12th instant, and request you will be so good as to let me know whether His Excellency will be pleased to grant an interview to the members of the deputation.

2. The members intend starting to Madras as early as possible before the end of this month.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Municipal Councillors, Tuticorin, dated , No.

It is now so many years since a water-supply scheme to our town has been proposed, discussed, and submitted and over and over we represented to the Government the miseries and hardships of the people especially in times of droughts which are so frequent but up to date nothing definite has been done.

2. There has been some consolation to us when we heard from Government a few months ago that the Sanitary Engineer has been asked to prepare estimates to a less expensive water scheme on gravitation principle. There it lies and God knows when it is going to come.

3. It is a wonder that epidemics of most serious nature did not break out in this town; because, exclusive of the impurity of the water which the people have to drink, in times of water-supply failures, even the water we get from Korampallam tank by open channel is impure and subject to various pollutions. It will be unsafe no doubt to expect such special protections of Providence any more, unless the scheme is taken up at once. I am afraid most serious consequences are in store for this unfortunate town. Many towns which are very much less in importance receive the attention of Government, and water schemes are sanctioned and carried out without delay; whereas this town which is only next in importance of trade to the metropolis is ignored altogether. I am sure His Excellency the Governor will be only pleased to sanction the water scheme if he is only properly informed of the sufferings and miseries of the people for want of water-supply.

4. I therefore beg to propose that three members of the Council be selected and requested to wait on a deputation on His Excellency the Governor and lay before him the real state of affairs in this town for want of a water scheme.

No. 1031 M., 8TH JUNE 1898.

Extract from the Proceedings of the Municipal Council, Tuticorin, dated 12th February 1897.

* * * * * * *

Read motion from the Chairman regarding water-supply scheme to this town.

Resolution No. 7.—Resolved that Captain Baker, the Chairman, and Rev. Gnanakan be requested to wait on His Excellency the Governor on deputation regarding the water scheme.

* * * * * * *

Herewith the file about Tuticorin.

G. S. FORBES.

To the Private Secretary.

Seen and returned with thanks.

A. E. H[AVELOCK]—6-3-97.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated 10th March 1897, *No.* 46.

I return the Tuticorin water-supply papers. Jones has been to see me and I understand him to agree that the storage reservoir should have its bed puddled 1½ feet deep. With regard to the distance between the reservoir and the road, the men, who is carrying out the work, can see that enough space is left. I think there should be 300 feet.

It seems that it is considered inadvisable to lower the bed of the filter beds. It is not for me to say. Assuming them 7·40 I suppose a conduit 1¾ feet diameter is required. This is for Campbell to decide. All I am concerned about is that the reservoir and conduit or at least the latter should be built soon. I am afraid anybody who expects the Public Works Department to build the conduit in one dry season will be disappointed.

To the Local and Municipal Department.

LOCAL AND MUNICIPAL DEPARTMENT.

As the adoption of any particular scheme must depend largely on the amount of contribution or aid, Government can afford to give to the Municipality, this file must, until the financial position is clearer, lie over.

G. S. F[ORBES]—28-5-97.

Yes, he should.

A. E. H[AVELOCK]—25-5-98.

I don't think the draft is enough. The Sanitary Engineer should be asked what he has been doing since the issue of G.O., No. 1571 M., dated 16th September 1896.

H. W. B[LISS]—20-5-98.

I concur.

2. The Tuticorin water-supply is, as far as my information guides me, the most pressing and important of those before us. In the linked file, the Tuticorin water-supply scheme and all others are ordered to lie over until our financial position is clearer. Our revenue is coming in well. Perhaps Sir H. Bliss would consider whether a further step towards getting this Tuticorin scheme set on foot, might now be taken.

A. E. H[AVELOCK]—20-5-98.

Circulated to the Honourable Member again.

H. TREMENHEERE—21-5-98.

I am afraid there is very little chance at present of our having funds to forward any water and drainage schemes other than those entered in the budget (Tirupati, Rs. 77,400, Vizagapatam, Rs. 20,500 and Cocanada, Rs. 52,100). It is ~~due~~ that our revenue is coming in well, but (1) if we get an extra and unanticipated 20 lakhs this year, we could not use it, for we are limited as to expenditure to the provision

made on the expenditure side of the budget, and (2) the first charge on any increase of revenue we may get will be provision for restoring our balance to the stipulated minimum of 20 lakhs. As the budget for 1898–1899 stands, we shall close the year with a balance of 6·08 only. We have therefore a sum of Rs. 13·92 to make good from our annual surpluses of revenue over expenditure before we shall be restored to a state of solvency.

2. Another reason why we cannot at present help forward Municipal water and drainage schemes is that no allotment has been made us at present wherefrom we can grant loans to Municipalities. The Municipal Councils will therefore have to raise money in the open market, instead of borrowing from Government at 4 or 4¼ per cent. with the bank rate at 12 per cent., it is unnecessary to labour the point that they cannot hope to raise loans in the open market on any terms which they can afford.

3. Our position will not improbably be eased during the year by the fact that we shall not need to spend on famine relief the whole sum of Rs. 8·50 which has been provided. But on the other hand, we only provided half a lakh, I think, for plague expenditure, which won't be anything like enough. We shall probably spend 2 or 2½ lakhs on plague preventive measures, even if plague does not actually break out: if it does, no one can say how much, perhaps 10 to 15 lakhs. Moreover, if we have any savings out of the budget provision for famine, they are already appropriated to the scheme for the better payment of the taluk establishments, if sanctioned by the Secretary of State, as I have little doubt they will be.

·50 under 24. Medical—Provincial.
C. M. SCHMIDT.

Also additional Munsif's Courts.
C. M. SCHMIDT.

4. I have written the above partly from memory and partly from reference to the original (Preliminary) issue* of the civil estimates, so the Financial Department had better see before this goes to His Excellency and correct any errors I may have made.

*Dated 14th January 1898.

H. W. B[LISS]—21–5–98.

To the Financial Department with reference to the Honourable Member's note.

H. TREMENHEERE—23–5–98.

To the Financial Department.

FINANCIAL DEPARTMENT.

Honourable Member's figures have been corrected with reference to the figures in the Financial statement.

C. M. SCHMIDT—23–5–98.

A. T. ARUNDEL—23–5–98.

I accept, with regret, the draft Government Order. But, I should be glad if this matter be brought to notice after the lapse of four months, when perhaps our financial position may have become more assured.

A. E. H[AVELOCK]—25–5–98.

To the Local and Municipal Department.

LOCAL AND MUNICIPAL DEPARTMENT.

Issue the draft.

G. S. F[ORBES]—6–6–98.

[G.O., No. 1031 M., dated 8th June 1898.]

[L. & M. 60]

LOCAL AND MUNICIPAL DEPARTMENT.

NOTE FILE.

1031 2

Re Cemetery site
No 1031
8-6-94

Please put
Docs 3 Ports
in
Engl

Subject
Tuticorin Water Supply Scheme. 10

LOCAL AND MUNICIPAL DEPARTMENT.

V.R. Circular Cutts Cw. 1031 dtd 8-6-98

Current No. 3174 M

From

The Sanitary Board. no 2635 D
21st Nov 96.

I dont find any report of the San. Engrs forwarding scheme E explaining the estimated cost of maintenance, under that scheme, of Rs 11,100 - I should like further info, for I dont understand whether that scheme should be so summarily rejected - Nor, I may say, do I comprehend the intrinsic superiority of a pumping to a gravitation scheme, which seems to be assumed as a fact.

Why have schemes F & G not been drawn ?

Please send up some sort of plans by means of which I may be able to understand the various schemes.

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Hy. A.

Hy/B. Engr. No 1435 M. 18-2-96

FOR ORDERS.

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910

Engineer might be revised by reducing the supply per head from 15 to 10 gallons. This recommendation of the Sanitary Board was approved by Government and in its order No.435 M., dated 16th March 1896, the Sanitary Engineer was requested to submit revised estimates. The Municipal Council in its resolution thereon expressed the opinion that even on Sanitary grounds 10 gallons per head would be quite insufficient and that fully 15 gallons would be required for each person in the town and as it still thought that pumping might with advantage be dispensed with, the Government was requested to reconsider its decision in the matter. But this letter was recorded in G.O.No.1277 M., dated 31st July 1896, pending receipt of the revised estimate called for from the Sanitary Engineer.

2. With reference however to the Government order of March 1896 quoted above, the Sanitary Engineer in the first instance submitted for the approval of the Sanitary Board, two schemes, one for Rs 2,73,140 retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10 gallon supply and the other for Rs 3,30,000 providing in addition to the modifications of the original scheme referred to above for

(1) such an increse in the size of the reserve tank as would render it capable of holding 9 months' supply of

Why should not Mr. Jones' proposed q- with supply tank branch also all the proposed expenditure be wanted? Mr. Hughes had by Know more about all these matters than anyone else. Please consult him personally & let me know what I may C.

He thinks -

Hiallery will to say that the assessment at Interim might be brought to a much higher standard if special officers were taken. I daresay they might be. But it would not, I think, be safe to sanction a scheme for the supply of Interim on the chance.

19/1/97

Draft to be put up for Mr Hughes

Please see draft G.O. proposed.

3

of water, instead of only 4 months' supply as originally intended and (2) chambers for Gill's arrangements for filters.

27

The Sanitary Board however considered these two schemes as impracticable for financial reasons and asked the Sanitary Engineer to state if a cheaper scheme could not be devised. On this the Sanitary Engineer proposed to reduce the cost of his scheme to Rs 2,68,334 by omitting filter beds and service reservoirs. As this amount was also considered by the Board to be large, the Sanitary Engineer submitted a gravitation scheme, which though more expensive in the first instance than the pumping scheme costing Rs 2,68,334 involved a cheaper annual cost. In this scheme the service reservoir, the filters, the pumping house and engines are all omitted.

3. The following statement, given by Chairman, shows the cost and working charges of the several schemes above referred to:-

× Vide current

ee

Items	Scheme	Capital cost	Annual working charges	Remarks.
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank	3,19,430	18,000.	That the working cost is Rs per annum appears from the tary Commissioners' ... No. 2070/S dt 18-11- 5.
B	— do — for 10 gallons per head — do —	2,73,140	16720	The working cost has been given by the S. Engineer. The figures Statement are based o Jones's calculations in th of schemes D & E.
C	— do — do — with 9 months' supply in the reserve tank	3,30,000	18,310	
D	— do — do — (filters and service reservoir omitted)	2,68 334	14.970	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted)	2,78,000	11,100	Note. The capital Cost each of the schemes does not include pro for establishment. omission appears
F	Municipal Chairman's scheme	1,00,000	not known	authorized by G.O. 847 referred to by Mr Jones his comparative sta
G	District Board Engineers	1,61,850	not known	

4

After a careful consideration of all the schemes, the Sanitary Board agrees with the Sanitary Engineer in recommending scheme D, if Government considers scheme C too expensive.

If scheme D, being the cheaper of the two schemes approved by the Sanitary Board, is undertaken and if the Government makes a grant to the Council of half the cost as already promised and lends the balance at 4¼ per cent interest, the amount required to liquidate the loan in 30 years would be Rs 7,996, which together with the working charges of Rs 14,970 represents an annual expendi-ture of Rs 22,966. This ~~will~~ would however be reduced by Rs 596 if a sum of Rs 10,000 out of the current balance reserved for the water supply scheme is deducted from the loan now required.

In the existing state of affairs this sum is beyond the means of the Municipality; but if the proposal to raise the rates of the taxes on houses and lands and the water tax from 7½ to 8½ and 4 to 8 per cent respectively is passed into law and if the tax on arts is extended to all the classes of the schedule, then the additional income which may be expected would be

Water tax -------	Rs 15,799
House & land tax--,,	4,443
Arts tax--------- ,,	585
Total Rs	Rs 20,827.

Thus the total amount available from all the sources will be Rs 20,827 or Rs 1543 less than the amount required by the Municipal

× Note- This is approximately taken at ⅛ of the current demand for 1895-96 of Rs 4,682.

Flag A.

Flag D.

5 38

Municipal Council. Leaving altogether out of account the annual income× expected from the South Indian Railway Company, the above deficit can easily be met by thoroughly revising the taxe on buildings and lands-Vide the notes× stitched with G.O.No. 180 M dt 6-2-95.

4. In these circumstances it is submitted that the Sanitary Board's recommendation to undertake scheme D may be approved.

V Raghavachariar
16/11/97

H.M.

Scheme C should if possible be approved. I have always been of opinion that Tuticorin is very much underassessed all round: but I donot believe we shall have the arts properly imposed unless (as I suggested when I was (Collector of Tinnevelly) a special officer is deputed to do the work.

Would it not also be reasonable to ask Port Funds to make a contribution?

Note

The returns from certain [illegible] pack up with the budget estimate of provincial taxes and grants had to be awaited.

Please put her V.Rs of 18/11/97
H.M.S. Secretary 19/11/97

E. 22-4.96—1,000

...inee, Burn & Co's. (delivery

...E. 1031 M.

Rep dear Jones No 22 of 26-2-97

Please see Kupia Letter.

PUBLIC WORKS SECRETARIAT,
IRRIGATION BRANCH,
CHEPAK, MADRAS.

The S.E. asked me to consult him. Can you 25 Feb 1897
show him the difficulties. I shall speedily

My dear Forbes! Yours marked P.W.S.C.D. 2

I received the plans of the Intermediate water supply scheme two days ago but have not been able to examine them until today. I do not wish to offer any opinion on the proposed distributing works and confine my remarks to the works which concern me as an Irrigation Officer viz the reserve tank and Conduit.

At first sight charged for all the water raised from Karampallam

...orbes dated 25th. February
...Engineer to Government.

...k of the Korampallam tank.

...s than 150 feet below the road...
...new tank is farther from the
...ere has been no interfere...
...ber may be discharged from t...
...y by the channel crossing the
...not been interfered with.

...t wet land and for which no
...timate.

...p for the reserve tank is
...nitary Engineer's estimate
...ain look at para. 8 of repor...
...ated 27th. July 1895 where an increased allotment for land
is referred to.

(C). Whether it is intended to make the bund of earth dug close by.

In para. 19 of the Sanitary Engineer's letter No. 1558 dated 27th. July 1895 embodied in G.O. No. 159 M Mis., dated 14th. February 1894, he says "The tank is proposed to be for... of simple banks without pitching, the slopes are 2½ to 1 both inside & out with a puddle wall in the centre. The soil is sandy and there is no economy to be obtained by making the banks with steeper slopes as sand hills & other excavation the bed of the tank give the quantity of earth sufficient make the banks of the section proposed. The banks will be turfed and the top of the tank will be 4 feet above the ...mum water level of th... tank.

The data for th... rate of Rs ... 1000 cu...

but afterwards, for reasons into which I need not enter, it was conceded that only the water reaching the Service reservoir should be charged for. I cannot say whether water is now passed by meter, or otherwise — The quantity issued from the tank is about six times what reaches the town and irrigation under the tank is carried on with much difficulty and partly restricted owing to the large supply drawn off for Intercourse and the system of giving the town the preference as long as the supply lasts. In this way I think Govt. loses Rs 2000 to Rs 3000 per annum. The construction of a water-tight

conduit should have been insisted on long ago. The proposal now is to make a second tank, to be filled from the Krumpathum Tank and keep the water fresh when the K. supply fails — The second tank is undoubtedly required if the town is to be supplied throughout the year and I have already expressed my opinion that it should be made large enough to contain 9 months supply. It need not however be filled every year but receive partial fillings during freshes and be filled at some time each year to the highest level reached by in the K. Tank. Regarding the site of the reservoir

I notice that it does not appear to have been taken into account that there is a bye-wash near the left flank of the K. Tank which is intended to discharge when there is a higher flood than the open ordy dam can dispose of without there is danger to the bund. The water from the sea finds its way through village and crosses the fresh water channel in the two places entering far into the tank. There should be a space of 150 feet left between the road and the reservoir bank — The next point is that the site is in the most part wet land for which no compensation is provided in the estt. I do not know whether it is intended to make the bund of earth dug close by. The rate apparently towards bringing earth from a good distance — In my letter of the 29th which is in the file, I gave reasons for thinking that the waste by leakage and evaporation from the K Tank is probably 1½ ft a month. Mr. Jones has taken no notice of this but apparently adheres to his estimate of 5 inches a month loss from the reservoir evidently expecting to stop all leakage by the puddle wall 4 feet 6 in below the tank bed

PUBLIC WORKS SECRETARIAT,
IRRIGATION BRANCH,
CHEPAK, MADRAS.

page 12 dated [illegible] 1896). Agai

Perhaps he has had
excavations made and
found a clay bed at that
level. If he has not done so, I think
a thorough examination of the
place should be made, as a
leaky tank would be useless, and
if the matter cannot be placed
beyond doubt in any other way
a small tank might be made
as an experiment and filled by
boring from the Permanter channel
Regarding the Conduit which
is proposed to build with
bed of the fresh water Ch:
I think it might be found
economic to build the whole
four miles in the season while
the the Tanks are dry and in time
to allow it to set before the rainy
begins. It will take 2500 lins
of tiles which have to be carted
about 20 miles a railed 30 r
carted 3 but of course they
could be prepared in advance
they not have a 15" or 18"
Cement or glazed earthenware
pipe which could be laid in
a very short time and would
be stronger than and as water-
tight as the Culvert, while
costing very much less.

Yrs Truly
W. Hughes

I return the papers & plans

dated 27th. July 1896 where

S.E. 29-4-96—1,000
5

No. 406 GOVERNMENT OF MADRAS.

Office of Sanitary Engineer to Govt.,

Fort St. George, 1 3 1897.

8P7

Dear Forbes.

Herewith note on Mr Hughes remarks re to Entrenchment Water Supply Scheme - which I think fully reply to his criticisms.

Yours sincerely

H Price

S.S. Forbes Esq
Secy to Govt

very

1031 M.

9P

bes dated 25th. February
Engineer to Government.

of the Korampallam tank.

than 150 feet below the road
new tank is farther from the
ere has been no interferen
ter may be discharged from t
ly by the channel crossing the
s not been interfered with.

rt wet land and for which no
estimate.

up for the reserve tank is
Sanitary Engineer's estimate
page 12 dated 27th. July 1896). Again look at para. 8 of repor
dated 27th. July 1896 where an increased allotment for land
is referred to.

(C). Whether it is intended to make the bund of earth dug close by.

In para. 19 of the Sanitary Engineer's letter No. 15[illegible]
dated 27th. July 1895 embodied in G.O. No. 159 M Mis., dated
14th. February 1894, he says "The tank is proposed to be for
of simple banks without pitching, the slopes are 2½ to 1 both
inside & out with a puddle wall in the centre. The soil is
sandy and there is no economy to be obtained by making the
banks with steeper slopes as sand hills & other excavation
the bed of the tank give the quantity of earth sufficient
make the banks of the section proposed. The banks will be
turfed and the top of the tank will be 4 feet above the
mum water level of the tank.

The data for the rate of [illegible] 1000 cu

18" stoneware pipes, Burn & Co's. (delivery

TUTICORIN WATER SUPPLY.

D.O. from Mr. Hughes to Mr. Forbes dated 25th. February 1897 transferred to the Sanitary Engineer to Government.

(A). Bye-wash near the left flank of the Korampallam tank.

There is a space of not less than 150 feet below the road & reservoir bund. The bund of the new tank is farther from the road than the channel so that there has been no interferen with any course through which water may be discharged from t bye-wash. The crossing is evidently by the channel crossing the fresh water channel, and this has not been interfered with.

(B). The site is for the most part wet land and for which no compensation is allowed in the estimate.

Compensation of land taken up for the reserve tank is provided in the estimate, (vide Sanitary Engineer's estimate page 13 dated 27th. July 1896). Again look at para. 8 of repor dated 27th. July 1896 where an increased allotment for land is referred to.

(C). Whether it is intended to make the bund of earth dug close by.

In para. 19 of the Sanitary Engineer's letter No. 15? dated 27th. July 1895 embodied in G.O. No. 159 M Mis., dated 14th. February 1894, he says "The tank is proposed to be for of simple banks without pitching, the slopes are 2½ to 1 bot inside & out with a puddle wall in the centre. The soil is sandy and there is no economy to be obtained by making the banks with steeper slopes as sand hills & other excavation the bed or the tank give the quantity of earth sufficient make the banks of the section proposed. The banks will be turfed and the top of the tank will be 4 feet above the mum water level of th tank.

The data for th rate of Rs 1000 cu

1000 cubic feet Earth work ----- ----------Rs 3-13-0

180 yards Lead at 6 annas for 30 yards ----- 3-6-0

3 yards Lift at 5 annas ---------- 0-6-0

Total- 6-8-0

(D). Perhaps he (Sanitary Engineer) has had excavations made & found a clay bed at that level.

In estimating the area of the proposed tank, Sanitary Engineer in his report dated 27th. July 1896 says "Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable".

There is no evidence of any clay bed below the sandy soil, and it would be inexpedient to arrange for tank taking into account a high evaporation & leakage for 34,000 when only 25,000 will use water at first and will probably not use even 10 gallons, and when it may be the case that by the time 34,000 people have to be provided for, the Korampallam tank may be filled to its proper level. The area of the tank altered is based on only a level of 16.00 & not 19.40 which is the proper full tank level.

(E). Why not have 15" or 18" cement or glazed earthenware pipe which could be laid in a very short time and would be stronger than and as water tight as the culvert while costing very much less.

Mr. Hughes suggests a 15" or 18" pipe-A 12" pipe or less might be similarly suggested, but what is required is a 31" pipe or else the full quantity of water for 34,000 people will not be obtainable. And this is a portion of the work which must be made full size at once. But even if an 18" pipe was allowable the cost would be more than what is proposed, vide the following.

The cost of 31" Masonry culvert for a length of 33,100 feet as estimated is Rs 44,472 or say Rs 2 a foot.

The cost per foot of cement & stoneware pipes is as below:-

31" cement pipes (laid) ----------Rs 3-0-0

31" stoneware pipes, Burn & Co's at Calcutta (exclusive of conveying charges

18" stoneware pipes, Burn & Co's. (delivery at Calcutta exclusive of conveying charges & laying) ----------Rs 2-8-0.

18" Doulton's stoneware pipes (delivered at Bombay)----------Rs 3-8-0.

15" ----------do----------Rs 2-8-0.

The above rates clearly show that cement or stoneware pipes cannot be substituted for a masonry conduit, so that even if the fall were increased & much expenditure incurred in excavation & extra cost for filter, for service reservoir, for engine & for pumping & pipes so small as 15" [redacted] used there would be no economy but the reverse.

Bricks quite good enough for the conduit are obtainable 10 miles from Korampallam. The culvert would be built in lengths, the channel being replaced by iron pipes during the building of the lower portion so that the building might occupy any length of time & the supply still go on.

Sanitary Engineer to Government.

GOVERNMENT HOUSE
MADRAS
2nd March 1897

D.O.No. 39

My dear Forbes

With reference to the enclosed, which please return, I shall be glad if you will send up the papers regarding the Tuticorin Water Supply scheme for His Excellency's information.

Yours Sincerely

W. P. Inn

G. S. Forbes Esqre &c.

Municipal Council Office
Tuticorin 16th February 1897

By J. Mills Peter Victoria
Avergal
Chairman Municipal Council
Tuticorin

Private Secretary to
His Excellency the Governor
Madras

Sir

I have to submit a Copy of my
the resolution of the
Council dated 12th instant
you will be so good as
to let me know whether His Excellency
will be pleased to grant an interview
to the members of the Deputation
2. The members intend starting to
Madras as early as possible before
the end of this month.

I have the honour to be
Sir,
Your Most Obedient Servant
J. Mills Peter Victoria

No 97

Municipal Council's Office
Tuticorin 16th February 89

From.

M R Ry J. M. Pate Victoria
Avergal
Chairman Municipal Council
Tuticorin

To

The Private Secretary to
His Excellency the Governor
Madras

Sir,

I beg to submit a Copy of my motion and the resolution of the Municipal Council dated 12th instant and request You will be so good as to let me know whether His Excellency will be pleased to grant an interview to the members of the Deputation. 2. The members intend starting to Madras as early as possible before the end of this month.

I have the honour to be
Sir,
Your Most Obedient Servant.
J M R de Victoria

Rs. 10 3/4 $1.50

92

From

The Chairman
Municipal Council
Trichy

To

The Private Secretary
to His Excellency
The Governor
Madras

Dated 16th
Desp'd 17th
Recd February 1897

No 97
Enc: Two

Submitting a copy of the resolution of the Council requesting to be informed whether His Excellency will be pleased to grant an interview to the members of Deputation proceeding to Madras in connection with Water supply Scheme.

1793 13

To

The Municipal Councillors
Trichy

A

Gentlemen,

It is now so many years since a water supply scheme to our Town has been proposed, discussed and submitted and over and over we represented to the Government the miseries and hardships of the people especially in times of droughts which are so frequent but up to date nothing definite has been done -

There has been some consolation to us when we heard from Government a few months ago that the Sanitary Engineer has been asked to prepare estimates to a less expensive water scheme on Gravitation principle. There it lies and God knows when it is going to come -

It is a wonder that epidemics of most serious nature did not break out in this Town because exclusive of the impurity of the water which the people have to drink - in times of water supply failures, even the water we get from Korampallam Tank by open channel is impure and subject to various pollutions. It will be unsafe no doubt to expect such special protections of Providence any more, unless the Scheme is taken up at once - I am afraid most serious consequences are in store for this unfortunate Town - Many towns which are very much less in importance receive the attention of Government, and water schemes are sanctioned and carried out without delay; whereas this town which is only next in importance of trade to the Metropolis is ignored altogether. I am sure His Excellency The Governor will be only pleased to sanction the water scheme if he is only properly informed of the sufferings and miseries of the people for want of water supply -

I therefore beg to propose that three members of the Council be selected and requested

2 No 139 of 1897

to wait on a Deputation on His Excellency The Governor and lay before him the real state of affairs in this Town for want of a water Scheme.

(Signed) J Wm B Roche Victoria

Chairman

True Copy

J Wm B Roche Victoria

Chairman

Extract from the Proceedings of the Municipal Council Victoria in their meeting held on Friday the 12th February 1897 at 5.30 P.M.

Present:-

M. R. By J Wm B Roche Victoria Bengal

Chairman

T. N. Baker Esq

T. Harvey Esq

G. Elsworger Esq

M. R. By T. M. Ramachandra Chettiar Nayudu

" P. Viravagu Pillai Bengal

" S. Y. Moidin Kadir Khan Bahadur

" M. Kadir Moidin Raster Bl

" A. Ganapathi Pillai Bengal

Revd. C. O. Gnanadian B. A.

× × ×

7. Read motion from the Chairman regarding water Supply Scheme to this town.

Resolved that Captain Baker the Chairman & Revd Gnanadian be requested to wait on His Excellency the Governor on Deputation regarding the

3/
No 39 of 1897

the Waters Scheme

× × ×

(Signed) J. Mitt Roche Victoria

Chairman

True Extract

J. M. Roche Victoria

Chairman

[L. & M. No.]

Local & Munl. (1897) Department.

D. O. No. 39

D. O.

From The Private Secretary to H.E. the Governor

My dear Sir
Herewith the file.
about Tuticorin
Yours Sincy
S. Bailey

No.

Dated 2-3-1897

Received 4-3-1897

Registered 4-3-1897

Enclosures 3

Spare copies.

to the Private Secretary to the Govt. Secretariat

A.H 6.3.97.

to the Local Debt

SUBJECT.

Requesting that the papers regarding the Tuticorin Water supply scheme may be sent up for His Excellency's information.

BACK PAPERS.

G.O.	No.	Department.	Date.

FURTHER PAPERS.

G.O.	No.	Department.	Date.

D.O. No 46

PUBLIC WORKS SECRETARIAT,
IRRIGATION BRANCH,
CHEPAUK, MADRAS.

10 March 97

My dear Parker.

I return the Tuticorin water supply papers. Jones has been to see me and I understand him to agree that the Storage reservoir should have its bed puddled 1½' deep. With regard to the distance between the reservoir and the road the men who are carrying out the work can see that enough space is left – I think there should be 300 ft.

It seems that it is considered inadvisable to locate the bed of position is clearer see over

E. P. Parker Esq.
25/3/97

97) Department.

D. O. No. 46

From W. Hughes Esqr.

No.

Dated 10 March 1897.

Received 10-3-1897

Registered 10-3-1897

Enclosures

Spare copies.

SUBJECT.

Returning with remarks the Tuticorin Water Supply Papers.

the filter beds. It is not for me
to say. Assuming them 7.40
I suppose a Conduit 13/6 diam.
is required - That is for Campbell
to decide. All I am concerned
about is that the reservoir and
Conduit (and the latter) should be built soon.
I am afraid anybody who
expects the Dpt to build this
Conduit in one day season will
be disappointed.

Yr truly
W. Hughes

Local & Munl. (1897) Department.

D. O. No. 46

D. O.

For orders

From W. Hughes Esqr.

As the adoption of any particular scheme must depend largely on the amt of contributions or aid for. can afford to give to the Mtly. this file must enlist the financial position is clearer hereover

No.

Dated 10 March 1897.

Received 10-3-1897

Registered 10-3-1897

Enclosures

Spare copies.

SUBJECT.

Returning with remarks the Tuticorin Water Supply Papers.

BACK PAPERS.

G.O.	No.	Department.	

FURTHER PAPERS.

G.O.	No.	Department.	Date.

Local & Munl. (189) Department.

CURRENT No. 16576

From The Chairman Delegate Municipal Council Tuticorin

No. 227

Dated 10th May 1898

Received

Registered

Enclosures

Spare copies

SUBJECT.

Reporting that there is not a dry source of drinking water in the town be questioning the Government to frame a scheme of water supply at present.

Order

As the adoption of any particular scheme of water supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the municipal council, the Government regrets that nothing can be done until the financial position of Government is clearer. Meanwhile, the municipal council should do its best to improve the existing tanks and wells in the town.

2. The Chairman's letter should have been submitted through the Collector as required in G.O. No 1162 M.

4th September 1893.

P.T.O.

Note The file of papers connected with this subject was sent up to the Secretariat on the 12th instant with a draft D.O. to the Private Secretary.

VK 9/5/98

I don't think there is enough - The Sanitary Dept. will be asked what they have been doing since the issue of G.O. 15/1 Mn 18-9-96

Hs [illegible]
20/5/98

1. Yes, sir.

2. The Tuticorin Water-supply is, as far as my information goes, the most pressing and important of those before us. In the linked file, the Tuticorin water-supply scheme is referred to the next until our financial position is clearer. Our Revenue is coming in well. Perhaps Sir H. Blair would consider whether a further step towards getting the Tuticorin scheme out of hand might now be taken.

A.G.H. 20.5.98

H. M. a/c

Circulated to the Hon'ble Member

21-5-98

To Chairman, M.C. Tuticorin,
through the Collector of Tinnevelly.

I am glad there is every likelihood of your having funds to forward a scheme for water-supply and drainage for Tuticorin at present. I am unable to say whether any of the schemes other than those entered in the Budget (Tirupati, Cocanada, Rs 77400; Vizagapatam, Rs 20,500; and Rs 52,100). At the same time that our Revenue is coming in well, but (1) if we get an extra unanticipated 20 lakhs this year, we could not use it, for we are limited as to expenditure by the provision made on the Expenditure side of the Budget, and (2) the first charge on any increase of Revenue will be provision for famine, for which we still have to find 20 lakhs.

1898

BACK PAPERS.

G.O.	No	Department.	Date.

Yes, Secretariat. H.S.H. 25.5.98

FURTHER PAPERS.

G.O.	No.	Department.	Date.

* 1898-99 stand, we shall close the year with a balance of 3·32 only. We have therefore a sum of 16·68 to make good from our casual surpluses of previous years before we shall be entitled to retain a portion of any surplus for provincial purposes.

Another reason why we cannot at present help forward Mr. Wallace's drainage schemes is that no allotment has been made us at present for which we can grant loans to Municipalities. The M. Cos will therefore have to raise money in the open market, instead of borrowing from Govt at 4 or 4¼ %. I have written to the Bank at 12%, & it is unnecessary to labour the point that they cannot hope to raise loans in the open market on any terms which they can afford. Our position will not improbably be considered during the year by the Govt of India, & I shall not fail to

· 50 under 24-
Medical. Provincial
Curt Schmidt

Also additional
Sums of Cs Courts
Curt Schmidt

x Dy 14/1/98

1898

Grant a Famine Relief
8·50
the wholesome of 8·35 which has been provided. Upon the other hand, we only provided half a lakh, I think, for plague subvention; which cost be anything like enough - we shall probably spend 2 or 2½ lakhs on plague prevention measures, even if plague does not actually break out: if it does, no one can say how much, perhaps 10 to 15 lakhs. Moreover, if we have any savings on the Budget provision for famine, they are already appropriated to the scheme for the better payment of the Taluka Sirkars, if sanctioned by the S. of S., as I have little doubt they will be.

I have written the above partly from memory & partly from reference to the original (Preliminary) issue of the Civil Estimates, & the F.D. had better see before this goes to H.E. & correct any errors I may have made.

Hs [illegible]
21/5/98

To Financial with reference to H.M.'s note

H. I. Prendergast
23 5 98

Rec'd 23/5/98.

Jud. Dept

To.

Loc. Dept.

These figures have been corrected with ref: to the figures in the Financial Statement

Chetchmidt 23.5.98

N.H. 23.5.98

Accept, with regret, the draft G.O.

But I should be glad if this matter be brought to notice after the lapse of four months, - when perhaps our financial position may have become more assured.

A.H. 25.5.98

Issue the draft

8/6/98

Not 1031 M

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Read
Regd. } 1898. Enclosures
Spare copies

G.O., No. 1031 M., 8th June 1898.

Tuticorin water-supply scheme.

Stating, with remarks, that Government can do nothing with regard to the — until its financial position is clearer and requesting the Sanitary Engineer to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers :—

I

Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

Read—the following papers :—

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. JONES, Esq., MEM INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. HUGHES, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
No.—1412.

I have the honour to acknowledge and thank you for your No. 505 T.N of 4th May 1896.

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

Letter—from J. A. JONES, Esq., MEM., INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 19th June 1896.
No.—1913.

I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
No.—801-T. W.

With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

Year.	July.	August.	September.	October.	November.	December.
1886	..	..	..	15·42	15·35	14·67
1887	12·94	12·71	15·54	15·43	14·97	16·38
1888	..	..	..	15·95	16·00	16·86
1889	13·23	11·83	..	16·78	16·20	14·96
1890	12·50	12·62	15·06	14·65	14·30	16·83
1891	..	..	..	15·56	17·25	18·34
1892	13·98	12·93	..	..	..	..
1893	12·30	..	12·10	14·50	16·50	18·00
1894	12·72	..	..	11·55	14·85	14·30
1895	..	..	..	16·49	17·79	18·29
	12·14	..	..			

Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained :—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1895.
B	Pumping scheme for 10 gallons per head with 4 months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones' calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	
F	Municipal Chairman's scheme ..	Not known.	Not known.	
G	District Board Engineer's scheme ..			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows :—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

(True Extract).

R. PARSONS,
Secretary.

To the Secretary to Government, Local and Municipa Department,
with papers.

II

Letter—from G. ZELLWEGER, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.
Dated—the 10th May 1898.
No.—227.

I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

4. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town, and would point out in conclusion that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
(through the Collector of Tinnevelly).
,, Sanitary Board.
,, ,, Engineer.

LOCAL AND MUNICIPAL DEPARTMENT.

NOTES CONNECTED WITH G.O., No. 1031 M., DATED 8TH JUNE 1898.

[SUBJECT.—*Tuticorin water-supply scheme.*]

From the Sanitary Board, dated 21st November 1896, No. 263-S.

The history of the schemes for the water-supply of Tuticorin originally proposed by the Sanitary Engineer, is given in the note for orders stitched with G.O., No. 75 M., dated 16th January 1896. In that order the pumping scheme approved by the Sanitary Board was declared to be impracticable on financial grounds and the Board was requested to consider the two gravitation schemes estimated to cost Rs. 1,00,000 and Rs. 1,61,850 respectively, proposed by the Chairman of the Municipal Council and the Local Fund Engineer. On this, however, the Sanitary Board in its resolution No. 538, dated 24th February 1896, came to the conclusion that it was impossible to arrange for a satisfactory supply of water to Tuticorin without pumping and recommended that the original pumping scheme of the Sanitary Engineer might be revised by reducing the supply per head from 15 to 10 gallons. This recommendation of the Sanitary Board was approved by Government and in their order No. 435 M., dated 16th March 1896, the Sanitary Engineer was requested to submit revised estimates. The Municipal Council in its resolution thereon expressed the opinion that even on sanitary grounds 10 gallons per head would be quite insufficient and that fully 15 gallons would be required for each person in the town and as it still thought that pumping might with advantage be dispensed with, the Government were requested to reconsider their decision in the matter. But this was recorded in G.O., No. 1277 M, dated 31st July 1896, pending receipt of the revised estimate called for from the Sanitary Engineer.

2. With reference however to the Government Order of March 1896 quoted above, the Sanitary Engineer in the first instance submitted for the approval of the Sanitary Board, two schemes, one for Rs. 2,73,140 retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply and the other for Rs. 3,30,000 providing in addition to the modifications of the original scheme referred to above for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended, and

(2) chambers for Gill's arrangements for filters.

The Sanitary Board, however, considered these two schemes as impracticable for financial reasons and asked the Sanitary Engineer to state if a cheaper scheme could not be devised. On this, the Sanitary Engineer proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoirs. As this amount was also considered by the Board to be large, the Sanitary Engineer submitted a gravitation scheme, which though more expensive in the first instance than the pumping scheme costing Rs. 2,68,334, involved a cheaper annual cost. In this scheme the service reservoir, the filters, the pumping house and engines are all omitted.

3. The following statement given by the Sanitary Board shows the cost and working charges of the several schemes above referred to:—

Items.	Scheme.	Capital cost.	Annual working charges.	Remarks.
		RS.	RS.	
A.	Pumping scheme for 15 gallons per head with four months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office-note No. 2070-S., dated 18th November 1895.
B.	Pumping scheme for 10 gallons per head with four months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in statement are based on Jones' calculations in the case of schemes D and E.
C.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank.	3,30,000	18,310	
D.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	*Note.*—The capital cost in each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896 referred to by Mr. Jones in his comparative statement.
E.	Gravitation scheme for 10 gallons per head with nine months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	....
F.	Municipal Chairman's scheme	1,00,000	Not known.	....
G.	District Board Engineer's	1,61,850	Do.	....

4. After a careful consideration of all the schemes the Sanitary Board agrees with the Sanitary Engineer in recommending scheme D, if Government considers scheme C too expensive.

5. If scheme D, being the cheaper of the two schemes approved by the Sanitary Board, is undertaken and if the Government makes a grant to the Council of half the cost as already promised and lends the balance at $4\frac{1}{4}$ per cent. interest, the amount required to liquidate the loan in 30 years would be Rs. 7,996, which together with the working charges of Rs. 14,970 represents an annual expenditure of Rs. 22,966. This would however be reduced by Rs. 596, if a sum of Rs. 10,000 out of the current balance reserved for the water-supply scheme is deducted from the loan now required.

6. In the existing state of affairs this sum is beyond the means of the Municipality; but if the proposal to raise the rates of the taxes on houses and lands and the water-tax from $7\frac{1}{2}$ to $8\frac{1}{2}$ and 4 to 8 per cent. respectively is passed into law and if the tax on arts is extended to all the classes of the schedule, then the additional income which may be expected would be—

	RS.
Water-tax	15,799
House and land tax	4,443
Arts tax	585
Total ..	20,827

Thus the total amount available from all the sources will be Rs. 20,827 or Rs. 1,543 less than the amount required by the Municipal Council. Leaving altogether out of account the annual income expected from the South Indian Railway Company, the above deficit can easily be met by thoroughly revising the taxes on buildings and lands—*vide* the notes stitched with G.O., No. 180 M., dated 6th February 1895.

7. In these circumstances it is submitted that the Sanitary Board's recommendation to undertake scheme D may be approved.

V. RAGHAVA CHARLU—16-1-97.

Scheme C should, if possible, be approved. I have always been of opinion that Tuticorin is very much under-assessed all round: but I do not believe we shall have the assessment properly imposed unless (as I suggested when I was Collector of Tinnevelly) a special officer is deputed to do the work.

2. Would it not also be reasonable to ask Port funds to make a contribution?

G. S. FORBES—18-1-97.

I don't find any report of the Sanitary Engineer's forwarding scheme E and explaining the estimated cost of maintenance, under that scheme, of Rs. 11,100. I should like further information, for I don't understand why that scheme should be so summarily rejected. Nor, I may say, do I comprehend the intrinsic superiority of a pumping to a gravitation scheme, which seems to be assumed as a fact.

2. Why have schemes F and G not been examined?

3. Please send up some sort of plans by means of which I may be able to understand the various schemes.

4. Also please state whether, in view of the fact that, as I understand, the Korampallam tank has just breached, it is worth while to go on with any of these schemes. My impression is that the Korampallam tank or the channel supplying it breaches every two or three years. If so, why shouldn't Mr. Jones' proposed nine months' supply tank breach also and all the proposed expenditure be wasted? Mr. Hughes probably knows more about all these matters than any one else. Please consult him personally and let me know what he thinks.

5. It is all very well to say that the assessments at Tuticorin might be brought to a much higher standard if a special officer were put on. I daresay they might be. But it would not, I think, be safe to sanction a scheme for the supply of Tuticorin on the chance.

H. W. B[LISS]—19-1-97.

Draft demi-official to Mr. Hughes.

G. S. FORBES.

Please see draft demi-official put up.

V. RAGHAVA CHARLU—22-1-97.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated the 25th February 1897.

I received the plans of the Tuticorin water-supply scheme two days ago, but have not been able to examine them until to-day. I do not wish to offer any opinion on the proposed distribution works and confine my remarks to the works which concern me as an Irrigation officer, viz., the reserve tank and conduit.

2. At first Government charged for all the water issued from Korampallam tank but afterwards, for reasons into which I need not enter, it was conceded that only the water reaching the service reservoir should be charged for. I cannot say whether water is now paid for on measurement or otherwise. The quantity issued from the tank is about six times what reaches the town, and irrigation under the tank is carried on with much difficulty and greatly restricted owing to the large supply drawn off for Tuticorin and the system of giving the town the preference as long as the supply lasts. In this way I think Government loses Rs. 2,000 to Rs. 3,000 per annum. The construction of a water-tight conduit should have been insisted on long ago. The proposal now is to make a reserve tank, to be filled from the Korampallam tank and keep the water for use when the Korampallam supply gives out. The reserve tank is undoubtedly required if the town is to be supplied throughout the year and I have already expressed my opinion that it should be made large enough to contain nine months' supply. It will not however be filled every year but receive partial fillings during freshes and be filled at some time each year to the highest level reached in the Korampallam tank. Regarding the site of the reservoir I

A notice that it does not appear to have been taken into account that there is a bye-wash near the left flank of the Korampallam tank which is intended to

discharge when there is a higher flood than the Oopar oday dam can dispose of or when there is danger to the bund. The water from this goes past Korampallam village and crosses the fresh water channel in the low ground not very far from the sluice. There should be a space of a few hundred feet left between the road and the reservoir bank. The next point is that the site is for the most part wet land for which no compensation is provided in the estimate. I do not know whether it is intended to make the bund of earth dug close by. The rate apparently provides for bringing earth from a good distance. In my letter of 4th May, which is in the file, I gave reasons for thinking that the waste by leakage and evaporation from the Korampallam tank is probably 1½ feet a month. Mr. Jones has taken no notice of this but apparently adheres to his estimate of 5 inches a month loss from the new tank, evidently expecting to stop all leakage by the puddle wall extending to 4 feet below the tank bed. Perhaps he has had excavations made and found a clay bed at that level. If he has not done so, I think a thorough examination of the place should be made, or a leaky tank would be useless, and if the matter cannot be placed beyond doubt in any other way a small tank might be made as an experiment and filled by baling from the fresh water channel.

B **C** **D**

There is notoriously great leakage.
G. S. Forbes.

3. Regarding the conduit which it is proposed to build in the bed of the fresh water channel, I think it might be found impossible to build the whole four miles in one season while the Korampallam tank is dry and in time to allow it to set before the supply begins. It will take 2,500 tons of bricks which have to be carted about 20 miles or railed 30 and carted 3, but of course they could be prepared in advance. Why not have 15″ or 18″ cement or glazed earthenware pipe which could be laid in a very short time and would be stronger than and as water-tight as the culvert, while costing very much less.

E

I return the papers and plans.

Demi-official from G. S. Forbes, Esq., I.C.S., Secretary to Government, Local and Municipal Department, to the Sanitary Engineer to Government, dated the 26th February 1897, No. 22.

Please see Hughes' letter.

2. The Honourable Member asked me to consult him. Can you throw light on his difficulties—see specially points marked **A, B, C, D, E.**

Demi-official from J. A. Jones, Esq., Sanitary Engineer to Government, to the Secretary to Government, Local and Municipal Department, dated 1st March 1897, No. 406.

Herewith notes on Mr. Hughes' remarks as to Tuticorin water-supply scheme, which I think fully reply to his criticisms.

Tuticorin Water-supply.

1. **A**—Bye-wash near the left flank of the Korampallam tank.—There is a space of not less than 150 feet below the road and reservoir bund. The bund of the new tank is farther from the road than the channel so that there has been no interference with any course through which water may be discharged from the bye-wash. The crossing is evidently by the channel crossing the fresh water channel, and this has not been interfered with.

2. **B**—The site is for the most part wet land and for which no compensation is allowed in the estimate.—Compensation for land taken up for the reserve tank *is* provided in the estimate—*vide* Sanitary Engineer's estimate, page 12, dated 27th July 1896. Again look at paragraph 8 of report, dated 27th July 1896, where *an increased* allotment for land is referred to.

3. **C**—Whether it is intended to make the bund of earth dug close by.—In paragraph 19 of the Sanitary Engineer's letter No. 1538, dated 27th July 1893, embodied in G.O., Mis. No. 159 M., dated 14th February 1894, he says "The tank is proposed to be formed of simple banks without pitching, the slopes are 2½ to 1 both inside and out with a puddle wall in the centre. The soil is very sandy and there is no economy to be obtained by making the banks with steeper slopes as sand hills and other excavations in the bed of the tank give the quantity of earth sufficient to make the banks of the section proposed. The banks will be *turfed* and the top of the tank will be 4 feet above the maximum water level of the tank.

The data for the rate of Rs. 6-8-0 per 1,000 cubic feet are—

	Rs.	A.	P.
One thousand cubic feet earthwork	2	12	0
One hundred and eighty yards lead at As. 6 for 20 yards	3	6	0
Two yards lift at As. 3	0	6	0
Total ..	6	8	0

4. **D**—Perhaps he (Sanitary Engineer) has had excavations made and found a clay bed at that level.—In estimating the area of the proposed tank, the Sanitary Engineer in his report, dated 27th July 1896, says: "*Evaporation has not been allowed for, as scheme is for* 34,000 *people whereas there are only* 25,000 *to be provided for* at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable."

5. There is no evidence of any clay bed below the sandy soil, and it would be inexpedient to arrange for tank taking into account a high evaporation and leakage for 34,000 when only 25,000 will use water at first and will probably not use even 10 gallons, and when it may be the case that by the time 34,000 people have to be provided for, the Korampallam tank may be filled to its proper level. The area of the tank altered is based on only a level of 16·00 and not 19·40 which is the proper full tank level.

6. **E**—Why not have 15″ or 18″ cement or glazed earthenware pipe which could be laid in a very short time and would be stronger than, and as water-tight as, the culvert while costing very much less.—Mr. Hughes suggests a 15″ or 18″ pipe. A 12″ pipe or less might be similarly suggested, but what is required is a 21″ pipe or else the full quantity of water for 34,000 people will not be obtainable. And this is a portion of the work which must be made full size at once. But even if an 18″ pipe was allowable, the cost would be more than what is proposed—*vide* the following:—

The cost of 21″ masonry culvert for a length of 22,100 feet as estimated is Rs. 44,472 or, say, Rs. 2 a foot.

The cost per foot of cement and stoneware pipes is as below:—

	Rs.	A.	P.
21″ cement pipes (laid)	3	0	0
21″ stoneware pipes, Burn & Co.'s at Calcutta (exclusive of conveying charges and laying)	4	0	0
18″ stoneware pipes, Burn & Co.'s (delivery at Calcutta exclusive of conveying charges and laying)	2	8	0
18″ Doulton's stoneware pipes (delivered at Bombay)	3	8	0
15″ do. do.	2	8	0

7. The above rates clearly show that cement or stoneware pipes cannot be substituted for a masonry conduit, so that even if the fall were increased and much expenditure incurred in excavation and extra cost for filter, for service reservoir, for engine and for pumping and pipes so small as 15″ used, there would be no economy but the reverse.

8. Bricks quite good enough for the conduit are obtainable 10 miles from Korampallam. The culvert would be built in lengths, the channel being replaced by iron pipes during the building of the lower portion so that the building might occupy any length of time and the supply still go on.

Demi-official from H. A. Sim, Esq., I.C.S., Private Secretary to His Excellency the Governor, to the Secretary to Government, Local and Municipal Department, dated 2nd March 1897, No. 39.

With reference to the enclosed, which please return, I shall be glad if you will send up the papers regarding the Tuticorin water-supply scheme for His Excellency's information.

Enclosures.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Private Secretary to His Excellency the Governor, dated 16th February 1897, No. 97.

I beg to submit a copy of my motion and the resolution of the Municipal Council, dated 12th instant, and request you will be so good as to let me know whether His Excellency will be pleased to grant an interview to the members of the deputation.

2. The members intend starting to Madras as early as possible before the end of this month.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Municipal Councillors, Tuticorin.

It is now so many years since a water-supply scheme to our town has been proposed, discussed, and submitted and over and over we represented to the Government the miseries and hardships of the people especially in times of droughts which are so frequent but up to date nothing definite has been done.

2. There has been some consolation to us when we heard from Government a few months ago that the Sanitary Engineer has been asked to prepare estimates to a less expensive water scheme on gravitation principle. There it lies and God knows when it is going to come.

3. It is a wonder that epidemics of most serious nature did not break out in this town; because, exclusive of the impurity of the water which the people have to drink, in times of water-supply failures, even the water we get from Korampallam tank by open channel is impure and subject to various pollutions. It will be unsafe no doubt to expect such special protections of Providence any more, unless the scheme is taken up at once. I am afraid most serious consequences are in store for this unfortunate town. Many towns which are very much less in importance receive the attention of Government, and water schemes are sanctioned and carried out without delay; whereas this town which is only next in importance of trade to the metropolis is ignored altogether. I am sure His Excellency the Governor will be only pleased to sanction the water scheme if he is only properly informed of the sufferings and miseries of the people for want of water-supply.

4. I therefore beg to propose that three members of the Council be selected and requested to wait on a deputation on His Excellency the Governor and lay before him the real state of affairs in this town for want of a water scheme.

Extract from the Proceedings of the Municipal Council, Tuticorin, dated 12th February 1897.

* * * * *

Read motion from the Chairman regarding water-supply scheme to this town.

Resolution No. 7.—Resolved that Captain Baker, the Chairman, and Rev. Mr. Gnanakan be requested to wait on His Excellency the Governor on deputation regarding the water scheme.

* * * * *

Herewith the file about Tuticorin.

G. S. Forbes.

To the Private Secretary.

Seen and returned with thanks.

A. E. H[avelock]—6-3-97.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated 10th March 1897, No. 46.

I return the Tuticorin water-supply papers. Jones has been to see me and I understand him to agree that the storage reservoir should have its bed puddled $1\frac{1}{2}$ feet deep. With regard to the distance between the reservoir and the road, the men who is carrying out the work, can see that enough space is left. I think there should be 300 feet.

2. It seems that it is considered inadvisable to lower the bed of the filter beds. It is not for me to say. Assuming them 7·40 I suppose a conduit $1\frac{3}{4}$ feet diameter is required. This is for Campbell to decide. All I am concerned about is that the reservoir and conduit or at least the latter should be built soon. I am afraid anybody who expects the Public Works Department to build the conduit in one dry season will be disappointed.

To the Local and Municipal Department.

Local and Municipal Department.

As the adoption of any particular scheme must depend largely on the amount of contribution or aid, Government can afford to give to the Municipality, this file must, until the financial position is clearer, lie over.

G. S. Forbes—28-5-97.

Yes, he should.

A. E. H[avelock]—25-5-98.

I don't think the draft is enough. The Sanitary Engineer should be asked what he has been doing since the issue of G.O., No. 1571 M., dated 16th September 1896.

H. W. B[liss]—20-5-98.

I concur.

2. The Tuticorin water-supply is, as far as my information guides me, the most pressing and important of those before us. In the linked file, the Tuticorin water-supply scheme and all others are ordered to lie over until our financial position is clearer. Our revenue is coming in well. Perhaps Sir H. Bliss would consider whether a further step towards getting this Tuticorin scheme set on foot might now be taken.

A. E. H[avelock]—20-5-98.

Circulated to the Honourable Member again.

H. Tremenheere—21-5-98.

I am afraid there is very little chance at present of our having funds to forward any water and drainage schemes other than those entered in the budget (Tirupati, Rs. 77,400, Vizagapatam, Rs. 20,500 and Cocanada, Rs. 52,100). It is true that our revenue is coming in well, but (1) if we get an extra and unanticipated 20 lakhs this year, we could not use it, for we are limited as to expenditure to the provision made on the expenditure side of the budget, and (2) the first charge on any increase of revenue we may get will be provision for restoring our balance to the stipulated minimum of 20 lakhs. As the budget for 1898-99 stands, we shall close the year with a balance of 6·08 only. We have therefore a sum of Rs. 13·92 to make good from our annual surpluses of revenue over expenditure before we shall be restored to a state of solvency.

2. Another reason why we cannot at present help forward Municipal water and drainage schemes is that no allotment has been made us at present wherefrom we can grant loans to Municipalities. The Municipal Councils will therefore have to raise money in the open market, instead of borrowing from Government at 4 or $4\frac{1}{4}$ per cent. with the bank rate at 12 per cent., it is unnecessary to labour the point that they cannot hope to raise loans in the open market on any terms which they can afford.

3 Our position will not improbably be raised during the year by the fact that we shall not need to spend on famine relief the whole sum of Rs. 8·50 which has been provided. But on the other hand, we only provided half a lakh, I think, for plague expenditure, which won't be anything like enough. We shall probably spend 2 or 2½ lakhs on plague preventive measures, even if plague does not actually break out: if it does, no one can say how much, perhaps 10 to 15 lakhs. Moreover, if we have any savings out of the budget provision for famine, they are already appropriated to the scheme for the better payment of the taluk establishments, if sanctioned by the Secretary of State, as I have little doubt they will be.

·50 under 24. Medical—Provincial.
C. M. Schmidt.

Also additional Munsif's Courts.
C.M.S.

4. I have written the above partly from memory and partly from reference to the original (preliminary) issue* of the civil estimates, so the Financial Department had better see before this goes to His Excellency and correct any errors I may have made.

* Dated 14th January 1898.

H. W. B[liss]—21-5-98.

To the Financial Department with reference to the Honourable Member's note.

H. Tremenheere—23-5-98.

Financial Department.

Honourable Member's figures have been corrected with reference to the figures in the Financial statement.

C. M. Schmidt—23-5-98.

A. T. A[rundel]—23-5-98.

I accept, with regret, the draft Government Order. But, I should be glad if this matter be brought to notice after the lapse of four months, when perhaps our financial position may have become more assured.

A. E. H[avelock]—25-5-98.

To the Local and Municipal Department.

Local and Municipal Department.

Issue the draft.

G. S. Forbes—6-6-98.

[G.O., No. 1031 M., dated 8th June 1898.]

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd } 1898. *Enclosures*
Regd. } *Spare copies*

G.O., No. 1031 M., 8th June 1898.

Tuticorin water-supply scheme.

Stating, with remarks, that Government can do nothing with regard to the — until its financial position is clearer and requesting the Sanitary Engineer to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers :—

I

Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

Read—the following papers :—

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. JONES, Esq., MEM INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. HUGHES, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice-floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
No.—1412.

I have the honour to acknowledge and thank you for your No. 505 T.N of 4th May 1896.

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

Letter—from J. A. JONES, Esq., MEM., INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 19th June 1896.
No.—1913.

I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
No.—801-T. W.

With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

Year.	July.	August.	September.	October.	November.	December.
1886	12·94	12·71	15·54	15·42	15·35	14·67
1887	..	..	..	15·43	14·97	16·38
1888	13·23	11·83	..	15·95	16·00	16·86
1889	12·50	12·62	15·06	16·78	16·20	14·96
1890	..	..	..	14·65	14·30	16·83
1891	13·98	12·93	12·10	15·56	17·25	18·34
1892	12·80	..	..	..	..	..
1893	12·72	..	..	14·50	16·50	18·00
1894	..	..	..	11·55	14·85	14·30
1895	12·14	..	..	16·49	17·79	18·29

Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained :—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1895.
B	Pumping scheme for 10 gallons per head with 4 months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones' calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	
F	Municipal Chairman's scheme ..	Not known.	Not known.	
G	District Board Engineer's scheme ..			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows :—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

(True Extract).

R. PARSONS,
Secretary.

To the Secretary to Government, Local and Municipa Department, with papers.

II

Letter—from G. ZELLWEGER, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.
Dated—the 10th May 1898.
No.—227.

I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

4. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town, and would point out in conclusion that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

No. 1031 M., 8TH JUNE 1898.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
(through the Collector of Tinnevelly).
,, Sanitary Board.
,, ,, Engineer.

LOCAL AND MUNICIPAL DEPARTMENT.

NOTES CONNECTED WITH G.O., No. 1031 M., DATED 8TH JUNE 1898.

[SUBJECT.—*Tuticorin water-supply scheme.*]

From the Sanitary Board, dated 21st November 1896, No. 263-S.

The history of the schemes for the water-supply of Tuticorin originally proposed by the Sanitary Engineer, is given in the note for orders stitched with G.O., No. 75 M., dated 16th January 1896. In that order the pumping scheme approved by the Sanitary Board was declared to be impracticable on financial grounds and the Board was requested to consider the two gravitation schemes estimated to cost Rs. 1,00,000 and Rs. 1,61,850 respectively, proposed by the Chairman of the Municipal Council and the Local Fund Engineer. On this, however, the Sanitary Board in its resolution No. 538, dated 24th February 1896, came to the conclusion that it was impossible to arrange for a satisfactory supply of water to Tuticorin without pumping and recommended that the original pumping scheme of the Sanitary Engineer might be revised by reducing the supply per head from 15 to 10 gallons. This recommendation of the Sanitary Board was approved by Government and in their order No. 435 M., dated 16th March 1896, the Sanitary Engineer was requested to submit revised estimates. The Municipal Council in its resolution thereon expressed the opinion that even on sanitary grounds 10 gallons per head would be quite insufficient and that fully 15 gallons would be required for each person in the town and as it still thought that pumping might with advantage be dispensed with, the Government were requested to reconsider their decision in the matter. But this letter was recorded in G.O., No. 1277 M, dated 31st July 1896, pending receipt of the revised estimate called for from the Sanitary Engineer.

2. With reference however to the Government Order of March 1896 quoted above, the Sanitary Engineer in the first instance submitted for the approval of the Sanitary Board, two schemes, one for Rs. 2,73,140 retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply and the other for Rs. 3,30,000 providing in addition to the modifications of the original scheme referred to above for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended, and

(2) chambers for Gill's arrangements for filters.

The Sanitary Board, however, considered these two schemes as impracticable for financial reasons and asked the Sanitary Engineer to state if a cheaper scheme could not be devised. On this, the Sanitary Engineer proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoirs. As this amount was also considered by the Board to be large, the Sanitary Engineer submitted a gravitation scheme, which though more expensive in the first instance than the pumping scheme costing Rs. 2,68,334, involved a cheaper annual cost. In this scheme the service reservoir, the filters, the pumping house and engines are all omitted.

3. The following statement given by the Sanitary Board shows the cost and working charges of the several schemes above referred to:—

Items.	Scheme.	Capital cost.	Annual working charges.	Remarks.
		Rs.	Rs.	
A.	Pumping scheme for 15 gallons per head with four months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office-note No. 2070-S., dated 18th November 1895.
B.	Pumping scheme for 10 gallons per head with four months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in statement are based on Jones' calculations in the case of schemes D and E.
C.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank.	3,30,000	18,310	
D.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	
E.	Gravitation scheme for 10 gallons per head with nine months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	*Note.*—The capital cost in each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896 referred to by Mr. Jones in his comparative statement.
F.	Municipal Chairman's scheme	1,00,000	Not known.	....
G.	District Board Engineer's	1,61,850	Do.	....

4. After a careful consideration of all the schemes the Sanitary Board agrees with the Sanitary Engineer in recommending scheme D, if Government considers scheme C too expensive.

5. If scheme D, being the cheaper of the two schemes approved by the Sanitary Board, is undertaken and if the Government makes a grant to the Council of half the cost as already promised and lends the balance at $4\frac{1}{4}$ per cent. interest, the amount required to liquidate the loan in 30 years would be Rs. 7,996, which together with the working charges of Rs. 14,970 represents an annual expenditure of Rs. 22,966. This would however be reduced by Rs. 596, if a sum of Rs. 10,000 out of the current balance reserved for the water-supply scheme is deducted from the loan now required.

6. In the existing state of affairs this sum is beyond the means of the Municipality; but if the proposal to raise the rates of the taxes on houses and lands and the water-tax from $7\frac{1}{2}$ to $8\frac{1}{2}$ and 4 to 8 per cent. respectively is passed into law and if the tax on arts is extended to all the classes of the schedule, then the additional income which may be expected would be—

	Rs.
Water-tax	15,799
House and land tax	4,443
Arts tax	585
Total ..	20,827

Thus the total amount available from all the sources will be Rs. 20,827 or Rs. 1,543 less than the amount required by the Municipal Council. Leaving altogether out of account the annual income expected from the South Indian Railway Company, the above deficit can easily be met by thoroughly revising the taxes on buildings and lands—*vide* the notes stitched with G.O., No. 180 M., dated 6th February 1895.

7. In these circumstances it is submitted that the Sanitary Board's recommendation to undertake scheme D may be approved.

V. RAGHAVA CHARLU—16-1-97.

Scheme C should, if possible, be approved. I have always been of opinion that Tuticorin is very much under-assessed all round: but I do not believe we shall have the assessment properly imposed unless (as I suggested when I was Collector of Tinnevelly) a special officer is deputed to do the work.

2. Would it not also be reasonable to ask Port funds to make a contribution?

G. S. FORBES—18-1-97.

I don't find any report of the Sanitary Engineer's forwarding scheme E and explaining the estimated cost of maintenance, under that scheme, of Rs. 11,100. I should like further information, for I don't understand why that scheme should be so summarily rejected. Nor, I may say, do I comprehend the intrinsic superiority of a pumping to a gravitation scheme, which seems to be assumed as a fact.

2. Why have schemes F and G not been examined?

3. Please send up some sort of plans by means of which I may be able to understand the various schemes.

4. Also please state whether, in view of the fact that, as I understand, the Korampallam tank has just breached, it is worth while to go on with any of these schemes. My impression is that the Korampallam tank or the channel supplying it breaches every two or three years. If so, why shouldn't Mr. Jones' proposed nine months' supply tank breach also and all the proposed expenditure be wasted? Mr. Hughes probably knows more about all these matters than any one else. Please consult him personally and let me know what he thinks.

5. It is all very well to say that the assessments at Tuticorin might be brought to a much higher standard if a special officer were put on. I daresay they might be. But it would not, I think, be safe to sanction a scheme for the supply of Tuticorin on the chance.

H. W. B[LISS]—19-1-97.

Draft demi-official to Mr. Hughes.

G. S. FORBES.

Please see draft demi-official put up.

V. RAGHAVA CHARLU—22-1-97.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated the 25th February 1897.

I received the plans of the Tuticorin water-supply scheme two days ago, but have not been able to examine them until to-day. I do not wish to offer any opinion on the proposed distribution works and confine my remarks to the works which concern me as an Irrigation officer, viz., the reserve tank and conduit.

2. At first Government charged for all the water issued from Korampallam tank but afterwards, for reasons into which I need not enter, it was conceded that only the water reaching the service reservoir should be charged for. I cannot say whether water is now paid for on measurement or otherwise. The quantity issued from the tank is about six times what reaches the town, and irrigation under the tank is carried on with much difficulty and greatly restricted owing to the large supply drawn off for Tuticorin and the system of giving the town the preference as long as the supply lasts. In this way I think Government loses Rs. 2,000 to Rs. 3,000 per annum. The construction of a water-tight conduit should have been insisted on long ago. The proposal now is to make a reserve tank, to be filled from the Korampallam tank and keep the water for use when the Korampallam supply gives out. The reserve tank is undoubtedly required if the town is to be supplied throughout the year and I have already expressed my opinion that it should be made large enough to contain nine months' supply. It will not however be filled every year but receive partial fillings during freshes and be filled at some time each year to the highest level reached in the Korampallam tank. Regarding the site of the reservoir I notice that it does not appear to have been taken into account that there is a bye-wash near the left flank of the Korampallam tank which is intended to

A

discharge when there is a higher flood than the Oopar oday dam can dispose of or when there is danger to the bund. The water from this goes past Korampallam village and crosses the fresh water channel in the low ground not very far from the sluice. There should be a space of a few hundred feet left between the road and the reservoir bank. The next point is that the site is for the most part wet land for which no compensation is provided in the estimate. I do not know whether it is intended to make the bund of earth dug close by. The rate apparently provides for bringing earth from a good distance. In my letter of 4th May, which is in the file, I gave reasons for thinking that the waste by leakage and evaporation from the Korampallam tank is probably $1\frac{1}{2}$ feet a month. Mr. Jones has taken no notice of this but apparently adheres to his estimate of 5 inches a month loss from the new tank, evidently expecting to stop all leakage by the puddle wall extending to 4 feet below the tank bed. Perhaps he has had excavations made and found a clay bed at that level. If he has not done so, I think a thorough examination of the place should be made, or a leaky tank would be useless, and if the matter cannot be placed beyond doubt in any other way a small tank might be made as an experiment and filled by baling from the fresh water channel.

B **C** **D**

There is notoriously great leakage.
G. S. Forbes.

3. Regarding the conduit which it is proposed to build in the bed of the fresh water channel, I think it might be found impossible to build the whole four miles in one season while the Korampallam tank is dry and in time to allow it to set before the supply begins. It will take 2,500 tons of bricks which have to be carted about 20 miles or railed 30 and carted 3, but of course they could be prepared in advance. Why not have 15″ or 18″ cement or glazed earthenware pipe which could be laid in a very short time and would be stronger than and as water-tight as the culvert, while costing very much less.

E

I return the papers and plans.

Demi-official from G. S. Forbes, Esq., I.C.S., Secretary to Government, Local and Municipal Department, to the Sanitary Engineer to Government, dated the 26th February 1897, *No.* 22.

Please see Hughes' letter.

2. The Honourable Member asked me to consult him. Can you throw light on his difficulties—see specially points marked **A, B, C, D, E.**

Demi-official from J. A. Jones, Esq., Sanitary Engineer to Government, to the Secretary to Government, Local and Municipal Department, dated 1st March 1897, *No.* 406.

Herewith notes on Mr. Hughes' remarks as to Tuticorin water-supply scheme, which I think fully reply to his criticisms.

Tuticorin Water-supply.

1. **A**—Bye-wash near the left flank of the Korampallam tank.—There is a space of not less than 150 feet below the road and reservoir bund. The bund of the new tank is farther from the road than the channel so that there has been no interference with any course through which water may be discharged from the bye-wash. The crossing is evidently by the channel crossing the fresh water channel, and this has not been interfered with.

2. **B**—The site is for the most part wet land and for which no compensation is allowed in the estimate.—Compensation for land taken up for the reserve tank *is* provided in the estimate—*vide* Sanitary Engineer's estimate, page 12, dated 27th July 1896. Again look at paragraph 8 of report, dated 27th July 1896, where *an increased* allotment for land is referred to.

3. **C**—Whether it is intended to make the bund of earth dug close by.—In paragraph 19 of the Sanitary Engineer's letter No. 1538, dated 27th July 1893, embodied in G.O., Mis. No. 159 M., dated 14th February 1894, he says "The tank is proposed to be formed of simple banks without pitching, the slopes are $2\frac{1}{2}$ to 1 both inside and out with a puddle wall in the centre. The soil is very sandy and there is no economy to be obtained by making the banks with steeper slopes as sand hills and other excavations in the bed of the tank give the quantity of earth sufficient to make the banks of the section proposed. The banks will be *turfed* and the top of the tank will be 4 feet above the maximum water level of the tank.

The data for the rate of Rs. 6-8-0 per 1,000 cubic feet are—

	Rs.	A.	P.
One thousand cubic feet earthwork	2	12	0
One hundred and eighty yards lead at As. 6 for 20 yards	3	6	0
Two yards lift at As. 3	0	6	0
Total ..	6	8	0

4. **D**—Perhaps he (Sanitary Engineer) has had excavations made and found a clay bed at that level.—In estimating the area of the proposed tank, the Sanitary Engineer in his report, dated 27th July 1896, says: "*Evaporation has not been allowed for, as scheme is for* 34,000 *people whereas there are only* 25,000 *to be provided for* at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable."

5. There is no evidence of any clay bed below the sandy soil, and it would be inexpedient to arrange for tank taking into account a high evaporation and leakage for 34,000 when only 25,000 will use water at first and will probably not use even 10 gallons, and when it may be the case that by the time 34,000 people have to be provided for, the Korampallam tank may be filled to its proper level. The area of the tank altered is based on only a level of 16·00 and not 19·40 which is the proper full tank level.

6. **E**—Why not have 15″ or 18″ cement or glazed earthenware pipe which could be laid in a very short time and would be stronger than, and as water-tight as, the culvert while costing very much less.—Mr. Hughes suggests a 15″ or 18″ pipe. A 12″ pipe or less might be similarly suggested, but what is required is a 21″ pipe or else the full quantity of water for 34,000 people will not be obtainable. And this is a portion of the work which must be made full size at once. But even if an 18″ pipe was allowable, the cost would be more than what is proposed—*vide* the following:—

The cost of 21″ masonry culvert for a length of 22,100 feet as estimated is Rs. 44,472 or, say, Rs. 2 a foot.

The cost per foot of cement and stoneware pipes is as below:—

	Rs.	A.	P.
21″ cement pipes (laid)	3	0	0
21″ stoneware pipes, Burn & Co.'s at Calcutta (exclusive of conveying charges and laying)	4	0	0
18″ stoneware pipes, Burn & Co.'s (delivery at Calcutta exclusive of conveying charges and laying)	2	8	0
18″ Doulton's stoneware pipes (delivered at Bombay)	3	8	0
15″ do. do.	2	8	0

7. The above rates clearly show that cement or stoneware pipes cannot be substituted for a masonry conduit, so that even if the fall were increased and much expenditure incurred in excavation and extra cost for filter, for service reservoir, for engine and for pumping and pipes so small as 15″ used, there would be no economy but the reverse.

8. Bricks quite good enough for the conduit are obtainable 10 miles from Korampallam. The culvert would be built in lengths, the channel being replaced by iron pipes during the building of the lower portion so that the building might occupy any length of time and the supply still go on.

Demi-official from H. A. Sim, Esq., I.C.S., Private Secretary to His Excellency the Governor, to the Secretary to Government, Local and Municipal Department, dated 2nd March 1897, No. 39.

With reference to the enclosed, which please return, I shall be glad if you will send up the papers regarding the Tuticorin water-supply scheme for His Excellency's information.

ENCLOSURES.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Private Secretary to His Excellency the Governor, dated 16th February 1897, No. 97.

I beg to submit a copy of my motion and the resolution of the Municipal Council, dated 12th instant, and request you will be so good as to let me know whether His Excellency will be pleased to grant an interview to the members of the deputation.

2. The members intend starting to Madras as early as possible before the end of this month.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Municipal Councillors, Tuticorin.

It is now so many years since a water-supply scheme to our town has been proposed, discussed, and submitted and over and over we represented to the Government the miseries and hardships of the people especially in times of droughts which are so frequent but up to date nothing definite has been done.

2. There has been some consolation to us when we heard from Government a few months ago that the Sanitary Engineer has been asked to prepare estimates to a less expensive water scheme on gravitation principle. There it lies and God knows when it is going to come.

3. It is a wonder that epidemics of most serious nature did not break out in this town; because, exclusive of the impurity of the water which the people have to drink, in times of water-supply failures, even the water we get from Korampallam tank by open channel is impure and subject to various pollutions. It will be unsafe no doubt to expect such special protections of Providence any more, unless the scheme is taken up at once. I am afraid most serious consequences are in store for this unfortunate town. Many towns which are very much less in importance receive the attention of Government, and water schemes are sanctioned and carried out without delay; whereas this town which is only next in importance of trade to the metropolis is ignored altogether. I am sure His Excellency the Governor will be only pleased to sanction the water scheme if he is only properly informed of the sufferings and miseries of the people for want of water-supply.

4. I therefore beg to propose that three members of the Council be selected and requested to wait on a deputation on His Excellency the Governor and lay before him the real state of affairs in this town for want of a water scheme.

Extract from the Proceedings of the Municipal Council, Tuticorin, dated 12th February 1897.

* * * * *

Read motion from the Chairman regarding water-supply scheme to this town.

Resolution No. 7.—Resolved that Captain Baker, the Chairman, and Rev. Mr. Gnanakan be requested to wait on His Excellency the Governor on deputation regarding the water scheme.

* * * * *

Herewith the file about Tuticorin.

G. S. FORBES.

To the Private Secretary.

Seen and returned with thanks.

A. E. H[AVELOCK]—6-3-97.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated 10th March 1897, No. 46.

I return the Tuticorin water-supply papers. Jones has been to see me and I understand him to agree that the storage reservoir should have its bed puddled $1\frac{1}{2}$ feet deep. With regard to the distance between the reservoir and the road, the men who is carrying out the work, can see that enough space is left. I think there should be 300 feet.

2. It seems that it is considered inadvisable to lower the bed of the filter beds. It is not for me to say. Assuming them 7·40 I suppose a conduit $1\frac{3}{4}$ feet diameter is required. This is for Campbell to decide. All I am concerned about is that the reservoir and conduit or at least the latter should be built soon. I am afraid anybody who expects the Public Works Department to build the conduit in one dry season will be disappointed.

To the Local and Municipal Department.

LOCAL AND MUNICIPAL DEPARTMENT.

As the adoption of any particular scheme must depend largely on the amount of contribution or aid, Government can afford to give to the Municipality, this file must, until the financial position is clearer, lie over.

G. S. FORBES—28-5-97.

Yes, he should.
A. E. H[AVELOCK]—25-5-98.

I don't think the draft is enough. The Sanitary Engineer should be asked what he has been doing since the issue of G.O., No. 1571 M., dated 16th September 1896.

H. W. B[LISS]—20-5-98.

I concur.

2. The Tuticorin water-supply is, as far as my information guides me, the most pressing and important of those before us. In the linked file, the Tuticorin water-supply scheme and all others are ordered to lie over until our financial position is clearer. Our revenue is coming in well. Perhaps Sir H. Bliss would consider whether a further step towards getting this Tuticorin scheme set on foot might now be taken.

A. E. H[AVELOCK]—20-5-98.

Circulated to the Honourable Member again.

H. TREMENHEERE—21-5-98.

I am afraid there is very little chance at present of our having funds to forward any water and drainage schemes other than those entered in the budget (Tirupati, Rs. 77,400, Vizagapatam, Rs. 20,500 and Cocanada, Rs. 52,100). It is true that our revenue is coming in well, but (1) if we get an extra and unanticipated 20 lakhs this year, we could not use it, for we are limited as to expenditure to the provision made on the expenditure side of the budget, and (2) the first charge on any increase of revenue we may get will be provision for restoring our balance to the stipulated minimum of 20 lakhs. As the budget for 1898-99 stands, we shall close the year with a balance of 6·08 only. We have therefore a sum of Rs. 13·92 to make good from our annual surpluses of revenue over expenditure before we shall be restored to a state of solvency.

2. Another reason why we cannot at present help forward Municipal water and drainage schemes is that no allotment has been made us at present wherefrom we can grant loans to Municipalities. The Municipal Councils will therefore have to raise money in the open market, instead of borrowing from Government at 4 or $4\frac{1}{4}$ per cent. with the bank rate at 12 per cent., it is unnecessary to labour the point that they cannot hope to raise loans in the open market on any terms which they can afford.

3 Our position will not improbably be raised during the year by the fact that we shall not need to spend on famine relief the whole sum of Rs. 8·50 which has been provided. But on the other hand, we only provided half a lakh, I think, for plague expenditure, which won't be anything like enough. We shall probably spend 2 or 2½ lakhs on plague preventive measures, even if plague does not actually break out: if it does, no one can say how much, perhaps 10 to 15 lakhs. Moreover, if we have any savings out of the budget provision for famine, they are already appropriated to the scheme for the better payment of the taluk establishments, if sanctioned by the Secretary of State, as I have little doubt they will be.

·50 under 24. Medical—Provincial.
C. M. Schmidt.

Also additional Munsif's Courts.
C.M.S.

4. I have written the above partly from memory and partly from reference to the original (preliminary) issue* of the civil estimates, so the Financial Department had better see before this goes to His Excellency and correct any errors I may have made.

* Dated 14th January 1898.

H. W. B[liss]—21-5-98.

To the Financial Department with reference to the Honourable Member's note.

H. Tremenheere—23-5-98.

Financial Department.

Honourable Member's figures have been corrected with reference to the figures in the Financial statement.

C. M. Schmidt—23-5-98.

A. T. A[rundel]—23-5-98.

I accept, with regret, the draft Government Order. But, I should be glad if this matter be brought to notice after the lapse of four months, when perhaps our financial position may have become more assured.

A. E. H[avelock]—25-5-98.

To the Local and Municipal Department.

Local and Municipal Department.

Issue the draft.

G. S. Forbes—6-6-98.

[G.O., No. 1031 M., dated 8th June 1898.]

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Read } 1898. *Enclosures*

Regd. } *Spare copies*

G.O., No. 1031 M., 8th June 1898.

Tuticorin water-supply scheme.

Stating, with remarks, that Government can do nothing with regard to the — until its financial position is clearer and requesting the Sanitary Engineer to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

Read—the following papers :—

I

Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

Read—the following papers :—

Letter—from J. A. Jones, Esq., mem. inst. c.e., f.r.s.e., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. Jones, Esq., mem inst. c.e., f.r.s.e., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. Hughes, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. Jones, Esq., mem. inst. c.e., f.r.s.e., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
No.—1412.

I have the honour to acknowledge and thank you for your No. 505 T.N of 4th May 1896.

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

Letter—from J. A. Jones, Esq., mem., inst. c.e., f.r.s.e., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 19th June 1896.
No.—1913.

I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

No. 1031 M., 8TH JUNE 1898.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
No.—801-T. W.

With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

Year.	July.	August.	September.	October.	November.	December.
1886	..	..	..	..	..	..
1887	12·94	12·71	15·54	15·42	15·35	14·67
1888	..	..	..	15·43	14·97	16·38
1889	13·23	11·83	..	15·95	16·00	16·86
1890	12·50	12·62	15·06	16·78	16·20	14·96
1891	..	..	..	14·65	14·30	16·83
1892	13·98	12·93	12·10	15·56	17·25	18·34
1893	12·80	..	..	..	..	..
1894	12·72	..	..	14·50	16·50	18·00
1895	..	..	..	11·55	14·85	14·30
	12·14	..	..	16·49	17·79	18·29

Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained :—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1895.
B	Pumping scheme for 10 gallons per head with 4 months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones, calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	
F	Municipal Chairman's scheme ..	Not known.	Not known.	
G	District Board Engineer's scheme ..			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows :—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

(True Extract).

R. Parsons,
Secretary.

To the Secretary to Government, Local and Municipa Department,
with papers.

II

Letter—from G. Zellweger, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.
Dated—the 10th May 1898.
No.—227.

I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

4. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town, and would point out in conclusion that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

No. 1031 M., 8TH JUNE 1898.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
" Sanitary Board. (through the Collector of Tinnevelly).
" " Engineer.

NOTES CONNECTED WITH G.O., No. 1031 M., DATED 8TH JUNE 1898.

[SUBJECT.—*Tuticorin water-supply scheme.*]

From the Sanitary Board, dated 21st November 1896, No. 263-S.

The history of the schemes for the water-supply of Tuticorin originally proposed by the Sanitary Engineer, is given in the note for orders stitched with G.O., No. 75 M., dated 16th January 1896. In that order the pumping scheme approved by the Sanitary Board was declared to be impracticable on financial grounds and the Board was requested to consider the two gravitation schemes estimated to cost Rs. 1,00,000 and Rs. 1,61,850 respectively, proposed by the Chairman of the Municipal Council and the Local Fund Engineer. On this, however, the Sanitary Board in its resolution No. 538, dated 24th February 1896, came to the conclusion that it was impossible to arrange for a satisfactory supply of water to Tuticorin without pumping and recommended that the original pumping scheme of the Sanitary Engineer might be revised by reducing the supply per head from 15 to 10 gallons. This recommendation of the Sanitary Board was approved by Government and in their order No. 435 M., dated 16th March 1896, the Sanitary Engineer was requested to submit revised estimates. The Municipal Council in its resolution thereon expressed the opinion that even on sanitary grounds 10 gallons per head would be quite insufficient and that fully 15 gallons would be required for each person in the town and as it still thought that pumping might with advantage be dispensed with, the Government were requested to reconsider their decision in the matter. But this letter was recorded in G.O., No. 1277 M, dated 31st July 1896, pending receipt of the revised estimate called for from the Sanitary Engineer.

2. With reference however to the Government Order of March 1896 quoted above, the Sanitary Engineer in the first instance submitted for the approval of the Sanitary Board, two schemes, one for Rs. 2,73,140 retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply and the other for Rs. 3,30,000 providing in addition to the modifications of the original scheme referred to above for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended, and

(2) chambers for Gill's arrangements for filters.

The Sanitary Board, however, considered these two schemes as impracticable for financial reasons and asked the Sanitary Engineer to state if a cheaper scheme could not be devised. On this, the Sanitary Engineer proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoirs. As this amount was also considered by the Board to be large, the Sanitary Engineer submitted a gravitation scheme, which though more expensive in the first instance than the pumping scheme costing Rs. 2,68,334, involved a cheaper annual cost. In this scheme the service reservoir, the filters, the pumping house and engines are all omitted.

discharge when there is a higher flood than the Oopar oday dam can dispose of or when there is danger to the bund. The water from this goes past Korampallam village and crosses the fresh water channel in the low ground not very far from the sluice. There should be a space of a few hundred feet left between the road and the reservoir bank. **B** The next point is that the site is for the most part wet land for which no compensation is provided in the estimate. I do not know whether it is intended to make the bund of earth dug close by. **C** The rate apparently provides for bringing earth from a good distance. In my letter of 4th May, which is in the file, I gave reasons for thinking that the waste by leakage and evaporation from the Korampallam tank is probably $1\frac{1}{2}$ feet a month. Mr. Jones has taken no notice of this but apparently adheres to his estimate of 5 inches a month loss from the new tank, evidently expecting to stop all leakage by the puddle wall extending to 4 feet below the tank bed. **D** Perhaps he has had excavations made and found a clay bed at that level. If he has not done so, I think a thorough examination of the place should be made, or a leaky tank would be useless, and if the matter cannot be placed beyond doubt in any other way a small tank might be made as an experiment and filled by baling from the fresh water channel.

There is notoriously great leakage.
G. S. Forbes.

3. Regarding the conduit which it is proposed to build in the bed of the fresh water channel, I think it might be found impossible to build the whole four miles in one season while the Korampallam tank is dry and in time to allow it to set before the supply begins. It will take 2,500 tons of bricks which have to be carted about 20 miles or railed 30 and carted 3, but of course they could be prepared in advance. **E** Why not have 15″ or 18″ cement or glazed earthenware pipe which could be laid in a very short time and would be stronger than and as water-tight as the culvert, while costing very much less.

I return the papers and plans.

Demi-official from G. S. Forbes, Esq., I.C.S., Secretary to Government, Local and Municipal Department, to the Sanitary Engineer to Government, dated the 26th February 1897, *No.* 22.

Please see Hughes' letter.

2. The Honourable Member asked me to consult him. Can you throw light on his difficulties—see specially points marked **A, B, C, D, E.**

Demi-official from J. A. Jones, Esq., Sanitary Engineer to Government, to the Secretary to Government, Local and Municipal Department, dated 1st March 1897, *No.* 406.

Herewith notes on Mr. Hughes' remarks as to Tuticorin water-supply scheme, which I think fully reply to his criticisms.

Tuticorin Water-supply.

1. **A**—Bye-wash near the left flank of the Korampallam tank.—There is a space of not less than 150 feet below the road and reservoir bund. The bund of the new tank is farther from the road than the channel so that there has been no interference with any course through which water may be discharged from the bye-wash. The crossing is evidently by the channel crossing the fresh water channel, and this has not been interfered with.

2. **B**—The site is for the most part wet land and for which no compensation is allowed in the estimate.—Compensation for land taken up for the reserve tank *is* provided in the estimate—*vide* Sanitary Engineer's estimate, page 12, dated 27th July 1896. Again look at paragraph 8 of report, dated 27th July 1896, where *an increased* allotment for land is referred to.

3. **C**—Whether it is intended to make the bund of earth dug close by.—In paragraph 19 of the Sanitary Engineer's letter No. 1538, dated 27th July 1893, embodied in G.O., Mis. No. 159 M., dated 14th February 1894, he says "The tank is proposed to be formed of simple banks without pitching, the slopes are $2\frac{1}{2}$ to 1 both inside and out with a puddle wall in the centre. The soil is very sandy and there is no economy to be obtained by making the banks with steeper slopes as sand hills and other excavations in the bed of the tank give the quantity of earth sufficient to make the banks of the section proposed. The banks will be *turfed* and the top of the tank will be 4 feet above the maximum water level of the tank.

The data for the rate of Rs. 6-8-0 per 1,000 cubic feet are—

	Rs.	A.	P.
One thousand cubic feet earthwork	2	12	0
One hundred and eighty yards lead at As. 6 for 20 yards	3	6	0
Two yards lift at As. 3	0	6	0
Total ..	6	8	0

4. **D**—Perhaps he (Sanitary Engineer) has had excavations made and found a clay bed at that level.—In estimating the area of the proposed tank, the Sanitary Engineer in his report, dated 27th July 1896, says: "*Evaporation has not been allowed for, as scheme is for* 34,000 *people whereas there are only* 25,000 *to be provided for* at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable."

5. There is no evidence of any clay bed below the sandy soil, and it would be inexpedient to arrange for tank taking into account a high evaporation and leakage for 34,000 when only 25,000 will use water at first and will probably not use even 10 gallons, and when it may be the case that by the time 34,000 people have to be provided for, the Korampallam tank may be filled to its proper level. The area of the tank altered is based on only a level of 16·00 and not 19·40 which is the proper full tank level.

6. **E**—Why not have 15″ or 18″ cement or glazed earthenware pipe which could be laid in a very short time and would be stronger than, and as water-tight as, the culvert while costing very much less.—Mr. Hughes suggests a 15″ or 18″ pipe. A 12″ pipe or less might be similarly suggested, but what is required is a 21″ pipe or else the full quantity of water for 34,000 people will not be obtainable. And this is a portion of the work which must be made full size at once. But even if an 18″ pipe was allowable, the cost would be more than what is proposed—*vide* the following:—

The cost of 21″ masonry culvert for a length of 22,100 feet as estimated is Rs. 44,472 or, say, Rs. 2 a foot.

The cost per foot of cement and stoneware pipes is as below:—

	Rs.	A.	P.
21″ cement pipes (laid)	3	0	0
21″ stoneware pipes, Burn & Co.'s at Calcutta (exclusive of conveying charges and laying)	4	0	0
18″ stoneware pipes, Burn & Co.'s (delivery at Calcutta exclusive of conveying charges and laying)	2	8	0
18″ Doulton's stoneware pipes (delivered at Bombay)	3	8	0
15″ do. do.	2	8	0

7. The above rates clearly show that cement or stoneware pipes cannot be substituted for a masonry conduit, so that even if the fall were increased and much expenditure incurred in excavation and extra cost for filter, for service reservoir, for engine and for pumping and pipes so small as 15″ used, there would be no economy but the reverse.

8. Bricks quite good enough for the conduit are obtainable 10 miles from Korampallam. The culvert would be built in lengths, the channel being replaced by iron pipes during the building of the lower portion so that the building might occupy any length of time and the supply still go on.

Demi-official from H. A. Sim, Esq., I.C.S., Private Secretary to His Excellency the Governor, to the Secretary to Government, Local and Municipal Department, dated 2nd March 1897, No. 39.

With reference to the enclosed, which please return, I shall be glad if you will send up the papers regarding the Tuticorin water-supply scheme for His Excellency's information.

Enclosures.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Private Secretary to His Excellency the Governor, dated 16th February 1897, No. 97.

I beg to submit a copy of my motion and the resolution of the Municipal Council, dated 12th instant, and request you will be so good as to let me know whether His Excellency will be pleased to grant an interview to the members of the deputation.

2. The members intend starting to Madras as early as possible before the end of this month.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Municipal Councillors, Tuticorin.

It is now so many years since a water-supply scheme to our town has been proposed, discussed, and submitted and over and over we represented to the Government the miseries and hardships of the people especially in times of droughts which are so frequent but up to date nothing definite has been done.

2. There has been some consolation to us when we heard from Government a few months ago that the Sanitary Engineer has been asked to prepare estimates to a less expensive water scheme on gravitation principle. There it lies and God knows when it is going to come.

3. It is a wonder that epidemics of most serious nature did not break out in this town; because, exclusive of the impurity of the water which the people have to drink, in times of water-supply failures, even the water we get from Korampallam tank by open channel is impure and subject to various pollutions. It will be unsafe no doubt to expect such special protections of Providence any more, unless the scheme is taken up at once. I am afraid most serious consequences are in store for this unfortunate town. Many towns which are very much less in importance receive the attention of Government, and water schemes are sanctioned and carried out without delay; whereas this town which is only next in importance of trade to the metropolis is ignored altogether. I am sure His Excellency the Governor will be only pleased to sanction the water scheme if he is only properly informed of the sufferings and miseries of the people for want of water-supply.

4. I therefore beg to propose that three members of the Council be selected and requested to wait on a deputation on His Excellency the Governor and lay before him the real state of affairs in this town for want of a water scheme.

Extract from the Proceedings of the Municipal Council, Tuticorin, dated 12th February 1897.

* * * * *

Read motion from the Chairman regarding water-supply scheme to this town.

Resolution No. 7.—Resolved that Captain Baker, the Chairman, and Rev. Mr. Gnanakan be requested to wait on His Excellency the Governor on deputation regarding the water scheme.

* * * * *

Herewith the file about Tuticorin.

G. S. Forbes.

To the Private Secretary.

Seen and returned with thanks.

A. E. H[avelock]—6-3-97.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated 10th March 1897, No. 46.

I return the Tuticorin water-supply papers. Jones has been to see me and I understand him to agree that the storage reservoir should have its bed puddled $1\frac{1}{2}$ feet deep. With regard to the distance between the reservoir and the road, the men. who is carrying out the work, can see that enough space is left. I think there should be 300 feet.

2. It seems that it is considered inadvisable to lower the bed of the filter beds. It is not for me to say. Assuming them 7·40 I suppose a conduit $1\frac{3}{4}$ feet diameter is required. This is for Campbell to decide. All I am concerned about is that the reservoir and conduit or at least the latter should be built soon. I am afraid anybody who expects the Public Works Department to build the conduit in one dry season will be disappointed.

To the Local and Municipal Department.

Local and Municipal Department.

As the adoption of any particular scheme must depend largely on the amount of contribution or aid, Government can afford to give to the Municipality, this file must, until the financial position is clearer, lie over.

G. S. Forbes—28-5-97.

Yes, he should.
A. E. H[avelock]—25-5-98.

I don't think the draft is enough. The Sanitary Engineer should be asked what he has been doing since the issue of G.O., No. 1571 M., dated 16th September 1896.

H. W. B[liss]—20-5-98.

I concur.

2. The Tuticorin water-supply is, as far as my information guides me, the most pressing and important of those before us. In the linked file, the Tuticorin water-supply scheme and all others are ordered to lie over until our financial position is clearer. Our revenue is coming in well. Perhaps Sir H. Bliss would consider whether a further step towards getting this Tuticorin scheme set on foot might now be taken.

A. E. H[avelock]—20-5-98.

Circulated to the Honourable Member again.

H. Tremenheere—21-5-98.

I am afraid there is very little chance at present of our having funds to forward any water and drainage schemes other than those entered in the budget (Tirupati, Rs. 77,400, Vizagapatam, Rs. 20,500 and Cocanada, Rs. 52,100). It is true that our revenue is coming in well, but (1) if we get an extra and unanticipated 20 lakhs this year, we could not use it, for we are limited as to expenditure to the provision made on the expenditure side of the budget, and (2) the first charge on any increase of revenue we may get will be provision for restoring our balance to the stipulated minimum of 20 lakhs. As the budget for 1898–99 stands, we shall close the year with a balance of 6·08 only. We have therefore a sum of Rs. 13·92 to make good from our annual surpluses of revenue over expenditure before we shall be restored to a state of solvency.

2. Another reason why we cannot at present help forward Municipal water and drainage schemes is that no allotment has been made us at present wherefrom we can grant loans to Municipalities. The Municipal Councils will therefore have to raise money in the open market, instead of borrowing from Government at 4 or $4\frac{1}{4}$ per cent. with the bank rate at 12 per cent., it is unnecessary to labour the point that they cannot hope to raise loans in the open market on any terms which they can afford.

3 Our position will not improbably be raised during the year by the fact that we shall not need to spend on famine relief the whole sum of Rs. 8·50 which has been provided. But on the other hand, we only provided half a lakh, I think, for plague expenditure, which won't be anything like enough. We shall probably spend 2 or 2½ lakhs on plague preventive measures, even if plague does not actually break out: if it does, no one can say how much, perhaps 10 to 15 lakhs. Moreover, if we have any savings out of the budget provision for famine, they are already appropriated to the scheme for the better payment of the taluk establishments, if sanctioned by the Secretary of State, as I have little doubt they will be.

·50 under 24. Medical—Provincial.
C. M. SCHMIDT.

Also additional Munsif's Courts.
C.M.S.

4. I have written the above partly from memory and partly from reference to the original (preliminary) issue* of the civil estimates, so the Financial Department had better see before this goes to His Excellency and correct any errors I may have made.

* Dated 14th January 1898.

H. W. B[LISS]—21-5-98.

To the Financial Department with reference to the Honourable Member's note.

H. TREMENHEERE—23-5-98.

FINANCIAL DEPARTMENT.

Honourable Member's figures have been corrected with reference to the figures in the Financial statement.

C. M. SCHMIDT—23-5-98.

A. T. A[RUNDEL]—23-5-98.

I accept, with regret, the draft Government Order. But, I should be glad if this matter be brought to notice after the lapse of four months, when perhaps our financial position may have become more assured.

A. E. H[AVELOCK]—25-5-98.

To the Local and Municipal Department.

LOCAL AND MUNICIPAL DEPARTMENT.

Issue the draft.

G. S. FORBES—6-6-98.

[G.O., No. 1031 M., dated 8th June 1898.]

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd } 1898. *Enclosures*
Regd. } *Spare copies*

G.O., No. 1031 M., 8th June 1898.

Tuticorin water-supply scheme.

Stating, with remarks, that Government can do nothing with regard to the — until its financial position is clearer and requesting the Sanitary Engineer to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers :—

I

Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

Read—the following papers :—

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. JONES, Esq., MEM INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. HUGHES, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was 4½ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about 1½ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
No.—1412.

I have the honour to acknowledge and thank you for your No. 505 T.N of 4th May 1896.

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

Letter—from J. A. JONES, Esq., MEM., INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 19th June 1896.
No.—1913.

I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
No.—801-T. W.

With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

Year.	July.	August.	September.	October.	November.	December.
1886	12·94	12·71	15·54	15·42	15·35	14·67
1887	..	..	..	15·43	14·97	16·38
1888	13·23	11·83	..	15·95	16·00	16·86
1889	12·50	12·62	15·06	16·78	16·20	14·96
1890	..	..	..	14·65	14·30	16·83
1891	13·98	12·93	12·10	15·56	17·25	18·34
1892	12·30	..	..	..	..	..
1893	12·72	..	..	14·50	16·50	18·00
1894	..	..	..	11·55	14·85	14·30
1895	12·14	..	..	16·49	17·79	18·29

Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained :—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1895.
B	Pumping scheme for 10 gallons per head with 4 months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones, calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	
F	Municipal Chairman's scheme ..	Not known.	Not known.	
G	District Board Engineer's scheme ..			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1893, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows :—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

(True Extract).

R. Parsons,
Secretary.

To the Secretary to Government, Local and Municipa Department,
with papers.

II

Letter—from G. Zellweger, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.
Dated—the 10th May 1898.
No.—227.

I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

4. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town, and would point out in conclusion that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
(through the Collector of Tinnevelly).
,, Sanitary Board.
,, ,, Engineer.

LOCAL AND MUNICIPAL DEPARTMENT.

NOTES CONNECTED WITH G.O., No. 1031 M., DATED 8TH JUNE 1898.

[SUBJECT.—*Tuticorin water-supply scheme.*]

From the Sanitary Board, dated 21st November 1896, No. 263-S.

The history of the schemes for the water-supply of Tuticorin originally proposed by the Sanitary Engineer, is given in the note for orders stitched with G.O., No. 75 M., dated 16th January 1896. In that order the pumping scheme approved by the Sanitary Board was declared to be impracticable on financial grounds and the Board was requested to consider the two gravitation schemes estimated to cost Rs. 1,00,000 and Rs. 1,61,850 respectively, proposed by the Chairman of the Municipal Council and the Local Fund Engineer. On this, however, the Sanitary Board in its resolution No. 538, dated 24th February 1896, came to the conclusion that it was impossible to arrange for a satisfactory supply of water to Tuticorin without pumping and recommended that the original pumping scheme of the Sanitary Engineer might be revised by reducing the supply per head from 15 to 10 gallons. This recommendation of the Sanitary Board was approved by Government and in their order No. 435 M., dated 16th March 1896, the Sanitary Engineer was requested to submit revised estimates. The Municipal Council in its resolution thereon expressed the opinion that even on sanitary grounds 10 gallons per head would be quite insufficient and that fully 15 gallons would be required for each person in the town and as it still thought that pumping might with advantage be dispensed with, the Government were requested to reconsider their decision in the matter. But this letter was recorded in G.O., No. 1277 M, dated 31st July 1896, pending receipt of the revised estimate called for from the Sanitary Engineer.

2. With reference however to the Government Order of March 1896 quoted above, the Sanitary Engineer in the first instance submitted for the approval of the Sanitary Board, two schemes, one for Rs. 2,73,140 retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply and the other for Rs. 3,30,000 providing in addition to the modifications of the original scheme referred to above for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended, and

(2) chambers for Gill's arrangements for filters.

The Sanitary Board, however, considered these two schemes as impracticable for financial reasons and asked the Sanitary Engineer to state if a cheaper scheme could not be devised. On this, the Sanitary Engineer proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoirs. As this amount was also considered by the Board to be large, the Sanitary Engineer submitted a gravitation scheme, which though more expensive in the first instance than the pumping scheme costing Rs. 2,68,334, involved a cheaper annual cost. In this scheme the service reservoir, the filters, the pumping house and engines are all omitted.

3. The following statement given by the Sanitary Board shows the cost and working charges of the several schemes above referred to :—

Items.	Scheme.	Capital cost.	Annual working charges.	Remarks.
		Rs.	Rs.	
A.	Pumping scheme for 15 gallons per head with four months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office-note No. 2070-S., dated 18th November 1895.
B.	Pumping scheme for 10 gallons per head with four months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in statement are based on Jones' calculations in the case of schemes D and E.
C.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank.	3,30,000	18,310	
D.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	*Note.*—The capital cost in each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896 referred to by Mr. Jones in his comparative statement.
E.	Gravitation scheme for 10 gallons per head with nine months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	....
F.	Municipal Chairman's scheme	1,00,000	Not known.	....
G.	District Board Engineer's	1,61,859	Do.	....

4. After a careful consideration of all the schemes the Sanitary Board agrees with the Sanitary Engineer in recommending scheme D, if Government considers scheme C too expensive.

5. If scheme D, being the cheaper of the two schemes approved by the Sanitary Board, is undertaken and if the Government makes a grant to the Council of half the cost as already promised and lends the balance at $4\frac{1}{4}$ per cent. interest, the amount required to liquidate the loan in 30 years would be Rs. 7,996, which together with the working charges of Rs. 14,970 represents an annual expenditure of Rs. 22,966. This would however be reduced by Rs. 596, if a sum of Rs. 10,000 out of the current balance reserved for the water-supply scheme is deducted from the loan now required.

6. In the existing state of affairs this sum is beyond the means of the Municipality; but if the proposal to raise the rates of the taxes on houses and lands and the water-tax from $7\frac{1}{2}$ to $8\frac{1}{2}$ and 4 to 8 per cent. respectively is passed into law and if the tax on arts is extended to all the classes of the schedule, then the additional income which may be expected would be—

	Rs.
Water-tax	15,799
House and land tax	4,443
Arts tax	585
Total ..	20,827

Thus the total amount available from all the sources will be Rs. 20,827 or Rs. 1,543 less than the amount required by the Municipal Council. Leaving altogether out of account the annual income expected from the South Indian Railway Company, the above deficit can easily be met by thoroughly revising the taxes on buildings and lands—*vide* the notes stitched with G.O., No. 180 M., dated 6th February 1895.

7. In these circumstances it is submitted that the Sanitary Board's recommendation to undertake scheme D may be approved.

V. RAGHAVA CHARLU—16-1-97.

Scheme C should, if possible, be approved. I have always been of opinion that Tuticorin is very much under-assessed all round: but I do not believe we shall have the assessment properly imposed unless (as I suggested when I was Collector of Tinnevelly) a special officer is deputed to do the work.

2. Would it not also be reasonable to ask Port funds to make a contribution?

G. S. FORBES—18-1-97.

I don't find any report of the Sanitary Engineer's forwarding scheme E and explaining the estimated cost of maintenance, under that scheme, of Rs. 11,100. I should like further information, for I don't understand why that scheme should be so summarily rejected. Nor, I may say, do I comprehend the intrinsic superiority of a pumping to a gravitation scheme, which seems to be assumed as a fact.

2. Why have schemes F and G not been examined?

3. Please send up some sort of plans by means of which I may be able to understand the various schemes.

4. Also please state whether, in view of the fact that, as I understand, the Korampallam tank has just breached, it is worth while to go on with any of these schemes. My impression is that the Korampallam tank or the channel supplying it breaches every two or three years. If so, why shouldn't Mr. Jones' proposed nine months' supply tank breach also and all the proposed expenditure be wasted? Mr. Hughes probably knows more about all these matters than any one else. Please consult him personally and let me know what he thinks.

5. It is all very well to say that the assessments at Tuticorin might be brought to a much higher standard if a special officer were put on. I daresay they might be. But it would not, I think, be safe to sanction a scheme for the supply of Tuticorin on the chance.

H. W. B[LISS]—19-1-97.

Draft demi-official to Mr. Hughes.

G. S. FORBES.

Please see draft demi-official put up.

V. RAGHAVA CHARLU—22-1-97.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated the 25th February 1897.

I received the plans of the Tuticorin water-supply scheme two days ago, but have not been able to examine them until to-day. I do not wish to offer any opinion on the proposed distribution works and confine my remarks to the works which concern me as an Irrigation officer, viz., the reserve tank and conduit.

2. At first Government charged for all the water issued from Korampallam tank but afterwards, for reasons into which I need not enter, it was conceded that only the water reaching the service reservoir should be charged for. I cannot say whether water is now paid for on measurement or otherwise. The quantity issued from the tank is about six times what reaches the town, and irrigation under the tank is carried on with much difficulty and greatly restricted owing to the large supply drawn off for Tuticorin and the system of giving the town the preference as long as the supply lasts. In this way I think Government loses Rs. 2,000 to Rs. 3,000 per annum. The construction of a water-tight conduit should have been insisted on long ago. The proposal now is to make a reserve tank, to be filled from the Korampallam tank and keep the water for use when the Korampallam supply gives out. The reserve tank is undoubtedly required if the town is to be supplied throughout the year and I have already expressed my opinion that it should be made large enough to contain nine months' supply. It will not however be filled every year but receive partial fillings during freshes and be filled at some time each year to the highest level reached in the Korampallam tank. Regarding the site of the reservoir I notice that it does not appear to have been taken into account that there is a bye-wash near the left flank of the Korampallam tank which is intended to

A

discharge when there is a higher flood than the Oopar oday dam can dispose of or when there is danger to the bund. The water from this goes past Korampallam village and crosses the fresh water channel in the low ground not very far from the sluice. There should be a space of a few hundred feet left between the road and the reservoir bank. The next point is that the site is for the most part wet land for which no compensation is provided in the estimate. I do not know whether it is intended to make the bund of earth dug close by. The rate apparently provides for bringing earth from a good distance. In my letter of 4th May, which is in the file, I gave reasons for thinking that the waste by leakage and evaporation from the Korampallam tank is probably $1\frac{1}{2}$ feet a month. Mr. Jones has taken no notice of this but apparently adheres to his estimate of 5 inches a month loss from the new tank, evidently expecting to stop all leakage by the puddle wall extending to 4 feet below the tank bed. Perhaps he has had excavations made and found a clay bed at that level. If he has not done so, I think a thorough examination of the place should be made, or a leaky tank would be useless, and if the matter cannot be placed beyond doubt in any other way a small tank might be made as an experiment and filled by baling from the fresh water channel.

B **C** **D**

There is notoriously great leakage.
G. S. Forbes.

3. Regarding the conduit which it is proposed to build in the bed of the fresh water channel, I think it might be found impossible to build the whole four miles in one season while the Korampallam tank is dry and in time to allow it to set before the supply begins. It will take 2,500 tons of bricks which have to be carted about 20 miles or railed 30 and carted 3, but of course they could be prepared in advance. Why not have 15″ or 18″ cement or glazed earthenware pipe which could be laid in a very short time and would be stronger than and as water-tight as the culvert, while costing very much less.

E

I return the papers and plans.

Demi-official from G. S. Forbes, Esq., I.C.S., Secretary to Government, Local and Municipal Department, to the Sanitary Engineer to Government, dated the 26th February 1897, No. 22.

Please see Hughes' letter.

2. The Honourable Member asked me to consult him. Can you throw light on his difficulties—see specially points marked **A, B, C, D, E.**

Demi-official from J. A. Jones, Esq., Sanitary Engineer to Government, to the Secretary to Government, Local and Municipal Department, dated 1st March 1897, No. 406.

Herewith notes on Mr. Hughes' remarks as to Tuticorin water-supply scheme, which I think fully reply to his criticisms.

Tuticorin Water-supply.

1. **A**—Bye-wash near the left flank of the Korampallam tank.—There is a space of not less than 150 feet below the road and reservoir bund. The bund of the new tank is farther from the road than the channel so that there has been no interference with any course through which water may be discharged from the bye-wash. The crossing is evidently by the channel crossing the fresh water channel, and this has not been interfered with.

2. **B**—The site is for the most part wet land and for which no compensation is allowed in the estimate.—Compensation for land taken up for the reserve tank *is* provided in the estimate—*vide* Sanitary Engineer's estimate, page 12, dated 27th July 1896. Again look at paragraph 8 of report, dated 27th July 1896, where *an increased* allotment for land is referred to.

3. **C**—Whether it is intended to make the bund of earth dug close by.—In paragraph 19 of the Sanitary Engineer's letter No. 1538, dated 27th July 1893, embodied in G.O., Mis. No. 159 M., dated 14th February 1894, he says "The tank is proposed to be formed of simple banks without pitching, the slopes are $2\frac{1}{2}$ to 1 both inside and out with a puddle wall in the centre. The soil is very sandy and there is no economy to be obtained by making the banks with steeper slopes as sand hills and other excavations in the bed of the tank give the quantity of earth sufficient to make the banks of the section proposed. The banks will be *turfed* and the top of the tank will be 4 feet above the maximum water level of the tank.

The data for the rate of Rs. 6-8-0 per 1,000 cubic feet are—

	Rs.	A.	P.
One thousand cubic feet earthwork	2	12	0
One hundred and eighty yards lead at As. 6 for 20 yards	3	6	0
Two yards lift at As. 3	0	6	0
Total ..	6	8	0

4. **D**—Perhaps he (Sanitary Engineer) has had excavations made and found a clay bed at that level.—In estimating the area of the proposed tank, the Sanitary Engineer in his report, dated 27th July 1896, says: "*Evaporation has not been allowed for, as scheme is for* 34,000 *people whereas there are only* 25,000 *to be provided for* at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable."

5. There is no evidence of any clay bed below the sandy soil, and it would be inexpedient to arrange for tank taking into account a high evaporation and leakage for 34,000 when only 25,000 will use water at first and will probably not use even 10 gallons, and when it may be the case that by the time 34,000 people have to be provided for, the Korampallam tank may be filled to its proper level. The area of the tank altered is based on only a level of 16·00 and not 19·40 which is the proper full tank level.

6. **E**—Why not have 15″ or 18″ cement or glazed earthenware pipe which could be laid in a very short time and would be stronger than, and as water-tight as, the culvert while costing very much less.—Mr. Hughes suggests a 15″ or 18″ pipe. A 12″ pipe or less might be similarly suggested, but what is required is a 21″ pipe or else the full quantity of water for 34,000 people will not be obtainable. And this is a portion of the work which must be made full size at once. But even if an 18″ pipe was allowable, the cost would be more than what is proposed—*vide* the following:—

The cost of 21″ masonry culvert for a length of 22,100 feet as estimated is Rs. 44,472 or, say, Rs. 2 a foot.

The cost per foot of cement and stoneware pipes is as below:—

	Rs.	A.	P.
21″ cement pipes (laid)	3	0	0
21″ stoneware pipes, Burn & Co.'s at Calcutta (exclusive of conveying charges and laying)	4	0	0
18″ stoneware pipes, Burn & Co.'s (delivery at Calcutta exclusive of conveying charges and laying)	2	8	0
18″ Doulton's stoneware pipes (delivered at Bombay)	3	8	0
15″ do. do.	2	8	0

7. The above rates clearly show that cement or stoneware pipes cannot be substituted for a masonry conduit, so that even if the fall were increased and much expenditure incurred in excavation and extra cost for filter, for service reservoir, for engine and for pumping and pipes so small as 15″ used, there would be no economy but the reverse.

8. Bricks quite good enough for the conduit are obtainable 10 miles from Korampallam. The culvert would be built in lengths, the channel being replaced by iron pipes during the building of the lower portion so that the building might occupy any length of time and the supply still go on.

Demi-official from H. A. Sim, Esq., I.C.S., Private Secretary to His Excellency the Governor, to the Secretary to Government, Local and Municipal Department, dated 2nd March 1897, No. 39.

With reference to the enclosed, which please return, I shall be glad if you will send up the papers regarding the Tuticorin water-supply scheme for His Excellency's information.

Enclosures.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Private Secretary to His Excellency the Governor, dated 16th February 1897, No. 97.

I beg to submit a copy of my motion and the resolution of the Municipal Council, dated 12th instant, and request you will be so good as to let me know whether His Excellency will be pleased to grant an interview to the members of the deputation.

2. The members intend starting to Madras as early as possible before the end of this month.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Municipal Councillors, Tuticorin.

It is now so many years since a water-supply scheme to our town has been proposed, discussed, and submitted and over and over we represented to the Government the miseries and hardships of the people especially in times of droughts which are so frequent but up to date nothing definite has been done.

2. There has been some consolation to us when we heard from Government a few months ago that the Sanitary Engineer has been asked to prepare estimates to a less expensive water scheme on gravitation principle. There it lies and God knows when it is going to come.

3. It is a wonder that epidemics of most serious nature did not break out in this town; because, exclusive of the impurity of the water which the people have to drink, in times of water-supply failures, even the water we get from Korampallam tank by open channel is impure and subject to various pollutions. It will be unsafe no doubt to expect such special protections of Providence any more, unless the scheme is taken up at once. I am afraid most serious consequences are in store for this unfortunate town. Many towns which are very much less in importance receive the attention of Government, and water schemes are sanctioned and carried out without delay; whereas this town which is only next in importance of trade to the metropolis is ignored altogether. I am sure His Excellency the Governor will be only pleased to sanction the water scheme if he is only properly informed of the sufferings and miseries of the people for want of water-supply.

4. I therefore beg to propose that three members of the Council be selected and requested to wait on a deputation on His Excellency the Governor and lay before him the real state of affairs in this town for want of a water scheme.

Extract from the Proceedings of the Municipal Council, Tuticorin, dated 12th February 1897.

* * * * *

Read motion from the Chairman regarding water-supply scheme to this town.

Resolution No. 7.—Resolved that Captain Baker, the Chairman, and Rev. Mr. Gnanakan be requested to wait on His Excellency the Governor on deputation regarding the water scheme.

* * * * *

Herewith the file about Tuticorin.

G. S. Forbes.

To the Private Secretary.

Seen and returned with thanks.

A. E. H[avelock]—6-3-97.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated 10th March 1897, No. 46.

I return the Tuticorin water-supply papers. Jones has been to see me and I understand him to agree that the storage reservoir should have its bed puddled $1\frac{1}{2}$ feet deep. With regard to the distance between the reservoir and the road, the men, who is carrying out the work, can see that enough space is left. I think there should be 300 feet.

2. It seems that it is considered inadvisable to lower the bed of the filter beds. It is not for me to say. Assuming them 7·40 I suppose a conduit $1\frac{3}{4}$ feet diameter is required. This is for Campbell to decide. All I am concerned about is that the reservoir and conduit or at least the latter should be built soon. I am afraid anybody who expects the Public Works Department to build the conduit in one dry season will be disappointed.

To the Local and Municipal Department.

Local and Municipal Department.

As the adoption of any particular scheme must depend largely on the amount of contribution or aid, Government can afford to give to the Municipality, this file must, until the financial position is clearer, lie over.

G. S. Forbes—28-5-97.

Yes, he should.
A. E. H[avelock]—25-5-98.

I don't think the draft is enough. The Sanitary Engineer should be asked what he has been doing since the issue of G.O., No. 1571 M., dated 16th September 1896.

H. W. B[liss]—20-5-98.

I concur.

2. The Tuticorin water-supply is, as far as my information guides me, the most pressing and important of those before us. In the linked file, the Tuticorin water-supply scheme and all others are ordered to lie over until our financial position is clearer. Our revenue is coming in well. Perhaps Sir H. Bliss would consider whether a further step towards getting this Tuticorin scheme set on foot might now be taken.

A. E. H[avelock]—20-5-98.

Circulated to the Honourable Member again.

H. Tremenheere—21-5-98.

I am afraid there is very little chance at present of our having funds to forward any water and drainage schemes other than those entered in the budget (Tirupati, Rs. 77,400, Vizagapatam, Rs. 20,500 and Cocanada, Rs. 52,100). It is true that our revenue is coming in well, but (1) if we get an extra and unanticipated 20 lakhs this year, we could not use it, for we are limited as to expenditure to the provision made on the expenditure side of the budget, and (2) the first charge on any increase of revenue we may get will be provision for restoring our balance to the stipulated minimum of 20 lakhs. As the budget for 1898-99 stands, we shall close the year with a balance of 6·08 only. We have therefore a sum of Rs. 13·92 to make good from our annual surpluses of revenue over expenditure before we shall be restored to a state of solvency.

2. Another reason why we cannot at present help forward Municipal water and drainage schemes is that no allotment has been made us at present wherefrom we can grant loans to Municipalities. The Municipal Councils will therefore have to raise money in the open market, instead of borrowing from Government at 4 or $4\frac{1}{4}$ per cent. with the bank rate at 12 per cent., it is unnecessary to labour the point that they cannot hope to raise loans in the open market on any terms which they can afford.

3 Our position will not improbably be raised during the year by the fact that we shall not need to spend on famine relief the whole sum of Rs. 8·50 which has been provided. But on the other hand, we only provided half a lakh, I think, for plague expenditure, which won't be anything like enough. We shall probably spend 2 or 2½ lakhs on plague preventive measures, even if plague does not actually break out: if it does, no one can say how much, perhaps 10 to 15 lakhs. Moreover, if we have any savings out of the budget provision for famine, they are already appropriated to the scheme for the better payment of the taluk establishments, if sanctioned by the Secretary of State, as I have little doubt they will be.

·50 under 24. Medical—Provincial.
C. M. SCHMIDT.

Also additional Munsif's Courts.
C.M.S.

4. I have written the above partly from memory and partly from reference to the original (preliminary) issue* of the civil estimates, so the Financial Department had better see before this goes to His Excellency and correct any errors I may have made.

* Dated 14th January 1898.

H. W. B[LISS]—21-5-98.

To the Financial Department with reference to the Honourable Member's note.

H. TREMENHEERE—23-5-98.

FINANCIAL DEPARTMENT.

Honourable Member's figures have been corrected with reference to the figures in the Financial statement.

C. M. SCHMIDT—23-5-98.

A. T. A[RUNDEL]—23-5-98.

I accept, with regret, the draft Government Order. But, I should be glad if this matter be brought to notice after the lapse of four months, when perhaps our financial position may have become more assured.

A. E. H[AVELOCK]—25-5-98.

To the Local and Municipal Department.

LOCAL AND MUNICIPAL DEPARTMENT.

Issue the draft.

G. S. FORBES—6-6-98.

[G.O., No. 1031 M., dated 8th June 1898.]

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Read } 1898. *Enclosures*
Regd. } *Spare copies*

G.O., No. 1031 M., 8th June 1898.

Tuticorin water-supply scheme.

Stating, with remarks, that Government can do nothing with regard to the — until its financial position is clearer and requesting the Sanitary Engineer to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

Read—the following papers :—

I

Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

Read—the following papers :—

Letter—from J. A. Jones, Esq., mem. inst. c.e., f.r.s.e., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. Jones, Esq., mem inst. c.e., f.r.s.e., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. Hughes, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. Jones, Esq., mem. inst. c.e., f.r.s.e., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
No.—1412.

I have the honour to acknowledge and thank you for your No. 505 T.N of 4th May 1896.

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

Letter—from J. A. Jones, Esq., mem., inst. c.e., f.r.s.e., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 19th June 1896.
No.—1913.

I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
No.—801-T. W.

With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

Year.	July.	August.	September.	October.	November.	December.
1886	12·94	12·71	15·54	15·42	15·35	14·67
1887	..	..	..	15·43	14·97	16·38
1888	13·23	11·83	..	15·95	16·00	16·86
1889	12·50	12·62	15·06	16·78	16·20	14·96
1890	..	..	..	14·65	14·30	16·83
1891	13·98	12·93	12·10	15·56	17·25	18·34
1892	12·30	..	..	..	..	..
1893	12·72	..	..	14·50	16·50	18·00
1894	..	..	..	11·55	14·85	14·30
1895	12·14	..	..	16·49	17·79	18·29

Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained:—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1895.
B	Pumping scheme for 10 gallons per head with 4 months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones' calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	
F	Municipal Chairman's scheme ..	Not known.	Not known	
G	District Board Engineer's scheme ..			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows:—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

(True Extract).

R. Parsons,
Secretary.

To the Secretary to Government, Local and Municipa Department,
with papers.

II

Letter—from G. Zellweger, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.
Dated—the 10th May 1898.
No.—227.

I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

4. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town, and would point out in conclusion that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. Forbes,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
(through the Collector of Tinnevelly).
,, Sanitary Board.
,, ,, Engineer.

Local and Municipal Department.

NOTES CONNECTED WITH G.O., No. 1031 M., DATED 8th JUNE 1898.

[Subject.—*Tuticorin water-supply scheme.*]

From the Sanitary Board, dated 21st November 1896, No. 263-S.

The history of the schemes for the water-supply of Tuticorin originally proposed by the Sanitary Engineer, is given in the note for orders stitched with G.O., No. 75 M., dated 16th January 1896. In that order the pumping scheme approved by the Sanitary Board was declared to be impracticable on financial grounds and the Board was requested to consider the two gravitation schemes estimated to cost Rs. 1,00,000 and Rs. 1,61,850 respectively, proposed by the Chairman of the Municipal Council and the Local Fund Engineer. On this, however, the Sanitary Board in its resolution No. 538, dated 24th February 1896, came to the conclusion that it was impossible to arrange for a satisfactory supply of water to Tuticorin without pumping and recommended that the original pumping scheme of the Sanitary Engineer might be revised by reducing the supply per head from 15 to 10 gallons. This recommendation of the Sanitary Board was approved by Government and in their order No. 435 M., dated 16th March 1896, the Sanitary Engineer was requested to submit revised estimates. The Municipal Council in its resolution thereon expressed the opinion that even on sanitary grounds 10 gallons per head would be quite insufficient and that fully 15 gallons would be required for each person in the town and as it still thought that pumping might with advantage be dispensed with, the Government were requested to reconsider their decision in the matter. But this letter was recorded in G.O., No. 1277 M, dated 31st July 1896, pending receipt of the revised estimate called for from the Sanitary Engineer.

2. With reference however to the Government Order of March 1896 quoted above, the Sanitary Engineer in the first instance submitted for the approval of the Sanitary Board, two schemes, one for Rs. 2,73,140 retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply and the other for Rs. 3,30,000 providing in addition to the modifications of the original scheme referred to above for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended, and

(2) chambers for Gill's arrangements for filters.

The Sanitary Board, however, considered these two schemes as impracticable for financial reasons and asked the Sanitary Engineer to state if a cheaper scheme could not be devised. On this, the Sanitary Engineer proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoirs. As this amount was also considered by the Board to be large, the Sanitary Engineer submitted a gravitation scheme, which though more expensive in the first instance than the pumping scheme costing Rs. 2,68,334, involved a cheaper annual cost. In this scheme the service reservoir, the filters, the pumping house and engines are all omitted.

3. The following statement given by the Sanitary Board shows the cost and working charges of the several schemes above referred to:—

Items.	Scheme.	Capital cost.	Annual working charges.	Remarks.
		Rs.	Rs.	
A.	Pumping scheme for 15 gallons per head with four months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office-note No. 2070-S., dated 18th November 1895.
B.	Pumping scheme for 10 gallons per head with four months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in statement are based on Jones' calculations in the case of schemes D and E.
C.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank.	3,30,000	18,310	
D.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	*Note.*—The capital cost in each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896 referred to by Mr. Jones in his comparative statement.
E.	Gravitation scheme for 10 gallons per head with nine months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	....
F.	Municipal Chairman's scheme	1,00,000	Not known.	....
G.	District Board Engineer's	1,61,850	Do.	....

4. After a careful consideration of all the schemes the Sanitary Board agrees with the Sanitary Engineer in recommending scheme D, if Government considers scheme C too expensive.

5. If scheme D, being the cheaper of the two schemes approved by the Sanitary Board, is undertaken and if the Government makes a grant to the Council of half the cost as already promised and lends the balance at $4\frac{1}{4}$ per cent. interest, the amount required to liquidate the loan in 30 years would be Rs. 7,996, which together with the working charges of Rs. 14,970 represents an annual expenditure of Rs. 22,966. This would however be reduced by Rs. 596, if a sum of Rs. 10,000 out of the current balance reserved for the water-supply scheme is deducted from the loan now required.

6. In the existing state of affairs this sum is beyond the means of the Municipality; but if the proposal to raise the rates of the taxes on houses and lands and the water-tax from $7\frac{1}{2}$ to $8\frac{1}{2}$ and 4 to 8 per cent. respectively is passed into law and if the tax on arts is extended to all the classes of the schedule, then the additional income which may be expected would be—

	Rs.
Water-tax	15,799
House and land tax	4,443
Arts tax	585
Total ..	20,827

Thus the total amount available from all the sources will be Rs. 20,827 or Rs. 1,543 less than the amount required by the Municipal Council. Leaving altogether out of account the annual income expected from the South Indian Railway Company, the above deficit can easily be met by thoroughly revising the taxes on buildings and lands—*vide* the notes stitched with G.O., No. 180 M., dated 6th February 1895.

7. In these circumstances it is submitted that the Sanitary Board's recommendation to undertake scheme D may be approved.

V. RAGHAVA CHARLU—16-1-97.

Scheme C should, if possible, be approved. I have always been of opinion that Tuticorin is very much under-assessed all round: but I do not believe we shall have the assessment properly imposed unless (as I suggested when I was Collector of Tinnevelly) a special officer is deputed to do the work.

2. Would it not also be reasonable to ask Port funds to make a contribution?

G. S. FORBES—18-1-97.

I don't find any report of the Sanitary Engineer's forwarding scheme E and explaining the estimated cost of maintenance, under that scheme, of Rs. 11,100. I should like further information, for I don't understand why that scheme should be so summarily rejected. Nor, I may say, do I comprehend the intrinsic superiority of a pumping to a gravitation scheme, which seems to be assumed as a fact.

2. Why have schemes F and G not been examined?

3. Please send up some sort of plans by means of which I may be able to understand the various schemes.

4. Also please state whether, in view of the fact that, as I understand, the Korampallam tank has just breached, it is worth while to go on with any of these schemes. My impression is that the Korampallam tank or the channel supplying it breaches every two or three years. If so, why shouldn't Mr. Jones' proposed nine months' supply tank breach also and all the proposed expenditure be wasted? Mr. Hughes probably knows more about all these matters than any one else. Please consult him personally and let me know what he thinks.

5. It is all very well to say that the assessments at Tuticorin might be brought to a much higher standard if a special officer were put on. I daresay they might be. But it would not, I think, be safe to sanction a scheme for the supply of Tuticorin on the chance.

H. W. B[LISS]—19-1-97.

Draft demi-official to Mr. Hughes.

G. S. FORBES.

Please see draft demi-official put up.

V. RAGHAVA CHARLU—22-1-97.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated the 25th February 1897.

I received the plans of the Tuticorin water-supply scheme two days ago, but have not been able to examine them until to-day. I do not wish to offer any opinion on the proposed distribution works and confine my remarks to the works which concern me as an Irrigation officer, viz., the reserve tank and conduit.

2. At first Government charged for all the water issued from Korampallam tank but afterwards, for reasons into which I need not enter, it was conceded that only the water reaching the service reservoir should be charged for. I cannot say whether water is now paid for on measurement or otherwise. The quantity issued from the tank is about six times what reaches the town, and irrigation under the tank is carried on with much difficulty and greatly restricted owing to the large supply drawn off for Tuticorin and the system of giving the town the preference as long as the supply lasts. In this way I think Government loses Rs. 2,000 to Rs. 3,000 per annum. The construction of a water-tight conduit should have been insisted on long ago. The proposal now is to make a reserve tank, to be filled from the Korampallam tank and keep the water for use when the Korampallam supply gives out. The reserve tank is undoubtedly required if the town is to be supplied throughout the year and I have already expressed my opinion that it should be made large enough to contain nine months' supply. It will not however be filled every year but receive partial fillings during freshes and be filled at some time each year to the highest level reached in the Korampallam tank. Regarding the site of the reservoir I

A notice that it does not appear to have been taken into account that there is a bye-wash near the left flank of the Korampallam tank which is intended to

discharge when there is a higher flood than the Oopar oday dam can dispose of or when there is danger to the bund. The water from this goes past Korampallam village and crosses the fresh water channel in the low ground not very far from the sluice. There should be a space of a few hundred feet left between the road and the reservoir bank. The next point is that the site is for the most part wet land for which no compensation is provided in the estimate. I do not know whether it is intended to make the bund of earth dug close by. The rate apparently provides for bringing earth from a good distance. In my letter of 4th May, which is in the file, I gave reasons for thinking that the waste by leakage and evaporation from the Korampallam tank is probably $1\frac{1}{2}$ feet a month. Mr. Jones has taken no notice of this but apparently adheres to his estimate of 5 inches a month loss from the new tank, evidently expecting to stop all leakage by the puddle wall extending to 4 feet below the tank bed. Perhaps he has had excavations made and found a clay bed at that level. If he has not done so, I think a thorough examination of the place should be made, or a leaky tank would be useless, and if the matter cannot be placed beyond doubt in any other way a small tank might be made as an experiment and filled by baling from the fresh water channel.

B C

There is notoriously great leakage.
G. S. FORBES.

D

3. Regarding the conduit which it is proposed to build in the bed of the fresh water channel, I think it might be found impossible to build the whole four miles in one season while the Korampallam tank is dry and in time to allow it to set before the supply begins. It will take 2,500 tons of bricks which have to be carted about 20 miles or railed 30 and carted 3, but of course they could be prepared in advance.

E Why not have 15″ or 18″ cement or glazed earthenware pipe which could be laid in a very short time and would be stronger than and as water-tight as the culvert, while costing very much less.

I return the papers and plans.

Demi-official from G. S. Forbes, Esq., I.C.S., Secretary to Government, Local and Municipal Department, to the Sanitary Engineer to Government, dated the 26th February 1897, No. 22.

Please see Hughes' letter.

2. The Honourable Member asked me to consult him. Can you throw light on his difficulties—see specially points marked **A, B, C, D, E.**

Demi-official from J. A. Jones, Esq., Sanitary Engineer to Government, to the Secretary to Government, Local and Municipal Department, dated 1st March 1897, No. 406.

Herewith notes on Mr. Hughes' remarks as to Tuticorin water-supply scheme, which I think fully reply to his criticisms.

Tuticorin Water-supply.

1. **A**—Bye-wash near the left flank of the Korampallam tank.—There is a space of not less than 150 feet below the road and reservoir bund. The bund of the new tank is farther from the road than the channel so that there has been no interference with any course through which water may be discharged from the bye-wash. The crossing is evidently by the channel crossing the fresh water channel, and this has not been interfered with.

2. **B**—The site is for the most part wet land and for which no compensation is allowed in the estimate.—Compensation for land taken up for the reserve tank *is* provided in the estimate—*vide* Sanitary Engineer's estimate, page 12, dated 27th July 1896. Again look at paragraph 8 of report, dated 27th July 1896, where *an increased* allotment for land is referred to.

3. **C**—Whether it is intended to make the bund of earth dug close by.—In paragraph 19 of the Sanitary Engineer's letter No. 1538, dated 27th July 1893, embodied in G.O., Mis. No. 159 M., dated 14th February 1894, he says "The tank is proposed to be formed of simple banks without pitching, the slopes are $2\frac{1}{2}$ to 1 both inside and out with a puddle wall in the centre. The soil is very sandy and there is no economy to be obtained by making the banks with steeper slopes as sand hills and other excavations in the bed of the tank give the quantity of earth sufficient to make the banks of the section proposed. The banks will be *turfed* and the top of the tank will be 4 feet above the maximum water level of the tank.

The data for the rate of Rs. 6-8-0 per 1,000 cubic feet are—

	RS.	A.	P.
One thousand cubic feet earthwork	2	12	0
One hundred and eighty yards lead at As. 6 for 20 yards	3	6	0
Two yards lift at As. 3	0	6	0
Total ..	6	8	0

4. **D**—Perhaps he (Sanitary Engineer) has had excavations made and found a clay bed at that level.—In estimating the area of the proposed tank, the Sanitary Engineer in his report, dated 27th July 1896, says: "*Evaporation has not been allowed for, as scheme is for* 34,000 *people whereas there are only* 25,000 *to be provided for* at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable."

5. There is no evidence of any clay bed below the sandy soil, and it would be inexpedient to arrange for tank taking into account a high evaporation and leakage for 34,000 when only 25,000 will use water at first and will probably not use even 10 gallons, and when it may be the case that by the time 34,000 people have to be provided for, the Korampallam tank may be filled to its proper level. The area of the tank altered is based on only a level of 16·00 and not 19·40 which is the proper full tank level.

6. **E**—Why not have 15″ or 18″ cement or glazed earthenware pipe which could be laid in a very short time and would be stronger than, and as water-tight as, the culvert while costing very much less.—Mr. Hughes suggests a 15″ or 18″ pipe. A 12″ pipe or less might be similarly suggested, but what is required is a 21″ pipe or else the full quantity of water for 34,000 people will not be obtainable. And this is a portion of the work which must be made full size at once. But even if an 18″ pipe was allowable, the cost would be more than what is proposed—*vide* the following:—

The cost of 21″ masonry culvert for a length of 22,100 feet as estimated is Rs. 44,472 or, say, Rs. 2 a foot.

The cost per foot of cement and stoneware pipes is as below:—

	RS.	A.	P.
21″ cement pipes (laid)	3	0	0
21″ stoneware pipes, Burn & Co.'s at Calcutta (exclusive of conveying charges and laying)	4	0	0
18″ stoneware pipes, Burn & Co.'s (delivery at Calcutta exclusive of conveying charges and laying)	2	8	0
18″ Doulton's stoneware pipes (delivered at Bombay)	3	8	0
15″ do. do.	2	8	0

7. The above rates clearly show that cement or stoneware pipes cannot be substituted for a masonry conduit, so that even if the fall were increased and much expenditure incurred in excavation and extra cost for filter, for service reservoir, for engine and for pumping and pipes so small as 15″ used, there would be no economy but the reverse.

8. Bricks quite good enough for the conduit are obtainable 10 miles from Korampallam. The culvert would be built in lengths, the channel being replaced by iron pipes during the building of the lower portion so that the building might occupy any length of time and the supply still go on.

Demi-official from H. A. Sim, Esq., I.C.S., Private Secretary to His Excellency the Governor, to the Secretary to Government, Local and Municipal Department, dated 2nd March 1897, No. 39.

With reference to the enclosed, which please return, I shall be glad if you will send up the papers regarding the Tuticorin water-supply scheme for His Excellency's information.

ENCLOSURES.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Private Secretary to His Excellency the Governor, dated 16th February 1897, No. 97.

I beg to submit a copy of my motion and the resolution of the Municipal Council, dated 12th instant, and request you will be so good as to let me know whether His Excellency will be pleased to grant an interview to the members of the deputation.

2. The members intend starting to Madras as early as possible before the end of this month.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Municipal Councillors, Tuticorin.

It is now so many years since a water-supply scheme to our town has been proposed, discussed, and submitted and over and over we represented to the Government the miseries and hardships of the people especially in times of droughts which are so frequent but up to date nothing definite has been done.

2. There has been some consolation to us when we heard from Government a few months ago that the Sanitary Engineer has been asked to prepare estimates to a less expensive water scheme on gravitation principle. There it lies and God knows when it is going to come.

3. It is a wonder that epidemics of most serious nature did not break out in this town; because, exclusive of the impurity of the water which the people have to drink, in times of water-supply failures, even the water we get from Korampallam tank by open channel is impure and subject to various pollutions. It will be unsafe no doubt to expect such special protections of Providence any more, unless the scheme is taken up at once. I am afraid most serious consequences are in store for this unfortunate town. Many towns which are very much less in importance receive the attention of Government, and water schemes are sanctioned and carried out without delay; whereas this town which is only next in importance of trade to the metropolis is ignored altogether. I am sure His Excellency the Governor will be only pleased to sanction the water scheme if he is only properly informed of the sufferings and miseries of the people for want of water-supply.

4. I therefore beg to propose that three members of the Council be selected and requested to wait on a deputation on His Excellency the Governor and lay before him the real state of affairs in this town for want of a water scheme.

Extract from the Proceedings of the Municipal Council, Tuticorin, dated 12th February 1897.

* * * * *

Read motion from the Chairman regarding water-supply scheme to this town.

Resolution No. 7.—Resolved that Captain Baker, the Chairman, and Rev. Mr. Gnanakan be requested to wait on His Excellency the Governor on deputation regarding the water scheme.

* * * * *

Herewith the file about Tuticorin.

G. S. FORBES.

To the Private Secretary.

Seen and returned with thanks.

A. E. H[AVELOCK]—6-3-97.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated 10th March 1897, No. 46.

I return the Tuticorin water-supply papers. Jones has been to see me and I understand him to agree that the storage reservoir should have its bed puddled $1\frac{1}{2}$ feet deep. With regard to the distance between the reservoir and the road, the men, who is carrying out the work, can see that enough space is left. I think there should be 300 feet.

2. It seems that it is considered inadvisable to lower the bed of the filter beds. It is not for me to say. Assuming them 7·40 I suppose a conduit $1\frac{3}{4}$ feet diameter is required. This is for Campbell to decide. All I am concerned about is that the reservoir and conduit or at least the latter should be built soon. I am afraid anybody who expects the Public Works Department to build the conduit in one dry season will be disappointed.

To the Local and Municipal Department.

LOCAL AND MUNICIPAL DEPARTMENT.

As the adoption of any particular scheme must depend largely on the amount of contribution or aid, Government can afford to give to the Municipality, this file must, until the financial position is clearer, lie over.

G. S. FORBES—28-5-97.

Yes, he should.

A. E. H[AVELOCK]—25-5-98.

I don't think the draft is enough. The Sanitary Engineer should be asked what he has been doing since the issue of G.O., No. 1571 M., dated 16th September 1896.

H. W. B[LISS]—20-5-98.

I concur.

2. The Tuticorin water-supply is, as far as my information guides me, the most pressing and important of those before us. In the linked file, the Tuticorin water-supply scheme and all others are ordered to lie over until our financial position is clearer. Our revenue is coming in well. Perhaps Sir H. Bliss would consider whether a further step towards getting this Tuticorin scheme set on foot might now be taken.

A. E. H[AVELOCK]—20-5-98.

Circulated to the Honourable Member again.

H. TREMENHEERE—21-5-98.

I am afraid there is very little chance at present of our having funds to forward any water and drainage schemes other than those entered in the budget (Tirupati, Rs. 77,400, Vizagapatam, Rs. 20,500 and Cocanada, Rs. 52,100). It is true that our revenue is coming in well, but (1) if we get an extra and unanticipated 20 lakhs this year, we could not use it, for we are limited as to expenditure to the provision made on the expenditure side of the budget, and (2) the first charge on any increase of revenue we may get will be provision for restoring our balance to the stipulated minimum of 20 lakhs. As the budget for 1898-99 stands, we shall close the year with a balance of 6·08 only. We have therefore a sum of Rs. 13·92 to make good from our annual surpluses of revenue over expenditure before we shall be restored to a state of solvency.

2. Another reason why we cannot at present help forward Municipal water and drainage schemes is that no allotment has been made us at present wherefrom we can grant loans to Municipalities. The Municipal Councils will therefore have to raise money in the open market, instead of borrowing from Government at 4 or $4\frac{1}{4}$ per cent. with the bank rate at 12 per cent., it is unnecessary to labour the point that they cannot hope to raise loans in the open market on any terms which they can afford.

3 Our position will not improbably be raised during the year by the fact that we shall not need to spend on famine relief the whole sum of Rs. 8·50 which has been provided. But on the other hand, we only provided half a lakh, I think, for plague expenditure, which won't be anything like enough. We shall probably spend 2 or 2½ lakhs on plague preventive measures, even if plague does not actually break out: if it does, no one can say how much, perhaps 10 to 15 lakhs. Moreover, if we have any savings out of the budget provision for famine, they are already appropriated to the scheme for the better payment of the taluk establishments, if sanctioned by the Secretary of State, as I have little doubt they will be.

·50 under 24. Medical—Provincial.
C. M. SCHMIDT.

Also additional Munsif's Courts.
C.M.S.

4. I have written the above partly from memory and partly from reference to the original (preliminary) issue* of the civil estimates, so the Financial Department had better see before this goes to His Excellency and correct any errors I may have made.

* Dated 14th January 1898.

H. W. B[LISS]—21-5-98.

To the Financial Department with reference to the Honourable Member's note.

H. TREMENHEERE—23-5-98.

FINANCIAL DEPARTMENT.

Honourable Member's figures have been corrected with reference to the figures in the Financial statement.

C. M. SCHMIDT—23-5-98.

A. T. A[RUNDEL]—23-5-98.

I accept, with regret, the draft Government Order. But, I should be glad if this matter be brought to notice after the lapse of four months, when perhaps our financial position may have become more assured.

A. E. H[AVELOCK]—25-5-98.

To the Local and Municipal Department.

LOCAL AND MUNICIPAL DEPARTMENT.

Issue the draft.

G. S. FORBES—6-6-98.

[G.O., No. 1031 M., dated 8th June 1898.]

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd } 1898. *Enclosures*
Regd. } *Spare copies*

G.O., No. 1031 M., 8th June 1898.

Tuticorin water-supply scheme.

Stating, with remarks, that Government can do nothing with regard to the — until its financial position is clearer and requesting the Sanitary Engineer to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

Read—the following papers :—

I

Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

Read—the following papers :—

Letter—from J. A. Jones, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. Jones, Esq., MEM INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. Hughes, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. Jones, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
No.—1412.

I have the honour to acknowledge and thank you for your No. 505 T.N of 4th May 1896.

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

Letter—from J. A. Jones, Esq., MEM., INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 19th June 1896.
No.—1913.

I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
No.—801-T. W.

With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

Year.	July.	August.	September.	October.	November.	December.
1886	12·94	12·71	15·54	15·42	15·35	14·67
1887	..	..	..	15·43	14·97	16·38
1888	13·23	11·83	..	15·95	16·00	16·86
1889	12·50	12·62	15·06	16·78	16·20	14·96
1890	..	..	..	14·65	14·30	16·83
1891	13·98	12·93	12·10	15·56	17·25	18·34
1892	12·80	..	..	..	..	..
1893	12·72	..	..	14·50	16·50	18·00
1894	..	..	..	11·55	14·85	14·30
1895	12·14	..	..	16·49	17·79	18·29

Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained :—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1895.
B	Pumping scheme for 10 gallons per head with 4 months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones' calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,870	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	
F	Municipal Chairman's scheme ..	Not known.	Not known.	
G	District Board Engineer's scheme ..			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows :—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

(True Extract).

R. PARSONS,
Secretary.

To the Secretary to Government, Local and Municipa Department,
with papers.

II

Letter—from G. ZELLWEGER, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.
Dated—the 10th May 1898.
No.—227.

I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

4. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town, and would point out in conclusion that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

No. 1031 M., 8TH JUNE 1898.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
" Sanitary Board. (through the Collector of Tinnevelly).
" " Engineer.

NOTES CONNECTED WITH G.O., No. 1031 M., DATED 8TH JUNE 1898.

[SUBJECT.—*Tuticorin water-supply scheme.*]

From the Sanitary Board, dated 21st November 1896, No. 263-S.

The history of the schemes for the water-supply of Tuticorin originally proposed by the Sanitary Engineer, is given in the note for orders stitched with G.O., No. 75 M., dated 16th January 1896. In that order the pumping scheme approved by the Sanitary Board was declared to be impracticable on financial grounds and the Board was requested to consider the two gravitation schemes estimated to cost Rs. 1,00,000 and Rs. 1,61,850 respectively, proposed by the Chairman of the Municipal Council and the Local Fund Engineer. On this, however, the Sanitary Board in its resolution No. 538, dated 24th February 1896, came to the conclusion that it was impossible to arrange for a satisfactory supply of water to Tuticorin without pumping and recommended that the original pumping scheme of the Sanitary Engineer might be revised by reducing the supply per head from 15 to 10 gallons. This recommendation of the Sanitary Board was approved by Government and in their order No. 435 M., dated 16th March 1896, the Sanitary Engineer was requested to submit revised estimates. The Municipal Council in its resolution thereon expressed the opinion that even on sanitary grounds 10 gallons per head would be quite insufficient and that fully 15 gallons would be required for each person in the town and as it still thought that pumping might with advantage be dispensed with, the Government were requested to reconsider their decision in the matter. But this letter was recorded in G.O., No. 1277 M, dated 31st July 1896, pending receipt of the revised estimate called for from the Sanitary Engineer.

2. With reference however to the Government Order of March 1896 quoted above, the Sanitary Engineer in the first instance submitted for the approval of the Sanitary Board, two schemes, one for Rs. 2,73,140 retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply and the other for Rs. 3,30,000 providing in addition to the modifications of the original scheme referred to above for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended, and

(2) chambers for Gill's arrangements for filters.

The Sanitary Board, however, considered these two schemes as impracticable for financial reasons and asked the Sanitary Engineer to state if a cheaper scheme could not be devised. On this, the Sanitary Engineer proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoirs. As this amount was also considered by the Board to be large, the Sanitary Engineer submitted a gravitation scheme, which though more expensive in the first instance than the pumping scheme costing Rs. 2,68,334, involved a cheaper annual cost. In this scheme the service reservoir, the filters, the pumping house and engines are all omitted.

3. The following statement given by the Sanitary Board shows the cost and working charges of the several schemes above referred to:—

Items.	Scheme.	Capital cost.	Annual working charges.	Remarks.
		RS.	RS.	
A.	Pumping scheme for 15 gallons per head with four months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office-note No. 2070-S., dated 18th November 1895.
B.	Pumping scheme for 10 gallons per head with four months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in statement are based on Jones' calculations in the case of schemes D and E.
C.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank.	3,30,000	18,310	
D.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	
E.	Gravitation scheme for 10 gallons per head with nine months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	*Note.*—The capital cost in each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896 referred to by Mr. Jones in his comparative statement.
F.	Municipal Chairman's scheme	1,00,000	Not known.	....
G.	District Board Engineer's	1,61,850	Do.	....

4. After a careful consideration of all the schemes the Sanitary Board agrees with the Sanitary Engineer in recommending scheme D, if Government considers scheme C too expensive.

5. If scheme D, being the cheaper of the two schemes approved by the Sanitary Board, is undertaken and if the Government makes a grant to the Council of half the cost as already promised and lends the balance at $4\frac{1}{4}$ per cent. interest, the amount required to liquidate the loan in 30 years would be Rs. 7,996, which together with the working charges of Rs. 14,970 represents an annual expenditure of Rs. 22,966. This would however be reduced by Rs. 596, if a sum of Rs. 10,000 out of the current balance reserved for the water-supply scheme is deducted from the loan now required.

6. In the existing state of affairs this sum is beyond the means of the Municipality; but if the proposal to raise the rates of the taxes on houses and lands and the water-tax from $7\frac{1}{2}$ to $8\frac{1}{2}$ and 4 to 8 per cent. respectively is passed into law and if the tax on arts is extended to all the classes of the schedule, then the additional income which may be expected would be—

	RS.
Water-tax	15,799
House and land tax	4,443
Arts tax	585
Total ..	20,827

Thus the total amount available from all the sources will be Rs. 20,827 or Rs. 1,543 less than the amount required by the Municipal Council. Leaving altogether out of account the annual income expected from the South Indian Railway Company, the above deficit can easily be met by thoroughly revising the taxes on buildings and lands—*vide* the notes stitched with G.O., No. 180 M., dated 6th February 1895.

7. In these circumstances it is submitted that the Sanitary Board's recommendation to undertake scheme D may be approved.

V. RAGHAVA CHARLU—16-1-97.

Scheme C should, if possible, be approved. I have always been of opinion that Tuticorin is very much under-assessed all round: but I do not believe we shall have the assessment properly imposed unless (as I suggested when I was Collector of Tinnevelly) a special officer is deputed to do the work.

2. Would it not also be reasonable to ask Port funds to make a contribution?

G. S. FORBES—18-1-97.

I don't find any report of the Sanitary Engineer's forwarding scheme E and explaining the estimated cost of maintenance, under that scheme, of Rs. 11,100. I should like further information, for I don't understand why that scheme should be so summarily rejected. Nor, I may say, do I comprehend the intrinsic superiority of a pumping to a gravitation scheme, which seems to be assumed as a fact.

2. Why have schemes F and G not been examined?

3. Please send up some sort of plans by means of which I may be able to understand the various schemes.

4. Also please state whether, in view of the fact that, as I understand, the Korampallam tank has just breached, it is worth while to go on with any of these schemes. My impression is that the Korampallam tank or the channel supplying it breaches every two or three years. If so, why shouldn't Mr. Jones' proposed nine months' supply tank breach also and all the proposed expenditure be wasted? Mr. Hughes probably knows more about all these matters than any one else. Please consult him personally and let me know what he thinks.

5. It is all very well to say that the assessments at Tuticorin might be brought to a much higher standard if a special officer were put on. I daresay they might be. But it would not, I think, be safe to sanction a scheme for the supply of Tuticorin on the chance.

H. W. B[LISS]—19-1-97.

Draft demi-official to Mr. Hughes.

G. S. FORBES.

Please see draft demi-official put up.

V. RAGHAVA CHARLU—22-1-97.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated the 25th February 1897.

I received the plans of the Tuticorin water-supply scheme two days ago, but have not been able to examine them until to-day. I do not wish to offer any opinion on the proposed distribution works and confine my remarks to the works which concern me as an Irrigation officer, viz., the reserve tank and conduit.

2. At first Government charged for all the water issued from Korampallam tank but afterwards, for reasons into which I need not enter, it was conceded that only the water reaching the service reservoir should be charged for. I cannot say whether water is now paid for on measurement or otherwise. The quantity issued from the tank is about six times what reaches the town, and irrigation under the tank is carried on with much difficulty and greatly restricted owing to the large supply drawn off for Tuticorin and the system of giving the town the preference as long as the supply lasts. In this way I think Government loses Rs. 2,000 to Rs. 3,000 per annum. The construction of a water-tight conduit should have been insisted on long ago. The proposal now is to make a reserve tank, to be filled from the Korampallam tank and keep the water for use when the Korampallam supply gives out. The reserve tank is undoubtedly required if the town is to be supplied throughout the year and I have already expressed my opinion that it should be made large enough to contain nine months' supply. It will not however be filled every year but receive partial fillings during freshes and be filled at some time each year to the highest level reached in the Korampallam tank. Regarding the site of the reservoir I A notice that it does not appear to have been taken into account that there is a bye-wash near the left flank of the Korampallam tank which is intended to

discharge when there is a higher flood than the Oopar oday dam can dispose of or when there is danger to the bund. The water from this goes past Korampallam village and crosses the fresh water channel in the low ground not very far from the sluice. There should be a space of a few hundred feet left between the road and the reservoir bank. **B** The next point is that the site is for the most part wet land for which no compensation is provided in the estimate. I do not know whether it is intended to make the bund of earth dug close by. **C** The rate apparently provides for bringing earth from a good distance. In my letter of 4th May, which is in the file, I gave reasons for thinking that the waste by leakage and evaporation from the Korampallam tank is probably $1\frac{1}{2}$ feet a month. Mr. Jones has taken no notice of this but apparently adheres to his estimate of 5 inches a month loss from the new tank, evidently expecting to stop all leakage by the puddle wall extending to 4 feet below the tank bed. **D** Perhaps he has had excavations made and found a clay bed at that level. If he has not done so, I think a thorough examination of the place should be made, or a leaky tank would be useless, and if the matter cannot be placed beyond doubt in any other way a small tank might be made as an experiment and filled by baling from the fresh water channel.

There is notoriously great leakage.
G. S. Forbes.

3. Regarding the conduit which it is proposed to build in the bed of the fresh water channel, I think it might be found impossible to build the whole four miles in one season while the Korampallam tank is dry and in time to allow it to set before the supply begins. It will take 2,500 tons of bricks which have to be carted about 20 miles or railed 30 and carted 3, but of course they could be prepared in advance. **E** Why not have 15″ or 18″ cement or glazed earthenware pipe which could be laid in a very short time and would be stronger than and as water-tight as the culvert, while costing very much less.

I return the papers and plans.

Demi-official from G. S. Forbes, Esq., I.C.S., Secretary to Government, Local and Municipal Department, to the Sanitary Engineer to Government, dated the 26th February 1897, No. 22.

Please see Hughes' letter.

2. The Honourable Member asked me to consult him. Can you throw light on his difficulties—see specially points marked **A, B, C, D, E.**

Demi-official from J. A. Jones, Esq., Sanitary Engineer to Government, to the Secretary to Government, Local and Municipal Department, dated 1st March 1897, No. 406.

Herewith notes on Mr. Hughes' remarks as to Tuticorin water-supply scheme, which I think fully reply to his criticisms.

Tuticorin Water-supply.

1. **A**—Bye-wash near the left flank of the Korampallam tank.—There is a space of not less than 150 feet below the road and reservoir bund. The bund of the new tank is farther from the road than the channel so that there has been no interference with any course through which water may be discharged from the bye-wash. The crossing is evidently by the channel crossing the fresh water channel, and this has not been interfered with.

2. **B**—The site is for the most part wet land and for which no compensation is allowed in the estimate.—Compensation for land taken up for the reserve tank *is* provided in the estimate—*vide* Sanitary Engineer's estimate, page 12, dated 27th July 1896. Again look at paragraph 8 of report, dated 27th July 1896, where *an increased* allotment for land is referred to.

3. **C**—Whether it is intended to make the bund of earth dug close by.—In paragraph 19 of the Sanitary Engineer's letter No. 1538, dated 27th July 1893, embodied in G.O., Mis. No. 159 M., dated 14th February 1894, he says "The tank is proposed to be formed of simple banks without pitching, the slopes are $2\frac{1}{2}$ to 1 both inside and out with a puddle wall in the centre. The soil is very sandy and there is no economy to be obtained by making the banks with steeper slopes as sand hills and other excavations in the bed of the tank give the quantity of earth sufficient to make the banks of the section proposed. The banks will be *turfed* and the top of the tank will be 4 feet above the maximum water level of the tank.

The data for the rate of Rs. 6-8-0 per 1,000 cubic feet are—

	Rs.	A.	P.
One thousand cubic feet earthwork	2	12	0
One hundred and eighty yards lead at As. 6 for 20 yards	3	6	0
Two yards lift at As. 3	0	6	0
Total ..	6	8	0

4. **D**—Perhaps he (Sanitary Engineer) has had excavations made and found a clay bed at that level.—In estimating the area of the proposed tank, the Sanitary Engineer in his report, dated 27th July 1896, says: "*Evaporation has not been allowed for, as scheme is for* 34,000 *people whereas there are only* 25,000 *to be provided for* at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable."

5. There is no evidence of any clay bed below the sandy soil, and it would be inexpedient to arrange for tank taking into account a high evaporation and leakage for 34,000 when only 25,000 will use water at first and will probably not use even 10 gallons, and when it may be the case that by the time 34,000 people have to be provided for, the Korampallam tank may be filled to its proper level. The area of the tank altered is based on only a level of 16·00 and not 19·40 which is the proper full tank level.

6. **E**—Why not have 15″ or 18″ cement or glazed earthenware pipe which could be laid in a very short time and would be stronger than, and as water-tight as, the culvert while costing very much less.—Mr. Hughes suggests a 15″ or 18″ pipe. A 12″ pipe or less might be similarly suggested, but what is required is a 21″ pipe or else the full quantity of water for 34,000 people will not be obtainable. And this is a portion of the work which must be made full size at once. But even if an 18″ pipe was allowable, the cost would be more than what is proposed—*vide* the following:—

The cost of 21″ masonry culvert for a length of 22,100 feet as estimated is Rs. 44,472 or, say, Rs. 2 a foot.

The cost per foot of cement and stoneware pipes is as below:—

	Rs.	A.	P.
21″ cement pipes (laid)	3	0	0
21″ stoneware pipes, Burn & Co.'s at Calcutta (exclusive of conveying charges and laying)	4	0	0
18″ stoneware pipes, Burn & Co.'s (delivery at Calcutta exclusive of conveying charges and laying)	2	8	0
18″ Doulton's stoneware pipes (delivered at Bombay)	3	8	0
15″ do. do.	2	8	0

7. The above rates clearly show that cement or stoneware pipes cannot be substituted for a masonry conduit, so that even if the fall were increased and much expenditure incurred in excavation and extra cost for filter, for service reservoir, for engine and for pumping and pipes so small as 15″ used, there would be no economy but the reverse.

8. Bricks quite good enough for the conduit are obtainable 10 miles from Korampallam. The culvert would be built in lengths, the channel being replaced by iron pipes during the building of the lower portion so that the building might occupy any length of time and the supply still go on.

Demi-official from H. A. Sim, Esq., I.C.S., Private Secretary to His Excellency the Governor, to the Secretary to Government, Local and Municipal Department, dated 2nd March 1897, No. 39.

With reference to the enclosed, which please return, I shall be glad if you will send up the papers regarding the Tuticorin water-supply scheme for His Excellency's information.

Enclosures.

Letter from M.R.Ry. J. M. B. Roche Victoria Avaroal, Chairman, Municipal Council, Tuticorin, to the Private Secretary to His Excellency the Governor, dated 16th February 1897, No. 97.

I beg to submit a copy of my motion and the resolution of the Municipal Council, dated 12th instant, and request you will be so good as to let me know whether His Excellency will be pleased to grant an interview to the members of the deputation.

2. The members intend starting to Madras as early as possible before the end of this month.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Municipal Councillors, Tuticorin.

It is now so many years since a water-supply scheme to our town has been proposed, discussed, and submitted and over and over we represented to the Government the miseries and hardships of the people especially in times of droughts which are so frequent but up to date nothing definite has been done.

2. There has been some consolation to us when we heard from Government a few months ago that the Sanitary Engineer has been asked to prepare estimates to a less expensive water scheme on gravitation principle. There it lies and God knows when it is going to come.

3. It is a wonder that epidemics of most serious nature did not break out in this town; because, exclusive of the impurity of the water which the people have to drink, in times of water-supply failures, even the water we get from Korampallam tank by open channel is impure and subject to various pollutions. It will be unsafe no doubt to expect such special protections of Providence any more, unless the scheme is taken up at once. I am afraid most serious consequences are in store for this unfortunate town. Many towns which are very much less in importance receive the attention of Government, and water schemes are sanctioned and carried out without delay; whereas this town which is only next in importance of trade to the metropolis is ignored altogether. I am sure His Excellency the Governor will be only pleased to sanction the water scheme if he is only properly informed of the sufferings and miseries of the people for want of water-supply.

4. I therefore beg to propose that three members of the Council be selected and requested to wait on a deputation on His Excellency the Governor and lay before him the real state of affairs in this town for want of a water scheme.

Extract from the Proceedings of the Municipal Council, Tuticorin, dated 12th February 1897.

* * * * *

Read motion from the Chairman regarding water-supply scheme to this town.

Resolution No. 7.—Resolved that Captain Baker, the Chairman, and Rev. Mr. Gnanakan be requested to wait on His Excellency the Governor on deputation regarding the water scheme.

* * * * *

Herewith the file about Tuticorin.

G. S. Forbes.

To the Private Secretary.

Seen and returned with thanks.

A. E. H[avelock]—6-3-97.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated 10th March 1897, No. 46.

I return the Tuticorin water-supply papers. Jones has been to see me and I understand him to agree that the storage reservoir should have its bed puddled $1\frac{1}{2}$ feet deep. With regard to the distance between the reservoir and the road, the men. who is carrying out the work, can see that enough space is left. I think there should be 300 feet.

2. It seems that it is considered inadvisable to lower the bed of the filter beds. It is not for me to say. Assuming them 7·40 I suppose a conduit $1\frac{3}{4}$ feet diameter is required. This is for Campbell to decide. All I am concerned about is that the reservoir and conduit or at least the latter should be built soon. I am afraid anybody who expects the Public Works Department to build the conduit in one dry season will be disappointed.

To the Local and Municipal Department.

Local and Municipal Department.

As the adoption of any particular scheme must depend largely on the amount of contribution or aid, Government can afford to give to the Municipality, this file must, until the financial position is clearer, lie over.

G. S. Forbes—28-5-97.

Yes, he should.
A. E. H[avelock]—25-5-98.

I don't think the draft is enough. The Sanitary Engineer should be asked what he has been doing since the issue of G.O., No. 1571 M., dated 16th September 1896.

H. W. B[liss]—20-5-98.

I concur.

2. The Tuticorin water-supply is, as far as my information guides me, the most pressing and important of those before us. In the linked file, the Tuticorin water-supply scheme and all others are ordered to lie over until our financial position is clearer. Our revenue is coming in well. Perhaps Sir H. Bliss would consider whether a further step towards getting this Tuticorin scheme set on foot might now be taken.

A. E. H[avelock]—20-5-98.

Circulated to the Honourable Member again.

H. Tremenheere—21-5-98.

I am afraid there is very little chance at present of our having funds to forward any water and drainage schemes other than those entered in the budget (Tirupati, Rs. 77,400, Vizagapatam, Rs. 20,500 and Cocanada, Rs. 52,100). It is true that our revenue is coming in well, but (1) if we get an extra and unanticipated 20 lakhs this year, we could not use it, for we are limited as to expenditure to the provision made on the expenditure side of the budget, and (2) the first charge on any increase of revenue we may get will be provision for restoring our balance to the stipulated minimum of 20 lakhs. As the budget for 1898-99 stands, we shall close the year with a balance of 6·08 only. We have therefore a sum of Rs. 13·92 to make good from our annual surpluses of revenue over expenditure before we shall be restored to a state of solvency.

2. Another reason why we cannot at present help forward Municipal water and drainage schemes is that no allotment has been made us at present wherefrom we can grant loans to Municipalities. The Municipal Councils will therefore have to raise money in the open market, instead of borrowing from Government at 4 or $4\frac{1}{4}$ per cent. with the bank rate at 12 per cent., it is unnecessary to labour the point that they cannot hope to raise loans in the open market on any terms which they can afford.

3 Our position will not improbably be raised during the year by the fact that we shall not need to spend on famine relief the whole sum of Rs. 8·50 which has been provided. But on the other hand, we only provided half a lakh, I think, for plague expenditure, which won't be anything like enough. We shall probably spend 2 or 2½ lakhs on plague preventive measures, even if plague does not actually break out: if it does, no one can say how much, perhaps 10 to 15 lakhs. Moreover, if we have any savings out of the budget provision for famine, they are already appropriated to the scheme for the better payment of the taluk establishments, if sanctioned by the Secretary of State, as I have little doubt they will be.

·50 under 24. Medical—Provincial.
C. M. SCHMIDT.

Also additional Munsif's Courts.
C.M.S.

4. I have written the above partly from memory and partly from reference to the original (preliminary) issue* of the civil estimates, so the Financial Department had better see before this goes to His Excellency and correct any errors I may have made.

* Dated 14th January 1898.

H. W. B[LISS]—21-5-98.

To the Financial Department with reference to the Honourable Member's note.

H. TREMENHEERE—23-5-98.

FINANCIAL DEPARTMENT.

Honourable Member's figures have been corrected with reference to the figures in the Financial statement.

C. M. SCHMIDT—23-5-98.

A. T. A[RUNDEL]—23-5-98.

I accept, with regret, the draft Government Order. But, I should be glad if this matter be brought to notice after the lapse of four months, when perhaps our financial position may have become more assured.

A. E. H[AVELOCK]—25-5-98.

To the Local and Municipal Department.

LOCAL AND MUNICIPAL DEPARTMENT.

Issue the draft.

G. S. FORBES—6-6-98.

[G.O., No. 1031 M., dated 8th June 1898.]

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd } 1898. *Enclosures*
Regd. } *Spare copies*

G.O., No. 1031 M., 8th June 1898.

Tuticorin water-supply scheme.

Stating, with remarks, that Government can do nothing with regard to the — until its financial position is clearer and requesting the Sanitary Engineer to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers :—

I

Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

Read—the following papers :—

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. JONES, Esq., MEM INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. HUGHES, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
No.—1412.

I have the honour to acknowledge and thank you for your No. 505 T N of 4th May 1896

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

Letter—from J. A. JONES, Esq., MEM., INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 19th June 1896.
No.—1913.

I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
No.—801-T. W.

With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

Year.	July.	August.	September.	October.	November.	December.
1886	12·94	12·71	15·54	15·42	15·35	14·67
1887	..	..	..	15·43	14·97	16·38
1888	13·23	11·83	..	15·95	16·00	16·86
1889	12·50	12·62	15·06	16·78	16·20	14·96
1890	..	..	..	14·65	14·30	16·83
1891	13·98	12·93	12·10	15·56	17·25	18·34
1892	12·30	..	..	..	..	..
1893	12·72	..	..	14·50	16·50	18·00
1894	..	..	..	11·55	14·85	14·30
1895	12·14	..	..	16·49	17·79	18·29

Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained :—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1895.
B	Pumping scheme for 10 gallons per head with 4(months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones' calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	
F	Municipal Chairman's scheme ..	Not known.	Not known	
G	District Board Engineer's scheme ..			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows :—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

(True Extract).

R. Parsons,
Secretary.

To the Secretary to Government, Local and Municipa Department,
with papers.

II

Letter—from G. Zellweger, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.
Dated—the 10th May 1898.
No.—227.

I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

4. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town, and would point out in conclusion that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

No. 1031 M., 8TH JUNE 1898.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
" Sanitary Board. (through the Collector of Tinnevelly).
" " Engineer.

NOTES CONNECTED WITH G.O., No. 1031 M., DATED 8TH JUNE 1898.

[SUBJECT.—*Tuticorin water-supply scheme.*]

From the Sanitary Board, dated 21st November 1896, No. 263-S.

The history of the schemes for the water-supply of Tuticorin originally proposed by the Sanitary Engineer, is given in the note for orders stitched with G.O., No. 75 M., dated 16th January 1896. In that order the pumping scheme approved by the Sanitary Board was declared to be impracticable on financial grounds and the Board was requested to consider the two gravitation schemes estimated to cost Rs. 1,00,000 and Rs. 1,61,850 respectively, proposed by the Chairman of the Municipal Council and the Local Fund Engineer. On this, however, the Sanitary Board in its resolution No. 538, dated 24th February 1896, came to the conclusion that it was impossible to arrange for a satisfactory supply of water to Tuticorin without pumping and recommended that the original pumping scheme of the Sanitary Engineer might be revised by reducing the supply per head from 15 to 10 gallons. This recommendation of the Sanitary Board was approved by Government and in their order No. 435 M., dated 16th March 1896, the Sanitary Engineer was requested to submit revised estimates. The Municipal Council in its resolution thereon expressed the opinion that even on sanitary grounds 10 gallons per head would be quite insufficient and that fully 15 gallons would be required for each person in the town and as it still thought that pumping might with advantage be dispensed with, the Government were requested to reconsider their decision in the matter. But this letter was recorded in G.O., No. 1277 M, dated 31st July 1896, pending receipt of the revised estimate called for from the Sanitary Engineer.

2. With reference however to the Government Order of March 1896 quoted above, the Sanitary Engineer in the first instance submitted for the approval of the Sanitary Board, two schemes, one for Rs. 2,73,140 retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply and the other for Rs. 3,30,000 providing in addition to the modifications of the original scheme referred to above for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended, and

(2) chambers for Gill's arrangements for filters.

The Sanitary Board, however, considered these two schemes as impracticable for financial reasons and asked the Sanitary Engineer to state if a cheaper scheme could not be devised. On this, the Sanitary Engineer proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoirs. As this amount was also considered by the Board to be large, the Sanitary Engineer submitted a gravitation scheme, which though more expensive in the first instance than the pumping scheme costing Rs. 2,68,334, involved a cheaper annual cost. In this scheme the service reservoir, the filters, the pumping house and engines are all omitted.

3. The following statement given by the Sanitary Board shows the cost and working charges of the several schemes above referred to:—

Items.	Scheme.	Capital cost.	Annual working charges.	Remarks.
		Rs.	Rs.	
A.	Pumping scheme for 15 gallons per head with four months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office-note No. 2070-S., dated 18th November 1895.
B.	Pumping scheme for 10 gallons per head with four months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in statement are based on Jones' calculations in the case of schemes D and E.
C.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank.	3,30,000	18,310	
D.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	*Note.*—The capital cost in each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896 referred to by Mr. Jones in his comparative statement.
E.	Gravitation scheme for 10 gallons per head with nine months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	....
F.	Municipal Chairman's scheme	1,00,000	Not known.	....
G.	District Board Engineer's	1,61,850	Do.	....

4. After a careful consideration of all the schemes the Sanitary Board agrees with the Sanitary Engineer in recommending scheme D, if Government considers scheme C too expensive.

5. If scheme D, being the cheaper of the two schemes approved by the Sanitary Board, is undertaken and if the Government makes a grant to the Council of half the cost as already promised and lends the balance at $4\frac{1}{4}$ per cent. interest, the amount required to liquidate the loan in 30 years would be Rs. 7,996, which together with the working charges of Rs. 14,970 represents an annual expenditure of Rs. 22,966. This would however be reduced by Rs. 596, if a sum of Rs. 10,000 out of the current balance reserved for the water-supply scheme is deducted from the loan now required.

6. In the existing state of affairs this sum is beyond the means of the Municipality; but if the proposal to raise the rates of the taxes on houses and lands and the water-tax from $7\frac{1}{2}$ to $8\frac{1}{2}$ and 4 to 8 per cent. respectively is passed into law and if the tax on arts is extended to all the classes of the schedule, then the additional income which may be expected would be—

	Rs.
Water-tax	15,799
House and land tax	4,443
Arts tax	585
Total ..	20,827

Thus the total amount available from all the sources will be Rs. 20,827 or Rs. 1,543 less than the amount required by the Municipal Council. Leaving altogether out of account the annual income expected from the South Indian Railway Company, the above deficit can easily be met by thoroughly revising the taxes on buildings and lands—*vide* the notes stitched with G.O., No. 180 M., dated 6th February 1895.

7. In these circumstances it is submitted that the Sanitary Board's recommendation to undertake scheme D may be approved.

V. RAGHAVA CHARLU—16-1-97.

Scheme C should, if possible, be approved. I have always been of opinion that Tuticorin is very much under-assessed all round: but I do not believe we shall have the assessment properly imposed unless (as I suggested when I was Collector of Tinnevelly) a special officer is deputed to do the work.

2. Would it not also be reasonable to ask Port funds to make a contribution?

G. S. FORBES—18-1-97.

I don't find any report of the Sanitary Engineer's forwarding scheme E and explaining the estimated cost of maintenance, under that scheme, of Rs. 11,100. I should like further information, for I don't understand why that scheme should be so summarily rejected. Nor, I may say, do I comprehend the intrinsic superiority of a pumping to a gravitation scheme, which seems to be assumed as a fact.

2. Why have schemes F and G not been examined?

3. Please send up some sort of plans by means of which I may be able to understand the various schemes.

4. Also please state whether, in view of the fact that, as I understand, the Korampallam tank has just breached, it is worth while to go on with any of these schemes. My impression is that the Korampallam tank or the channel supplying it breaches every two or three years. If so, why shouldn't Mr. Jones' proposed nine months' supply tank breach also and all the proposed expenditure be wasted? Mr. Hughes probably knows more about all these matters than any one else. Please consult him personally and let me know what he thinks.

5. It is all very well to say that the assessments at Tuticorin might be brought to a much higher standard if a special officer were put on. I daresay they might be. But it would not, I think, be safe to sanction a scheme for the supply of Tuticorin on the chance.

H. W. B[LISS]—19-1-97.

Draft demi-official to Mr. Hughes.

G. S. FORBES.

Please see draft demi-official put up.

V. RAGHAVA CHARLU—22-1-97.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated the 25th February 1897.

I received the plans of the Tuticorin water-supply scheme two days ago, but have not been able to examine them until to-day. I do not wish to offer any opinion on the proposed distribution works and confine my remarks to the works which concern me as an Irrigation officer, viz., the reserve tank and conduit.

2. At first Government charged for all the water issued from Korampallam tank but afterwards, for reasons into which I need not enter, it was conceded that only the water reaching the service reservoir should be charged for. I cannot say whether water is now paid for on measurement or otherwise. The quantity issued from the tank is about six times what reaches the town, and irrigation under the tank is carried on with much difficulty and greatly restricted owing to the large supply drawn off for Tuticorin and the system of giving the town the preference as long as the supply lasts. In this way I think Government loses Rs. 2,000 to Rs. 3,000 per annum. The construction of a water-tight conduit should have been insisted on long ago. The proposal now is to make a reserve tank, to be filled from the Korampallam tank and keep the water for use when the Korampallam supply gives out. The reserve tank is undoubtedly required if the town is to be supplied throughout the year and I have already expressed my opinion that it should be made large enough to contain nine months' supply. It will not however be filled every year but receive partial fillings during freshes and be filled at some time each year to the highest level reached in the Korampallam tank. Regarding the site of the reservoir I notice that it does not appear to have been taken into account that there is a bye-wash near the left flank of the Korampallam tank which is intended to

A

discharge when there is a higher flood than the Oopar oday dam can dispose of or when there is danger to the bund. The water from this goes past Korampallam village and crosses the fresh water channel in the low ground not very far from the sluice. There should be a space of a few hundred feet left between the road and the reservoir bank. **B** The next point is that the site is for the most part wet land for which no compensation is provided in the estimate. I do not know whether it is intended to make the bund of earth dug close by. **C** The rate apparently provides for bringing earth from a good distance. In my letter of 4th May, which is in the file, I gave reasons for thinking that the waste by leakage and evaporation from the Korampallam tank is probably $1\frac{1}{2}$ feet a month. Mr. Jones has taken no notice of this but apparently adheres to his estimate of 5 inches a month loss from the new tank, evidently expecting to stop all leakage by the puddle wall extending to 4 feet below the tank bed. **D** Perhaps he has had excavations made and found a clay bed at that level. If he has not done so, I think a thorough examination of the place should be made, or a leaky tank would be useless, and if the matter cannot be placed beyond doubt in any other way a small tank might be made as an experiment and filled by baling from the fresh water channel.

There is notoriously great leakage.
G. S. FORBES.

3. Regarding the conduit which it is proposed to build in the bed of the fresh water channel, I think it might be found impossible to build the whole four miles in one season while the Korampallam tank is dry and in time to allow it to set before the supply begins. It will take 2,500 tons of bricks which have to be carted about 20 miles or railed 30 and carted 3, but of course they could be prepared in advance. **E** Why not have 15″ or 18″ cement or glazed earthenware pipe which could be laid in a very short time and would be stronger than and as water-tight as the culvert, while costing very much less.

I return the papers and plans.

Demi-official from G. S. Forbes, Esq., I.C.S., Secretary to Government, Local and Municipal Department, to the Sanitary Engineer to Government, dated the 26th February 1897, No. 22.

Please see Hughes' letter.

2. The Honourable Member asked me to consult him. Can you throw light on his difficulties—see specially points marked **A, B, C, D, E.**

Demi-official from J. A. Jones, Esq., Sanitary Engineer to Government, to the Secretary to Government, Local and Municipal Department, dated 1st March 1897, No. 406.

Herewith notes on Mr. Hughes' remarks as to Tuticorin water-supply scheme, which I think fully reply to his criticisms.

Tuticorin Water-supply.

1. **A**—Bye-wash near the left flank of the Korampallam tank.—There is a space of not less than 150 feet below the road and reservoir bund. The bund of the new tank is farther from the road than the channel so that there has been no interference with any course through which water may be discharged from the bye-wash. The crossing is evidently by the channel crossing the fresh water channel, and this has not been interfered with.

2. **B**—The site is for the most part wet land and for which no compensation is allowed in the estimate.—Compensation for land taken up for the reserve tank *is* provided in the estimate—*vide* Sanitary Engineer's estimate, page 12, dated 27th July 1896. Again look at paragraph 8 of report, dated 27th July 1896, where *an increased* allotment for land is referred to.

3. **C**—Whether it is intended to make the bund of earth dug close by.—In paragraph 19 of the Sanitary Engineer's letter No. 1538, dated 27th July 1893, embodied in G.O., Mis. No. 159 M., dated 14th February 1894, he says "The tank is proposed to be formed of simple banks without pitching, the slopes are $2\frac{1}{2}$ to 1 both inside and out with a puddle wall in the centre. The soil is very sandy and there is no economy to be obtained by making the banks with steeper slopes as sand hills and other excavations in the bed of the tank give the quantity of earth sufficient to make the banks of the section proposed. The banks will be *turfed* and the top of the tank will be 4 feet above the maximum water level of the tank.

The data for the rate of Rs. 6-8-0 per 1,000 cubic feet are—

	RS.	A.	P.
One thousand cubic feet earthwork	2	12	0
One hundred and eighty yards lead at As. 6 for 20 yards	3	6	0
Two yards lift at As. 3	0	6	0
Total ..	6	8	0

4. **D**—Perhaps he (Sanitary Engineer) has had excavations made and found a clay bed at that level.—In estimating the area of the proposed tank, the Sanitary Engineer in his report, dated 27th July 1896, says: "*Evaporation has not been allowed for, as scheme is for* 34,000 *people whereas there are only* 25,000 *to be provided for* at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable."

5. There is no evidence of any clay bed below the sandy soil, and it would be inexpedient to arrange for tank taking into account a high evaporation and leakage for 34,000 when only 25,000 will use water at first and will probably not use even 10 gallons, and when it may be the case that by the time 34,000 people have to be provided for, the Korampallam tank may be filled to its proper level. The area of the tank altered is based on only a level of 16·00 and not 19·40 which is the proper full tank level.

6. **E**—Why not have 15″ or 18″ cement or glazed earthenware pipe which could be laid in a very short time and would be stronger than, and as water-tight as, the culvert while costing very much less.—Mr. Hughes suggests a 15″ or 18″ pipe. A 12″ pipe or less might be similarly suggested, but what is required is a 21″ pipe or else the full quantity of water for 34,000 people will not be obtainable. And this is a portion of the work which must be made full size at once. But even if an 18″ pipe was allowable, the cost would be more than what is proposed—*vide* the following:—

The cost of 21″ masonry culvert for a length of 22,100 feet as estimated is Rs. 44,472 or, say, Rs. 2 a foot.

The cost per foot of cement and stoneware pipes is as below:—

	RS.	A.	P.
21″ cement pipes (laid)	3	0	0
21″ stoneware pipes, Burn & Co.'s at Calcutta (exclusive of conveying charges and laying)	4	0	0
18″ stoneware pipes, Burn & Co.'s (delivery at Calcutta exclusive of conveying charges and laying)	2	8	0
18″ Doulton's stoneware pipes (delivered at Bombay)	3	8	0
15″ do. do.	2	8	0

7. The above rates clearly show that cement or stoneware pipes cannot be substituted for a masonry conduit, so that even if the fall were increased and much expenditure incurred in excavation and extra cost for filter, for service reservoir, for engine and for pumping and pipes so small as 15″ used, there would be no economy but the reverse.

8. Bricks quite good enough for the conduit are obtainable 10 miles from Korampallam. The culvert would be built in lengths, the channel being replaced by iron pipes during the building of the lower portion so that the building might occupy any length of time and the supply still go on.

Demi-official from H. A. Sim, Esq., I.C.S., Private Secretary to His Excellency the Governor, to the Secretary to Government, Local and Municipal Department, dated 2nd March 1897, No. 39.

With reference to the enclosed, which please return, I shall be glad if you will send up the papers regarding the Tuticorin water-supply scheme for His Excellency's information.

Enclosures.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Private Secretary to His Excellency the Governor, dated 16th February 1897, No. 97.

I beg to submit a copy of my motion and the resolution of the Municipal Council, dated 12th instant, and request you will be so good as to let me know whether His Excellency will be pleased to grant an interview to the members of the deputation.

2. The members intend starting to Madras as early as possible before the end of this month.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Municipal Councillors, Tuticorin.

It is now so many years since a water-supply scheme to our town has been proposed, discussed, and submitted and over and over we represented to the Government the miseries and hardships of the people especially in times of droughts which are so frequent but up to date nothing definite has been done.

2. There has been some consolation to us when we heard from Government a few months ago that the Sanitary Engineer has been asked to prepare estimates to a less expensive water scheme on gravitation principle. There it lies and God knows when it is going to come.

3. It is a wonder that epidemics of most serious nature did not break out in this town; because, exclusive of the impurity of the water which the people have to drink, in times of water-supply failures, even the water we get from Korampallam tank by open channel is impure and subject to various pollutions. It will be unsafe no doubt to expect such special protections of Providence any more, unless the scheme is taken up at once. I am afraid most serious consequences are in store for this unfortunate town. Many towns which are very much less in importance receive the attention of Government, and water schemes are sanctioned and carried out without delay; whereas this town which is only next in importance of trade to the metropolis is ignored altogether. I am sure His Excellency the Governor will be only pleased to sanction the water scheme if he is only properly informed of the sufferings and miseries of the people for want of water-supply.

4. I therefore beg to propose that three members of the Council be selected and requested to wait on a deputation on His Excellency the Governor and lay before him the real state of affairs in this town for want of a water scheme.

Extract from the Proceedings of the Municipal Council, Tuticorin, dated 12th February 1897.

* * * * *

Read motion from the Chairman regarding water-supply scheme to this town.

Resolution No. 7.—Resolved that Captain Baker, the Chairman, and Rev. Mr. Gnanakan be requested to wait on His Excellency the Governor on deputation regarding the water scheme.

* * * * *

Herewith the file about Tuticorin.

G. S. Forbes.

To the Private Secretary.

Seen and returned with thanks.

A. E. H[avelock]—6-3-97.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated 10th March 1897, No. 46.

I return the Tuticorin water-supply papers. Jones has been to see me and I understand him to agree that the storage reservoir should have its bed puddled $1\frac{1}{2}$ feet deep. With regard to the distance between the reservoir and the road, the men, who is carrying out the work, can see that enough space is left. I think there should be 300 feet.

2. It seems that it is considered inadvisable to lower the bed of the filter beds. It is not for me to say. Assuming them 7·40 I suppose a conduit $1\frac{3}{4}$ feet diameter is required. This is for Campbell to decide. All I am concerned about is that the reservoir and conduit or at least the latter should be built soon. I am afraid anybody who expects the Public Works Department to build the conduit in one dry season will be disappointed.

To the Local and Municipal Department.

Local and Municipal Department.

As the adoption of any particular scheme must depend largely on the amount of contribution or aid, Government can afford to give to the Municipality, this file must, until the financial position is clearer, lie over.

G. S. Forbes—28-5-97.

Yes, he should.
A. E. H[avelock]—25-5-98.

I don't think the draft is enough. The Sanitary Engineer should be asked what he has been doing since the issue of G.O., No. 1571 M., dated 16th September 1896.

H. W. B[liss]—20-5-98.

I concur.

2. The Tuticorin water-supply is, as far as my information guides me, the most pressing and important of those before us. In the linked file, the Tuticorin water-supply scheme and all others are ordered to lie over until our financial position is clearer. Our revenue is coming in well. Perhaps Sir H. Bliss would consider whether a further step towards getting this Tuticorin scheme set on foot might now be taken.

A. E. H[avelock]—20-5-98.

Circulated to the Honourable Member again.

H. Tremenheere—21-5-98.

I am afraid there is very little chance at present of our having funds to forward any water and drainage schemes other than those entered in the budget (Tirupati, Rs. 77,400, Vizagapatam, Rs. 20,500 and Cocanada, Rs. 52,100). It is true that our revenue is coming in well, but (1) if we get an extra and unanticipated 20 lakhs this year, we could not use it, for we are limited as to expenditure to the provision made on the expenditure side of the budget, and (2) the first charge on any increase of revenue we may get will be provision for restoring our balance to the stipulated minimum of 20 lakhs. As the budget for 1898-99 stands, we shall close the year with a balance of 6·08 only. We have therefore a sum of Rs. 13·92 to make good from our annual surpluses of revenue over expenditure before we shall be restored to a state of solvency.

2. Another reason why we cannot at present help forward Municipal water and drainage schemes is that no allotment has been made us at present wherefrom we can grant loans to Municipalities. The Municipal Councils will therefore have to raise money in the open market, instead of borrowing from Government at 4 or $4\frac{1}{4}$ per cent. with the bank rate at 12 per cent., it is unnecessary to labour the point that they cannot hope to raise loans in the open market on any terms which they can afford.

3 Our position will not improbably be raised during the year by the fact that we shall not need to spend on famine relief the whole sum of Rs. 8·50 which has been provided. But on the other hand, we only provided half a lakh, I think, for plague expenditure, which won't be anything like enough. We shall probably spend 2 or 2½ lakhs on plague preventive measures, even if plague does not actually break out: if it does, no one can say how much, perhaps 10 to 15 lakhs. Moreover, if we have any savings out of the budget provision for famine, they are already appropriated to the scheme for the better payment of the taluk establishments, if sanctioned by the Secretary of State, as I have little doubt they will be.

·50 under 24. Medical—Provincial.
C. M. SCHMIDT.

Also additional Munsif's Courts.
C.M.S.

4. I have written the above partly from memory and partly from reference to the original (preliminary) issue* of the civil estimates, so the Financial Department had better see before this goes to His Excellency and correct any errors I may have made.

*Dated 14th January 1898.

H. W. B[LISS]—21-5-98.

To the Financial Department with reference to the Honourable Member's note.

H. TREMENHEERE—23-5-98.

FINANCIAL DEPARTMENT.

Honourable Member's figures have been corrected with reference to the figures in the Financial statement.

C. M. SCHMIDT—23-5-98.

A. T. A[RUNDEL]—23-5-98.

I accept, with regret, the draft Government Order. But, I should be glad if this matter be brought to notice after the lapse of four months, when perhaps our financial position may have become more assured.

A. E. H[AVELOCK]—25-5-98.

To the Local and Municipal Department.

LOCAL AND MUNICIPAL DEPARTMENT.

Issue the draft.

G. S. FORBES—6-6-98.

[G.O., No. 1031 M., dated 8th June 1898.]

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Read } 1898. *Enclosures*

Regd. } *Spare copies*

G.O., No. 1031 M., 8th June 1898.

Tuticorin water-supply scheme.

Stating, with remarks, that Government can do nothing with regard to the — until its financial position is clearer and requesting the Sanitary Engineer to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers :—

I

Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

Read—the following papers :—

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. JONES, Esq., MEM INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. HUGHES, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
No.—1412.

I have the honour to acknowledge and thank you for your No. 505 T.N of 4th May 1896.

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

Letter—from J. A. JONES, Esq., MEM., INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 19th June 1896.
No.—1913.

I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
No.—801-T. W.

With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

Year.	July.	August.	September.	October.	November.	December.
1886	12·94	12·71	15·54	15·42	15·35	14·67
1887	..	..	..	15·43	14·97	16·38
1888	13·23	11·83	..	15·95	16·00	16·86
1889	12·50	12·62	15·06	16·78	16·20	14·96
1890	..	..	..	14·65	14·30	16·83
1891	13·98	12·93	12·10	15·56	17·25	18·34
1892	12·30	..	..	..	..	..
1893	12·72	..	..	14·50	16·50	18·00
1894	..	..	..	11·55	14·85	14·30
1895	12·14	..	..	16·49	17·79	18·29

Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
(through the Collector of Tinnevelly).
,, Sanitary Board.
,, ,, Engineer.

NOTES CONNECTED WITH G.O., No. 1031 M., DATED 8TH JUNE 1898.

[SUBJECT.—*Tuticorin water-supply scheme.*]

From the Sanitary Board, dated 21st November 1896, No. 263-S.

The history of the schemes for the water-supply of Tuticorin originally proposed by the Sanitary Engineer, is given in the note for orders stitched with G.O., No. 75 M., dated 16th January 1896. In that order the pumping scheme approved by the Sanitary Board was declared to be impracticable on financial grounds and the Board was requested to consider the two gravitation schemes estimated to cost Rs. 1,00,000 and Rs. 1,61,850 respectively, proposed by the Chairman of the Municipal Council and the Local Fund Engineer. On this, however, the Sanitary Board in its resolution No. 538, dated 24th February 1896, came to the conclusion that it was impossible to arrange for a satisfactory supply of water to Tuticorin without pumping and recommended that the original pumping scheme of the Sanitary Engineer might be revised by reducing the supply per head from 15 to 10 gallons. This recommendation of the Sanitary Board was approved by Government and in their order No. 435 M., dated 16th March 1896, the Sanitary Engineer was requested to submit revised estimates. The Municipal Council in its resolution thereon expressed the opinion that even on sanitary grounds 10 gallons per head would be quite insufficient and that fully 15 gallons would be required for each person in the town and as it still thought that pumping might with advantage be dispensed with, the Government were requested to reconsider their decision in the matter. But this letter was recorded in G.O., No. 1277 M, dated 31st July 1896, pending receipt of the revised estimate called for from the Sanitary Engineer.

2. With reference however to the Government Order of March 1896 quoted above, the Sanitary Engineer in the first instance submitted for the approval of the Sanitary Board, two schemes, one for Rs. 2,73,140 retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply and the other for Rs. 3,30,000 providing in addition to the modifications of the original scheme referred to above for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended, and

(2) chambers for Gill's arrangements for filters.

The Sanitary Board, however, considered these two schemes as impracticable for financial reasons and asked the Sanitary Engineer to state if a cheaper scheme could not be devised. On this, the Sanitary Engineer proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoirs. As this amount was also considered by the Board to be large, the Sanitary Engineer submitted a gravitation scheme, which though more expensive in the first instance than the pumping scheme costing Rs. 2,68,334, involved a cheaper annual cost. In this scheme the service reservoir, the filters, the pumping house and engines are all omitted.

3. The following statement given by the Sanitary Board shows the cost and working charges of the several schemes above referred to:—

Items.	Scheme.	Capital cost.	Annual working charges.	Remarks.
		Rs.	Rs.	
A.	Pumping scheme for 15 gallons per head with four months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office-note No. 2070-S., dated 18th November 1895.
B.	Pumping scheme for 10 gallons per head with four months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in statement are based on Jones' calculations in the case of schemes D and E.
C.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank.	3,30,000	18,310	
D.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	*Note.*—The capital cost in each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896 referred to by Mr. Jones in his comparative statement.
E.	Gravitation scheme for 10 gallons per head with nine months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	....
F.	Municipal Chairman's scheme	1,00,000	Not known.	....
G.	District Board Engineer's	1,61,850	Do.	....

4. After a careful consideration of all the schemes the Sanitary Board agrees with the Sanitary Engineer in recommending scheme D, if Government considers scheme C too expensive.

5. If scheme D, being the cheaper of the two schemes approved by the Sanitary Board, is undertaken and if the Government makes a grant to the Council of half the cost as already promised and lends the balance at $4\frac{1}{4}$ per cent. interest, the amount required to liquidate the loan in 30 years would be Rs. 7,996, which together with the working charges of Rs. 14,970 represents an annual expenditure of Rs. 22,966. This would however be reduced by Rs. 596, if a sum of Rs. 10,000 out of the current balance reserved for the water-supply scheme is deducted from the loan now required.

6. In the existing state of affairs this sum is beyond the means of the Municipality; but if the proposal to raise the rates of the taxes on houses and lands and the water-tax from $7\frac{1}{2}$ to $8\frac{1}{2}$ and 4 to 8 per cent. respectively is passed into law and if the tax on arts is extended to all the classes of the schedule, then the additional income which may be expected would be—

	Rs.
Water-tax	15,799
House and land tax	4,443
Arts tax	585
Total ..	20,827

Thus the total amount available from all the sources will be Rs. 20,827 or Rs. 1,543 less than the amount required by the Municipal Council. Leaving altogether out of account the annual income expected from the South Indian Railway Company, the above deficit can easily be met by thoroughly revising the taxes on buildings and lands—*vide* the notes stitched with G.O., No. 180 M., dated 6th February 1895.

7. In these circumstances it is submitted that the Sanitary Board's recommendation to undertake scheme D may be approved.

V. Raghava Charlu—16-1-97.

Scheme C should, if possible, be approved. I have always been of opinion that Tuticorin is very much under-assessed all round: but I do not believe we shall have the assessment properly imposed unless (as I suggested when I was Collector of Tinnevelly) a special officer is deputed to do the work.

2. Would it not also be reasonable to ask Port funds to make a contribution?

G. S. Forbes—18-1-97.

I don't find any report of the Sanitary Engineer's forwarding scheme E and explaining the estimated cost of maintenance, under that scheme, of Rs. 11,100. I should like further information, for I don't understand why that scheme should be so summarily rejected. Nor, I may say, do I comprehend the intrinsic superiority of a pumping to a gravitation scheme, which seems to be assumed as a fact.

2. Why have schemes F and G not been examined?

3. Please send up some sort of plans by means of which I may be able to understand the various schemes.

4. Also please state whether, in view of the fact that, as I understand, the Korampallam tank has just breached, it is worth while to go on with any of these schemes. My impression is that the Korampallam tank or the channel supplying it breaches every two or three years. If so, why shouldn't Mr. Jones' proposed nine months' supply tank breach also and all the proposed expenditure be wasted? Mr. Hughes probably knows more about all these matters than any one else. Please consult him personally and let me know what he thinks.

5. It is all very well to say that the assessments at Tuticorin might be brought to a much higher standard if a special officer were put on. I daresay they might be. But it would not, I think, be safe to sanction a scheme for the supply of Tuticorin on the chance.

H. W. B[liss]—19-1-97.

Draft demi-official to Mr. Hughes.

G. S. Forbes.

Please see draft demi-official put up.

V. Raghava Charlu—22-1-97.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated the 25th February 1897.

I received the plans of the Tuticorin water-supply scheme two days ago, but have not been able to examine them until to-day. I do not wish to offer any opinion on the proposed distribution works and confine my remarks to the works which concern me as an Irrigation officer, viz., the reserve tank and conduit.

2. At first Government charged for all the water issued from Korampallam tank but afterwards, for reasons into which I need not enter, it was conceded that only the water reaching the service reservoir should be charged for. I cannot say whether water is now paid for on measurement or otherwise. The quantity issued from the tank is about six times what reaches the town, and irrigation under the tank is carried on with much difficulty and greatly restricted owing to the large supply drawn off for Tuticorin and the system of giving the town the preference as long as the supply lasts. In this way I think Government loses Rs. 2,000 to Rs. 3,000 per annum. The construction of a water-tight conduit should have been insisted on long ago. The proposal now is to make a reserve tank, to be filled from the Korampallam tank and keep the water for use when the Korampallam supply gives out. The reserve tank is undoubtedly required if the town is to be supplied throughout the year and I have already expressed my opinion that it should be made large enough to contain nine months' supply. It will not however be filled every year but receive partial fillings during freshes and be filled at some time each year to the highest level reached in the Korampallam tank. Regarding the site of the reservoir I

A notice that it does not appear to have been taken into account that there is a bye-wash near the left flank of the Korampallam tank which is intended to

No. 1031 M., 8th June 1898.

Demi-official from H. A. Sim, Esq., I.C.S., Private Secretary to His Excellency the Governor, to the Secretary to Government, Local and Municipal Department, dated 2nd March 1897, No. 39.

With reference to the enclosed, which please return, I shall be glad if you will send up the papers regarding the Tuticorin water-supply scheme for His Excellency's information.

Enclosures.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Private Secretary to His Excellency the Governor, dated 16th February 1897, No. 97.

I beg to submit a copy of my motion and the resolution of the Municipal Council, dated 12th instant, and request you will be so good as to let me know whether His Excellency will be pleased to grant an interview to the members of the deputation.

2. The members intend starting to Madras as early as possible before the end of this month.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Municipal Councillors, Tuticorin.

It is now so many years since a water-supply scheme to our town has been proposed, discussed, and submitted and over and over we represented to the Government the miseries and hardships of the people especially in times of droughts which are so frequent but up to date nothing definite has been done.

2. There has been some consolation to us when we heard from Government a few months ago that the Sanitary Engineer has been asked to prepare estimates to a less expensive water scheme on gravitation principle. There it lies and God knows when it is going to come.

3. It is a wonder that epidemics of most serious nature did not break out in this town; because, exclusive of the impurity of the water which the people have to drink, in times of water-supply failures, even the water we get from Korampallam tank by open channel is impure and subject to various pollutions. It will be unsafe no doubt to expect such special protections of Providence any more, unless the scheme is taken up at once. I am afraid most serious consequences are in store for this unfortunate town. Many towns which are very much less in importance receive the attention of Government, and water schemes are sanctioned and carried out without delay; whereas this town which is only next in importance of trade to the metropolis is ignored altogether. I am sure His Excellency the Governor will be only pleased to sanction the water scheme if he is only properly informed of the sufferings and miseries of the people for want of water-supply.

4. I therefore beg to propose that three members of the Council be selected and requested to wait on a deputation on His Excellency the Governor and lay before him the real state of affairs in this town for want of a water scheme.

Extract from the Proceedings of the Municipal Council, Tuticorin, dated 12th February 1897.

* * * * *

Read motion from the Chairman regarding water-supply scheme to this town.

Resolution No. 7.—Resolved that Captain Baker, the Chairman, and Rev. Mr. Gnanakan be requested to wait on His Excellency the Governor on deputation regarding the water scheme.

* * * * *

Herewith the file about Tuticorin.

G. S. Forbes.

To the Private Secretary.

Seen and returned with thanks.

A. E. H[avelock]—6-3-97.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated 10th March 1897, No. 46.

I return the Tuticorin water-supply papers. Jones has been to see me and I understand him to agree that the storage reservoir should have its bed puddled 1½ feet deep. With regard to the distance between the reservoir and the road, the men, who is carrying out the work, can see that enough space is left. I think there should be 300 feet.

2. It seems that it is considered inadvisable to lower the bed of the filter beds. It is not for me to say. Assuming them 7·40 I suppose a conduit 1¾ feet diameter is required. This is for Campbell to decide. All I am concerned about is that the reservoir and conduit or at least the latter should be built soon. I am afraid anybody who expects the Public Works Department to build the conduit in one dry season will be disappointed.

To the Local and Municipal Department.

Local and Municipal Department.

As the adoption of any particular scheme must depend largely on the amount of contribution or aid, Government can afford to give to the Municipality, this file must, until the financial position is clearer, lie over.

G. S. Forbes—28-5-97.

Yes, he should.
A. E. H[avelock]—25-5-98.

I don't think the draft is enough. The Sanitary Engineer should be asked what he has been doing since the issue of G.O., No. 1571 M., dated 16th September 1896.

H. W. B[liss]—20-5-98.

I concur.

2. The Tuticorin water-supply is, as far as my information guides me, the most pressing and important of those before us. In the linked file, the Tuticorin water-supply scheme and all others are ordered to lie over until our financial position is clearer. Our revenue is coming in well. Perhaps Sir H. Bliss would consider whether a further step towards getting this Tuticorin scheme set on foot might now be taken.

A. E. H[avelock]—20-5-98.

Circulated to the Honourable Member again.

H. Trem[illegible]r—21-5-98.

I am afraid there is very little chance at present of our having funds to forward any water and drainage schemes other than those entered in the budget (Tirupati, Rs. 77,400, Vizagapatam, Rs. 20,500 and Cocanada, Rs. 52,100). It is true that our revenue is coming in well, but (1) if we get an extra and unanticipated 20 lakhs this year, we could not use it, for we are limited as to expenditure to the provision made on the expenditure side of the budget, and (2) the first charge on any increase of revenue we may get will be provision for restoring our balance to the stipulated minimum of 20 lakhs. As the budget for 1898-99 stands, we shall close the year with a balance of 6·08 only. We have therefore a sum of Rs. 13·92 to make good from our annual surpluses of revenue over expenditure before we shall be restored to a state of solvency.

2. Another reason why we cannot at present help forward Municipal water and drainage schemes is that no allotment has been made us at present wherefrom we can grant loans to Municipalities. The Municipal Councils will therefore have to raise money in the open market, instead of borrowing from Government at 4 or 4¼ per cent. with the bank rate at 12 per cent., it is unnecessary to labour the point that they cannot hope to raise loans in the open market on any terms which they can afford.

3 Our position will not improbably be raised during the year by the fact that we shall not need to spend on famine relief the whole sum of Rs. 8·50 which has been provided. But on the other hand, we only provided half a lakh, I think, for plague expenditure, which won't be anything like enough. We shall probably spend 2 or 2½ lakhs on plague preventive measures, even if plague does not actually break out: if it does, no one can say how much, perhaps 10 to 15 lakhs. Moreover, if we have any savings out of the budget provision for famine, they are already appropriated to the scheme for the better payment of the taluk establishments, if sanctioned by the Secretary of State, as I have little doubt they will be.

50 under 24. Medical—Provincial.
C. M. SCHMIDT.

Also additional Munsif's Courts.
C.M.S.

4. I have written the above partly from memory and partly from reference to the original (preliminary) issue* of the civil estimates, so the Financial Department had better see before this goes to His Excellency and correct any errors I may have made.

* Dated 14th January 1898.

H. W. B[LISS]—21-5-98.

To the Financial Department with reference to the Honourable Member's note.

H. TREMENHEERE—23-5-98.

FINANCIAL DEPARTMENT.

Honourable Member's figures have been corrected with reference to the figures in the Financial statement.

C. M. SCHMIDT—23-5-98.

A. T. A[RUNDEL]—23-5-98.

I accept, with regret, the draft Government Order. But, I should be glad if this matter be brought to notice after the lapse of four months, when perhaps our financial position may have become more assured.

A. E. H[AVELOCK]—25-5-98.

To the Local and Municipal Department.

LOCAL AND MUNICIPAL DEPARTMENT.

Issue the draft.

G. S. FORBES—6-6-98.

[G.O., No. 1031 M., dated 8th June 1898.]

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Read / *Regd.* } 1898. *Enclosures* / *Spare copies*

G.O., No. 1031 M., 8th June 1898.

Tuticorin water-supply scheme.

Stating, with remarks, that Government can do nothing with regard to the — until its financial position is clearer and requesting the Sanitary Engineer to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers :—

I

Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

Read—the following papers :—

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. JONES, Esq., MEM INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. HUGHES, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level. I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
No.—1412.

I have the honour to acknowledge and thank you for your No. 505 T.N of 4th May 1896.

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

Letter—from J. A. JONES, Esq., MEM., INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 19th June 1896.
No.—1913.

I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
No.—801-T. W.

With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

Year.	July.	August.	September.	October.	November.	December.
1886	12·94	12·71	15·54	15·42	15·35	14·67
1887	..	..	..	15·43	14·97	16·38
1888	13·23	11·83	..	15·95	16·00	16·86
1889	12·50	12·62	15·06	16·78	16·20	14·96
1890	..	..	..	14·65	14·30	16·83
1891	13·98	12·93	12·10	15·56	17·25	18·34
1892	12·30	..	..	..	..	..
1893	12·72	..	..	14·50	16·50	18·00
1894	..	..	..	11·55	14·85	14·30
1895	12·14	..	..	16·49	17·79	18·29

Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained :—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1895.
B	Pumping scheme for 10 gallons per head with 4(months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones' calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,73,000	11,100	
F	Municipal Chairman's scheme ..	Not known.	Not known.	
G	District Board Engineer's scheme ..			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows :—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

(True Extract).

R. Parsons,
Secretary.

To the Secretary to Government, Local and Municipa Department, with papers.

II

Letter—from G. Zellweger, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.
Dated—the 10th May 1898.
No.—227.

I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

4. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town, and would point out in conclusion that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

No. 1031 M., 8TH JUNE 1898.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
" Sanitary Board. (through the Collector of Tinnevelly).
" " Engineer.

LOCAL AND MUNICIPAL DEPARTMENT.

NOTES CONNECTED WITH G.O., No. 1031 M., DATED 8TH JUNE 1898.

[SUBJECT.—*Tuticorin water-supply scheme.*]

From the Sanitary Board, dated 21st November 1896, No. 263-S.

The history of the schemes for the water-supply of Tuticorin originally proposed by the Sanitary Engineer, is given in the note for orders stitched with G.O., No. 75 M., dated 16th January 1896. In that order the pumping scheme approved by the Sanitary Board was declared to be impracticable on financial grounds and the Board was requested to consider the two gravitation schemes estimated to cost Rs. 1,00,000 and Rs. 1,61,850 respectively, proposed by the Chairman of the Municipal Council and the Local Fund Engineer. On this, however, the Sanitary Board in its resolution No. 538, dated 24th February 1896, came to the conclusion that it was impossible to arrange for a satisfactory supply of water to Tuticorin without pumping and recommended that the original pumping scheme of the Sanitary Engineer might be revised by reducing the supply per head from 15 to 10 gallons. This recommendation of the Sanitary Board was approved by Government and in their order No. 435 M., dated 16th March 1896, the Sanitary Engineer was requested to submit revised estimates. The Municipal Council in its resolution thereon expressed the opinion that even on sanitary grounds 10 gallons per head would be quite insufficient and that fully 15 gallons would be required for each person in the town and as it still thought that pumping might with advantage be dispensed with, the Government were requested to reconsider their decision in the matter. But this letter was recorded in G.O., No. 1277 M, dated 31st July 1896, pending receipt of the revised estimate called for from the Sanitary Engineer.

2. With reference however to the Government Order of March 1896 quoted above, the Sanitary Engineer in the first instance submitted for the approval of the Sanitary Board, two schemes, one for Rs. 2,73,140 retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply and the other for Rs. 3,30,000 providing in addition to the modifications of the original scheme referred to above for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended, and

(2) chambers for Gill's arrangements for filters.

The Sanitary Board, however, considered these two schemes as impracticable for financial reasons and asked the Sanitary Engineer to state if a cheaper scheme could not be devised. On this, the Sanitary Engineer proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoirs. As this amount was also considered by the Board to be large, the Sanitary Engineer submitted a gravitation scheme, which though more expensive in the first instance than the pumping scheme costing Rs. 2,68,334, involved a cheaper annual cost. In this scheme the service reservoir, the filters, the pumping house and engines are all omitted.

3. The following statement given by the Sanitary Board shows the cost and working charges of the several schemes above referred to:—

Items.	Scheme.	Capital cost.	Annual working charges.	Remarks.
		Rs.	Rs.	
A.	Pumping scheme for 15 gallons per head with four months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office-note No. 2070-S., dated 18th November 1895.
B.	Pumping scheme for 10 gallons per head with four months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in statement are based on Jones' calculations in the case of schemes D and E.
C.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank.	3,30,000	18,310	
D.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	
E.	Gravitation scheme for 10 gallons per head with nine months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	*Note.*—The capital cost in each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896 referred to by Mr. Jones in his comparative statement.
F.	Municipal Chairman's scheme	1,00,000	Not known.	....
G.	District Board Engineer's	1,61,850	Do.	....
				....

4. After a careful consideration of all the schemes the Sanitary Board agrees with the Sanitary Engineer in recommending scheme D, if Government considers scheme C too expensive.

5. If scheme D, being the cheaper of the two schemes approved by the Sanitary Board, is undertaken and if the Government makes a grant to the Council of half the cost as already promised and lends the balance at $4\frac{1}{4}$ per cent. interest, the amount required to liquidate the loan in 30 years would be Rs. 7,996, which together with the working charges of Rs. 14,970 represents an annual expenditure of Rs. 22,966. This would however be reduced by Rs. 596, if a sum of Rs. 10,000 out of the current balance reserved for the water-supply scheme is deducted from the loan now required.

6. In the existing state of affairs this sum is beyond the means of the Municipality; but if the proposal to raise the rates of the taxes on houses and lands and the water-tax from $7\frac{1}{2}$ to $8\frac{1}{2}$ and 4 to 8 per cent. respectively is passed into law and if the tax on arts is extended to all the classes of the schedule, then the additional income which may be expected would be—

	Rs.
Water-tax	15,799
House and land tax	4,443
Arts tax	585
Total ..	20,827

Thus the total amount available from all the sources will be Rs. 20,827 or Rs. 1,543 less than the amount required by the Municipal Council. Leaving altogether out of account the annual income expected from the South Indian Railway Company, the above deficit can easily be met by thoroughly revising the taxes on buildings and lands—*vide* the notes stitched with G.O., No. 180 M., dated 6th February 1895.

7. In these circumstances it is submitted that the Sanitary Board's recommendation to undertake scheme D may be approved.

V. RAGHAVA CHARLU—16-1-97.

Scheme C should, if possible, be approved. I have always been of opinion that Tuticorin is very much under-assessed all round: but I do not believe we shall have the assessment properly imposed unless (as I suggested when I was Collector of Tinnevelly) a special officer is deputed to do the work.

2. Would it not also be reasonable to ask Port funds to make a contribution?

G. S. FORBES—18-1-97.

I don't find any report of the Sanitary Engineer's forwarding scheme E and explaining the estimated cost of maintenance, under that scheme, of Rs. 11,100. I should like further information, for I don't understand why that scheme should be so summarily rejected. Nor, I may say, do I comprehend the intrinsic superiority of a pumping to a gravitation scheme, which seems to be assumed as a fact.

2. Why have schemes F and G not been examined?

3. Please send up some sort of plans by means of which I may be able to understand the various schemes.

4. Also please state whether, in view of the fact that, as I understand, the Korampallam tank has just breached, it is worth while to go on with any of these schemes. My impression is that the Korampallam tank or the channel supplying it breaches every two or three years. If so, why shouldn't Mr. Jones' proposed nine months' supply tank breach also and all the proposed expenditure be wasted? Mr. Hughes probably knows more about all these matters than any one else. Please consult him personally and let me know what he thinks.

5. It is all very well to say that the assessments at Tuticorin might be brought to a much higher standard if a special officer were put on. I daresay they might be. But it would not, I think, be safe to sanction a scheme for the supply of Tuticorin on the chance.

H. W. B[LISS]—19-1-97.

Draft demi-official to Mr. Hughes.

G. S. FORBES.

Please see draft demi-official put up.

V. RAGHAVA CHARLU—22-1-97.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated the 25th February 1897.

I received the plans of the Tuticorin water-supply scheme two days ago, but have not been able to examine them until to-day. I do not wish to offer any opinion on the proposed distribution works and confine my remarks to the works which concern me as an Irrigation officer, viz., the reserve tank and conduit.

2. At first Government charged for all the water issued from Korampallam tank but afterwards, for reasons into which I need not enter, it was conceded that only the water reaching the service reservoir should be charged for. I cannot say whether water is now paid for on measurement or otherwise. The quantity issued from the tank is about six times what reaches the town, and irrigation under the tank is carried on with much difficulty and greatly restricted owing to the large supply drawn off for Tuticorin and the system of giving the town the preference as long as the supply lasts. In this way I think Government loses Rs. 2,000 to Rs. 3,000 per annum. The construction of a water-tight conduit should have been insisted on long ago. The proposal now is to make a reserve tank, to be filled from the Korampallam tank and keep the water for use when the Korampallam supply gives out. The reserve tank is undoubtedly required if the town is to be supplied throughout the year and I have already expressed my opinion that it should be made large enough to contain nine months' supply. It will not however be filled every year but receive partial fillings during freshes and be filled at some time each year to the highest level reached in the Korampallam tank. Regarding the site of the reservoir I notice that it does not appear to have been taken into account that there is a bye-wash near the left flank of the Korampallam tank which is intended to

A

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

Read—the following papers :—

I

Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

Read—the following papers :—

Letter—from J. A. Jones, Esq., mem. inst. c.e., f.r.s.e., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. Jones, Esq., mem inst. c.e., f.r.s.e., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. Hughes, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

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3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. Jones, Esq., mem. inst. c.e., f.r.s.e., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
No.—1412.

I have the honour to acknowledge and thank you for your No. 505 T.N of 4th May 1896.

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

Letter—from J. A. Jones, Esq., mem., inst. c.e., f.r.s.e., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 19th June 1896.
No.—1913.

I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
(through the Collector of Tinnevelly).
,, Sanitary Board.
,, ,, Engineer.

LOCAL AND MUNICIPAL DEPARTMENT.

NOTES CONNECTED WITH G.O., No. 1031 M., DATED 8TH JUNE 1898.

[SUBJECT.—*Tuticorin water-supply scheme.*]

From the Sanitary Board, dated 21st November 1896, No. 263-S.

The history of the schemes for the water-supply of Tuticorin originally proposed by the Sanitary Engineer, is given in the note for orders stitched with G.O., No. 75 M., dated 16th January 1896. In that order the pumping scheme approved by the Sanitary Board was declared to be impracticable on financial grounds and the Board was requested to consider the two gravitation schemes estimated to cost Rs. 1,00,000 and Rs. 1,61,850 respectively, proposed by the Chairman of the Municipal Council and the Local Fund Engineer. On this, however, the Sanitary Board in its resolution No. 538, dated 24th February 1896, came to the conclusion that it was impossible to arrange for a satisfactory supply of water to Tuticorin without pumping and recommended that the original pumping scheme of the Sanitary Engineer might be revised by reducing the supply per head from 15 to 10 gallons. This recommendation of the Sanitary Board was approved by Government and in their order No. 435 M., dated 16th March 1896, the Sanitary Engineer was requested to submit revised estimates. The Municipal Council in its resolution thereon expressed the opinion that even on sanitary grounds 10 gallons per head would be quite insufficient and that fully 15 gallons would be required for each person in the town and as it still thought that pumping might with advantage be dispensed with, the Government were requested to reconsider their decision in the matter. But this letter was recorded in G.O., No. 1277 M, dated 31st July 1896, pending receipt of the revised estimate called for from the Sanitary Engineer.

2. With reference however to the Government Order of March 1896 quoted above, the Sanitary Engineer in the first instance submitted for the approval of the Sanitary Board, two schemes, one for Rs. 2,73,140 retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply and the other for Rs. 3,30,000 providing in addition to the modifications of the original scheme referred to above for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended, and

(2) chambers for Gill's arrangements for filters.

The Sanitary Board, however, considered these two schemes as impracticable for financial reasons and asked the Sanitary Engineer to state if a cheaper scheme could not be devised. On this, the Sanitary Engineer proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoirs. As this amount was also considered by the Board to be large, the Sanitary Engineer submitted a gravitation scheme, which though more expensive in the first instance than the pumping scheme costing Rs. 2,68,334, involved a cheaper annual cost. In this scheme the service reservoir, the filters, the pumping house and engines are all omitted.

3. The following statement given by the Sanitary Board shows the cost and working charges of the several schemes above referred to:—

Items.	Scheme.	Capital cost.	Annual working charges.	Remarks.
		RS.	RS.	
A.	Pumping scheme for 15 gallons per head with four months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office-note No. 2070-S., dated 18th November 1895.
B.	Pumping scheme for 10 gallons per head with four months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in statement are based on Jones' calculations in the case of schemes D and E.
C.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank.	3,30,000	18,310	
D.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	*Note.*—The capital cost in each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896 referred to by Mr. Jones in his comparative statement.
E.	Gravitation scheme for 10 gallons per head with nine months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	....
F.	Municipal Chairman's scheme	1,00,000	Not known.	....
G.	District Board Engineer's	1,61,850	Do.	....

4. After a careful consideration of all the schemes the Sanitary Board agrees with the Sanitary Engineer in recommending scheme D, if Government considers scheme C too expensive.

5. If scheme D, being the cheaper of the two schemes approved by the Sanitary Board, is undertaken and if the Government makes a grant to the Council of half the cost as already promised and lends the balance at $4\frac{1}{4}$ per cent. interest, the amount required to liquidate the loan in 30 years would be Rs. 7,996, which together with the working charges of Rs. 14,970 represents an annual expenditure of Rs. 22,966. This would however be reduced by Rs. 596, if a sum of Rs. 10,000 out of the current balance reserved for the water-supply scheme is deducted from the loan now required.

6. In the existing state of affairs this sum is beyond the means of the Municipality; but if the proposal to raise the rates of the taxes on houses and lands and the water-tax from $7\frac{1}{2}$ to $8\frac{1}{2}$ and 4 to 8 per cent. respectively is passed into law and if the tax on arts is extended to all the classes of the schedule, then the additional income which may be expected would be—

	RS.
Water-tax	15,799
House and land tax	4,443
Arts tax	585
Total ..	20,827

Thus the total amount available from all the sources will be Rs. 20,827 or Rs. 1,543 less than the amount required by the Municipal Council. Leaving altogether out of account the annual income expected from the South Indian Railway Company, the above deficit can easily be met by thoroughly revising the taxes on buildings and lands—*vide* the notes stitched with G.O., No. 180 M., dated 6th February 1895.

7. In these circumstances it is submitted that the Sanitary Board's recommendation to undertake scheme D may be approved.

V. RAGHAVA CHARLU—16-1-97.

Scheme C should, if possible, be approved. I have always been of opinion that Tuticorin is very much under-assessed all round: but I do not believe we shall have the assessment properly imposed unless (as I suggested when I was Collector of Tinnevelly) a special officer is deputed to do the work.

2. Would it not also be reasonable to ask Port funds to make a contribution?

G. S. FORBES—18-1-97.

I don't find any report of the Sanitary Engineer's forwarding scheme E and explaining the estimated cost of maintenance, under that scheme, of Rs. 11,100. I should like further information, for I don't understand why that scheme should be so summarily rejected. Nor, I may say, do I comprehend the intrinsic superiority of a pumping to a gravitation scheme, which seems to be assumed as a fact.

2. Why have schemes F and G not been examined?

3. Please send up some sort of plans by means of which I may be able to understand the various schemes.

4. Also please state whether, in view of the fact that, as I understand, the Korampallam tank has just breached, it is worth while to go on with any of these schemes. My impression is that the Korampallam tank or the channel supplying it breaches every two or three years. If so, why shouldn't Mr. Jones' proposed nine months' supply tank breach also and all the proposed expenditure be wasted? Mr. Hughes probably knows more about all these matters than any one else. Please consult him personally and let me know what he thinks.

5. It is all very well to say that the assessments at Tuticorin might be brought to a much higher standard if a special officer were put on. I daresay they might be. But it would not, I think, be safe to sanction a scheme for the supply of Tuticorin on the chance.

H. W. B[LISS]—19-1-97.

Draft demi-official to Mr. Hughes.

G. S. FORBES.

Please see draft demi-official put up.

V. RAGHAVA CHARLU—22-1-97.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated the 25th February 1897.

I received the plans of the Tuticorin water-supply scheme two days ago, but have not been able to examine them until to-day. I do not wish to offer any opinion on the proposed distribution works and confine my remarks to the works which concern me as an Irrigation officer, viz., the reserve tank and conduit.

2. At first Government charged for all the water issued from Korampallam tank but afterwards, for reasons into which I need not enter, it was conceded that only the water reaching the service reservoir should be charged for. I cannot say whether water is now paid for on measurement or otherwise. The quantity issued from the tank is about six times what reaches the town, and irrigation under the tank is carried on with much difficulty and greatly restricted owing to the large supply drawn off for Tuticorin and the system of giving the town the preference as long as the supply lasts. In this way I think Government loses Rs. 2,000 to Rs. 3,000 per annum. The construction of a water-tight conduit should have been insisted on long ago. The proposal now is to make a reserve tank, to be filled from the Korampallam tank and keep the water for use when the Korampallam supply gives out. The reserve tank is undoubtedly required if the town is to be supplied throughout the year and I have already expressed my opinion that it should be made large enough to contain nine months' supply. It will not however be filled every year but receive partial fillings during freshes and be filled at some time each year to the highest level reached in the Korampallam tank. Regarding the site of the reservoir I notice that it does not appear to have been taken into account that there is a bye-wash near the left flank of the Korampallam tank which is intended to

discharge when there is a higher flood than the Oopar oday dam can dispose of or when there is danger to the bund. The water from this goes past Korampallam village and crosses the fresh water channel in the low ground not very far from the sluice. There should be a space of a few hundred feet left between the road and the
B reservoir bank. The next point is that the site is for the most part wet land for
C which no compensation is provided in the estimate. I do not know whether it is intended to make the bund of earth dug close by. The rate apparently provides for bringing earth from a good distance. In my letter of 4th May, which is in the file, I gave reasons for thinking that the waste by leakage and evaporation from the Korampallam tank is probably $1\frac{1}{2}$ feet a month. Mr. Jones has taken no notice of this but apparently adheres to his estimate of 5 inches a month loss from the new tank, evidently expecting to stop all leakage by the puddle wall extending to 4 feet below the tank bed. Perhaps he has had excavations made and found a clay bed at that level. If he has not done so, I think a thorough examination of the place should be made, or a leaky tank would be useless, and if the matter cannot be placed beyond doubt in any other way a small tank might be made as an experiment and filled by baling from the fresh water channel.

There is notoriously great leakage.
G. S. FORBES.
D

3. Regarding the conduit which it is proposed to build in the bed of the fresh water channel, I think it might be found impossible to build the whole four miles in one season while the Korampallam tank is dry and in time to allow it to set before the supply begins. It will take 2,500 tons of bricks which have to be carted about 20 miles or railed 30 and carted 3, but of course they could be prepared in advance.
E Why not have 15″ or 18″ cement or glazed earthenware pipe which could be laid in a very short time and would be stronger than and as water-tight as the culvert, while costing very much less.

I return the papers and plans.

Demi-official from G. S. Forbes, Esq., I.C.S., Secretary to Government, Local and Municipal Department, to the Sanitary Engineer to Government, dated the 26th February 1897, *No.* 22.

Please see Hughes' letter.

2. The Honourable Member asked me to consult him. Can you throw light on his difficulties—see specially points marked **A, B, C, D, E.**

Demi-official from J. A. Jones, Esq., Sanitary Engineer to Government, to the Secretary to Government, Local and Municipal Department, dated 1st March 1897, *No.* 406.

Herewith notes on Mr. Hughes' remarks as to Tuticorin water-supply scheme, which I think fully reply to his criticisms.

Tuticorin Water-supply.

1. **A**—Bye-wash near the left flank of the Korampallam tank.—There is a space of not less than 150 feet below the road and reservoir bund. The bund of the new tank is farther from the road than the channel so that there has been no interference with any course through which water may be discharged from the bye-wash. The crossing is evidently by the channel crossing the fresh water channel, and this has not been interfered with.

2. **B**—The site is for the most part wet land and for which no compensation is allowed in the estimate.—Compensation for land taken up for the reserve tank *is* provided in the estimate—*vide* Sanitary Engineer's estimate, page 12, dated 27th July 1896. Again look at paragraph 8 of report, dated 27th July 1896, where *an increased* allotment for land is referred to.

3. **C**—Whether it is intended to make the bund of earth dug close by.—In paragraph 19 of the Sanitary Engineer's letter No. 1538, dated 27th July 1893, embodied in G.O., Mis. No. 159 M., dated 14th February 1894, he says "The tank is proposed to be formed of simple banks without pitching, the slopes are $2\frac{1}{2}$ to 1 both inside and out with a puddle wall in the centre. The soil is very sandy and there is no economy to be obtained by making the banks with steeper slopes as sand hills and other excavations in the bed of the tank give the quantity of earth sufficient to make the banks of the section proposed. The banks will be *turfed* and the top of the tank will be 4 feet above the maximum water level of the tank.

The data for the rate of Rs. 6-8-0 per 1,000 cubic feet are—

	RS.	A.	P.
One thousand cubic feet earthwork	2	12	0
One hundred and eighty yards lead at As. 6 for 20 yards	3	6	0
Two yards lift at As. 3	0	6	0
Total ..	6	8	0

4. **D**—Perhaps he (Sanitary Engineer) has had excavations made and found a clay bed at that level.—In estimating the area of the proposed tank, the Sanitary Engineer in his report, dated 27th July 1896, says: "*Evaporation has not been allowed for, as scheme is for* 34,000 *people whereas there are only* 25,000 *to be provided for* at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable."

5. There is no evidence of any clay bed below the sandy soil, and it would be inexpedient to arrange for tank taking into account a high evaporation and leakage for 34,000 when only 25,000 will use water at first and will probably not use even 10 gallons, and when it may be the case that by the time 34,000 people have to be provided for, the Korampallam tank may be filled to its proper level. The area of the tank altered is based on only a level of 16·00 and not 19·40 which is the proper full tank level.

6. **E**—Why not have 15″ or 18″ cement or glazed earthenware pipe which could be laid in a very short time and would be stronger than, and as water-tight as, the culvert while costing very much less.—Mr. Hughes suggests a 15″ or 18″ pipe. A 12″ pipe or less might be similarly suggested, but what is required is a 21″ pipe or else the full quantity of water for 34,000 people will not be obtainable. And this is a portion of the work which must be made full size at once. But even if an 18″ pipe was allowable, the cost would be more than what is proposed—*vide* the following:—

The cost of 21″ masonry culvert for a length of 22,100 feet as estimated is Rs. 44,472 or, say, Rs. 2 a foot.

The cost per foot of cement and stoneware pipes is as below:—

	RS.	A.	P.
21″ cement pipes (laid)	3	0	0
21″ stoneware pipes, Burn & Co.'s at Calcutta (exclusive of conveying charges and laying)	4	0	0
18″ stoneware pipes, Burn & Co.'s (delivery at Calcutta exclusive of conveying charges and laying)	2	8	0
18″ Doulton's stoneware pipes (delivered at Bombay)	3	8	0
15″ do. do.	2	8	0

7. The above rates clearly show that cement or stoneware pipes cannot be substituted for a masonry conduit, so that even if the fall were increased and much expenditure incurred in excavation and extra cost for filter, for service reservoir, for engine and for pumping and pipes so small as 15″ used, there would be no economy but the reverse.

8. Bricks quite good enough for the conduit are obtainable 10 miles from Korampallam. The culvert would be built in lengths, the channel being replaced by iron pipes during the building of the lower portion so that the building might occupy any length of time and the supply still go on.

Demi-official from H. A. Sim, Esq., I.C.S., Private Secretary to His Excellency the Governor, to the Secretary to Government, Local and Municipal Department, dated 2nd March 1897, No. 39.

With reference to the enclosed, which please return, I shall be glad if you will send up the papers regarding the Tuticorin water-supply scheme for His Excellency's information.

Enclosures.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Private Secretary to His Excellency the Governor, dated 16th February 1897, No. 97.

I beg to submit a copy of my motion and the resolution of the Municipal Council, dated 12th instant, and request you will be so good as to let me know whether His Excellency will be pleased to grant an interview to the members of the deputation.

2. The members intend starting to Madras as early as possible before the end of this month.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Municipal Councillors, Tuticorin.

It is now so many years since a water-supply scheme to our town has been proposed, discussed, and submitted and over and over we represented to the Government the miseries and hardships of the people especially in times of droughts which are so frequent but up to date nothing definite has been done.

2. There has been some consolation to us when we heard from Government a few months ago that the Sanitary Engineer has been asked to prepare estimates to a less expensive water scheme on gravitation principle. There it lies and God knows when it is going to come.

3. It is a wonder that epidemics of most serious nature did not break out in this town; because, exclusive of the impurity of the water which the people have to drink, in times of water-supply failures, even the water we get from Korampallam tank by open channel is impure and subject to various pollutions. It will be unsafe no doubt to expect such special protections of Providence any more, unless the scheme is taken up at once. I am afraid most serious consequences are in store for this unfortunate town. Many towns which are very much less in importance receive the attention of Government, and water schemes are sanctioned and carried out without delay; whereas this town which is only next in importance of trade to the metropolis is ignored altogether. I am sure His Excellency the Governor will be only pleased to sanction the water scheme if he is only properly informed of the sufferings and miseries of the people for want of water-supply.

4. I therefore beg to propose that three members of the Council be selected and requested to wait on a deputation on His Excellency the Governor and lay before him the real state of affairs in this town for want of a water scheme.

Extract from the Proceedings of the Municipal Council, Tuticorin, dated 12th February 1897.

* * * * *

Read motion from the Chairman regarding water-supply scheme to this town.

Resolution No. 7.—Resolved that Captain Baker, the Chairman, and Rev. Mr. Gnanakan be requested to wait on His Excellency the Governor on deputation regarding the water scheme.

* * * * *

Herewith the file about Tuticorin.

G. S. Forbes.

To the Private Secretary.

Seen and returned with thanks.

A. E. H[avelock]—6-3-97.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated 10th March 1897, No. 46.

I return the Tuticorin water-supply papers. Jones has been to see me and I understand him to agree that the storage reservoir should have its bed puddled 1½ feet deep. With regard to the distance between the reservoir and the road, the men, who is carrying out the work, can see that enough space is left. I think there should be 300 feet.

2. It seems that it is considered inadvisable to lower the bed of the filter beds. It is not for me to say. Assuming them 7·40 I suppose a conduit 1¾ feet diameter is required. This is for Campbell to decide. All I am concerned about is that the reservoir and conduit or at least the latter should be built soon. I am afraid anybody who expects the Public Works Department to build the conduit in one dry season will be disappointed.

To the Local and Municipal Department.

Local and Municipal Department.

As the adoption of any particular scheme must depend largely on the amount of contribution or aid, Government can afford to give to the Municipality, this file must, until the financial position is clearer, lie over.

G. S. Forbes—28-5-97.

Yes, he should.
A. E. H[avelock]—25-5-98.

I don't think the draft is enough. The Sanitary Engineer should be asked what he has been doing since the issue of G.O., No. 1571 M., dated 16th September 1896.

H. W. B[liss]—20-5-98.

I concur.

2. The Tuticorin water-supply is, as far as my information guides me, the most pressing and important of those before us. In the linked file, the Tuticorin water-supply scheme and all others are ordered to lie over until our financial position is clearer. Our revenue is coming in well. Perhaps Sir H. Bliss would consider whether a further step towards getting this Tuticorin scheme set on foot might now be taken.

A. E. H[avelock]—20-5-98.

Circulated to the Honourable Member again.

H. Tremenheere—21-5-98.

I am afraid there is very little chance at present of our having funds to forward any water and drainage schemes other than those entered in the budget (Tirupati, Rs. 77,400, Vizagapatam, Rs. 20,500 and Cocanada, Rs. 52,100). It is true that our revenue is coming in well, but (1) if we get an extra and unanticipated 20 lakhs this year, we could not use it, for we are limited as to expenditure to the provision made on the expenditure side of the budget, and (2) the first charge on any increase of revenue we may get will be provision for restoring our balance to the stipulated minimum of 20 lakhs. As the budget for 1898-99 stands, we shall close the year with a balance of 6·08 only. We have therefore a sum of Rs. 13·92 to make good from our annual surpluses of revenue over expenditure before we shall be restored to a state of solvency.

2. Another reason why we cannot at present help forward Municipal water and drainage schemes is that no allotment has been made us at present wherefrom we can grant loans to Municipalities. The Municipal Councils will therefore have to raise money in the open market, instead of borrowing from Government at 4 or 4¼ per cent. with the bank rate at 12 per cent., it is unnecessary to labour the point that they cannot hope to raise loans in the open market on any terms which they can afford.

3 Our position will not improbably be raised during the year by the fact that we shall not need to spend on famine relief the whole sum of Rs. 8·50 which has been provided. But on the other hand, we only provided half a lakh, I think, for plague expenditure, which won't be anything like enough. We shall probably spend 2 or 2½ lakhs on plague preventive measures, even if plague does not actually break out: if it does, no one can say how much, perhaps 10 to 15 lakhs. Moreover, if we have any savings out of the budget provision for famine, they are already appropriated to the scheme for the better payment of the taluk establishments, if sanctioned by the Secretary of State, as I have little doubt they will be.

·50 under 24. Medical—Provincial.

C. M. Schmidt.

Also additional Munsif's Courts.

C.M.S.

4. I have written the above partly from memory and partly from reference to the original (preliminary) issue* of the civil estimates, so the Financial Department had better see before this goes to His Excellency and correct any errors I may have made.

* Dated 14th January 1898.

H. W. B[liss]—21-5-98.

To the Financial Department with reference to the Honourable Member's note.

H. Tremenheere—23-5-98.

Financial Department.

Honourable Member's figures have been corrected with reference to the figures in the Financial statement.

C. M. Schmidt—23-5-98.

A. T. A[rundel]—23-5-98.

I accept, with regret, the draft Government Order. But, I should be glad if this matter be brought to notice after the lapse of four months, when perhaps our financial position may have become more assured.

A. E. H[avelock]—25-5-98.

* *To the Local and Municipal Department.*

Local and Municipal Department.

Issue the draft.

G. S. Forbes—6-6-98.

[G.O., No. 1031 M., dated 8th June 1898.]

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd } 1898. *Enclosures*

Regd. } *Spare copies*

G.O., No. 1031 M., 8th June 1898.

Tuticorin water-supply scheme.

Stating, with remarks, that Government can do nothing with regard to the — until its financial position is clearer and requesting the Sanitary Engineer to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

No. 1031 M., 8TH JUNE 1898.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers :—

I

Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

Read—the following papers :—

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. JONES, Esq., MEM INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. HUGHES, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
No.—1412.

I have the honour to acknowledge and thank you for your No. 505 T.N of 4th May 1896.

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

Letter—from J. A. JONES, Esq., MEM., INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 19th June 1896.
No.—1913.

I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
No.—801-T. W.

With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

Year.	July.	August.	September.	October.	November.	December.
1886	12·94	12·71	15·54	15·42	15·35	14·67
1887	..	..	..	15·43	14·97	16·38
1888	13·23	11·83	..	15·95	16·00	16·86
1889	12·50	12·62	15·06	16·78	16·20	14·96
1890	..	..	..	14·65	14·30	16·83
1891	13·98	12·93	12·10	15·56	17·25	18·34
1892	12·30	..	..	..	..	..
1893	12·72	..	..	14·50	16·50	18·00
1894	..	..	..	11·55	14·85	14·30
1895	12·14	..	..	16·49	17·79	18·29

Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained :—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1895.
B	Pumping scheme for 10 gallons per head with 4[months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones' calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,370	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	
F	Municipal Chairman's scheme ..	Not known.	Not known.	
G	District Board Engineer's scheme ..			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows :—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

(True Extract).

R. Parsons,
Secretary.

To the Secretary to Government, Local and Municipa Department, with papers.

II

Letter—from G. Zellweger, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.
Dated—the 10th May 1898.
No.—227.

I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

4. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town, and would point out in conclusion that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
(through the Collector of Tinnevelly).
,, Sanitary Board.
,, ,, Engineer.

LOCAL AND MUNICIPAL DEPARTMENT.

NOTES CONNECTED WITH G.O., No. 1031 M., DATED 8TH JUNE 1898.

[SUBJECT.—*Tuticorin water-supply scheme.*]

From the Sanitary Board, dated 21st November 1896, No. 263-S.

The history of the schemes for the water-supply of Tuticorin originally proposed by the Sanitary Engineer, is given in the note for orders stitched with G.O., No. 75 M., dated 16th January 1896. In that order the pumping scheme approved by the Sanitary Board was declared to be impracticable on financial grounds and the Board was requested to consider the two gravitation schemes estimated to cost Rs. 1,00,000 and Rs. 1,61,850 respectively, proposed by the Chairman of the Municipal Council and the Local Fund Engineer. On this, however, the Sanitary Board in its resolution No. 538, dated 24th February 1896, came to the conclusion that it was impossible to arrange for a satisfactory supply of water to Tuticorin without pumping and recommended that the original pumping scheme of the Sanitary Engineer might be revised by reducing the supply per head from 15 to 10 gallons. This recommendation of the Sanitary Board was approved by Government and in their order No. 435 M., dated 16th March 1896, the Sanitary Engineer was requested to submit revised estimates. The Municipal Council in its resolution thereon expressed the opinion that even on sanitary grounds 10 gallons per head would be quite insufficient and that fully 15 gallons would be required for each person in the town and as it still thought that pumping might with advantage be dispensed with, the Government were requested to reconsider their decision in the matter. But this letter was recorded in G.O., No. 1277 M, dated 31st July 1896, pending receipt of the revised estimate called for from the Sanitary Engineer.

2. With reference however to the Government Order of March 1896 quoted above, the Sanitary Engineer in the first instance submitted for the approval of the Sanitary Board, two schemes, one for Rs. 2,73,140 retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply and the other for Rs. 3,30,000 providing in addition to the modifications of the original scheme referred to above for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended, and

(2) chambers for Gill's arrangements for filters.

The Sanitary Board, however, considered these two schemes as impracticable for financial reasons and asked the Sanitary Engineer to state if a cheaper scheme could not be devised. On this, the Sanitary Engineer proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoirs. As this amount was also considered by the Board to be large, the Sanitary Engineer submitted a gravitation scheme, which though more expensive in the first instance than the pumping scheme costing Rs. 2,68,334, involved a cheaper annual cost. In this scheme the service reservoir, the filters, the pumping house and engines are all omitted.

3. The following statement given by the Sanitary Board shows the cost and working charges of the several schemes above referred to :—

Items.	Scheme.	Capital cost.	Annual working charges.	Remarks.
		RS.	RS.	
A.	Pumping scheme for 15 gallons per head with four months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office-note No. 2070-S., dated 18th November 1895.
B.	Pumping scheme for 10 gallons per head with four months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in statement are based on Jones' calculations in the case of schemes D and E.
C.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank.	3,30,000	18,310	
D.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	*Note.*—The capital cost in each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896 referred to by Mr. Jones in his comparative statement.
E.	Gravitation scheme for 10 gallons per head with nine months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	....
F.	Municipal Chairman's scheme	1,00,000	Not known.	....
G.	District Board Engineer's	1,61,850	Do.	....

4. After a careful consideration of all the schemes the Sanitary Board agrees with the Sanitary Engineer in recommending scheme D, if Government considers scheme C too expensive.

5. If scheme D, being the cheaper of the two schemes approved by the Sanitary Board, is undertaken and if the Government makes a grant to the Council of half the cost as already promised and lends the balance at $4\frac{1}{4}$ per cent. interest, the amount required to liquidate the loan in 30 years would be Rs. 7,996, which together with the working charges of Rs. 14,970 represents an annual expenditure of Rs. 22,966. This would however be reduced by Rs. 596, if a sum of Rs. 10,000 out of the current balance reserved for the water-supply scheme is deducted from the loan now required.

6. In the existing state of affairs this sum is beyond the means of the Municipality; but if the proposal to raise the rates of the taxes on houses and lands and the water-tax from $7\frac{1}{2}$ to $8\frac{1}{2}$ and 4 to 8 per cent. respectively is passed into law and if the tax on arts is extended to all the classes of the schedule, then the additional income which may be expected would be—

	RS.
Water-tax	15,799
House and land tax	4,443
Arts tax	585
Total ..	20,827

Thus the total amount available from all the sources will be Rs. 20,827 or Rs. 1,543 less than the amount required by the Municipal Council. Leaving altogether out of account the annual income expected from the South Indian Railway Company, the above deficit can easily be met by thoroughly revising the taxes on buildings and lands—*vide* the notes stitched with G.O., No. 180 M., dated 6th February 1895.

7. In these circumstances it is submitted that the Sanitary Board's recommendation to undertake scheme D may be approved.

V. RAGHAVA CHARLU—16-1-97.

Scheme C should, if possible, be approved. I have always been of opinion that Tuticorin is very much under-assessed all round: but I do not believe we shall have the assessment properly imposed unless (as I suggested when I was Collector of Tinnevelly) a special officer is deputed to do the work.

2. Would it not also be reasonable to ask Port funds to make a contribution?

G. S. FORBES—18-1-97.

I don't find any report of the Sanitary Engineer's forwarding scheme E and explaining the estimated cost of maintenance, under that scheme, of Rs. 11,100. I should like further information, for I don't understand why that scheme should be so summarily rejected. Nor, I may say, do I comprehend the intrinsic superiority of a pumping to a gravitation scheme, which seems to be assumed as a fact.

2. Why have schemes F and G not been examined?

3. Please send up some sort of plans by means of which I may be able to understand the various schemes.

4. Also please state whether, in view of the fact that, as I understand, the Korampallam tank has just breached, it is worth while to go on with any of these schemes. My impression is that the Korampallam tank or the channel supplying it breaches every two or three years. If so, why shouldn't Mr. Jones' proposed nine months' supply tank breach also and all the proposed expenditure be wasted? Mr. Hughes probably knows more about all these matters than any one else. Please consult him personally and let me know what he thinks.

5. It is all very well to say that the assessments at Tuticorin might be brought to a much higher standard if a special officer were put on. I daresay they might be. But it would not, I think, be safe to sanction a scheme for the supply of Tuticorin on the chance.

H. W. B[LISS]—19-1-97.

Draft demi-official to Mr. Hughes.

G. S. FORBES.

Please see draft demi-official put up.

V. RAGHAVA CHARLU—22-1-97.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated the 25th February 1897.

I received the plans of the Tuticorin water-supply scheme two days ago, but have not been able to examine them until to-day. I do not wish to offer any opinion on the proposed distribution works and confine my remarks to the works which concern me as an Irrigation officer, viz., the reserve tank and conduit.

2. At first Government charged for all the water issued from Korampallam tank but afterwards, for reasons into which I need not enter, it was conceded that only the water reaching the service reservoir should be charged for. I cannot say whether water is now paid for on measurement or otherwise. The quantity issued from the tank is about six times what reaches the town, and irrigation under the tank is carried on with much difficulty and greatly restricted owing to the large supply drawn off for Tuticorin and the system of giving the town the preference as long as the supply lasts. In this way I think Government loses Rs. 2,000 to Rs. 3,000 per annum. The construction of a water-tight conduit should have been insisted on long ago. The proposal now is to make a reserve tank, to be filled from the Korampallam tank and keep the water for use when the Korampallam supply gives out. The reserve tank is undoubtedly required if the town is to be supplied throughout the year and I have already expressed my opinion that it should be made large enough to contain nine months' supply. It will not however be filled every year but receive partial fillings during freshes and be filled at some time each year to the highest level reached in the Korampallam tank. Regarding the site of the reservoir I A notice that it does not appear to have been taken into account that there is a bye-wash near the left flank of the Korampallam tank which is intended to

Demi-official from H. A. Sim, Esq., I.C.S., Private Secretary to His Excellency the Governor, to the Secretary to Government, Local and Municipal Department, dated 2nd March 1897, No. 39.

With reference to the enclosed, which please return, I shall be glad if you will send up the papers regarding the Tuticorin water-supply scheme for His Excellency's information.

Enclosures.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Private Secretary to His Excellency the Governor, dated 16th February 1897, No. 97.

I beg to submit a copy of my motion and the resolution of the Municipal Council, dated 12th instant, and request you will be so good as to let me know whether His Excellency will be pleased to grant an interview to the members of the deputation.

2. The members intend starting to Madras as early as possible before the end of this month.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Municipal Councillors, Tuticorin.

It is now so many years since a water-supply scheme to our town has been proposed, discussed, and submitted and over and over we represented to the Government the miseries and hardships of the people especially in times of droughts which are so frequent but up to date nothing definite has been done.

2. There has been some consolation to us when we heard from Government a few months ago that the Sanitary Engineer has been asked to prepare estimates to a less expensive water scheme on gravitation principle. There it lies and God knows when it is going to come.

3. It is a wonder that epidemics of most serious nature did not break out in this town; because, exclusive of the impurity of the water which the people have to drink, in times of water-supply failures, even the water we get from Korampallam tank by open channel is impure and subject to various pollutions. It will be unsafe no doubt to expect such special protections of Providence any more, unless the scheme is taken up at once. I am afraid most serious consequences are in store for this unfortunate town. Many towns which are very much less in importance receive the attention of Government, and water schemes are sanctioned and carried out without delay; whereas this town which is only next in importance of trade to the metropolis is ignored altogether. I am sure His Excellency the Governor will be only pleased to sanction the water scheme if he is only properly informed of the sufferings and miseries of the people for want of water-supply.

4. I therefore beg to propose that three members of the Council be selected and requested to wait on a deputation on His Excellency the Governor and lay before him the real state of affairs in this town for want of a water scheme.

Extract from the Proceedings of the Municipal Council, Tuticorin, dated 12th February 1897.

* * * * *

Read motion from the Chairman regarding water-supply scheme to this town.

Resolution No. 7.—Resolved that Captain Baker, the Chairman, and Rev. Mr. Gnanakan be requested to wait on His Excellency the Governor on deputation regarding the water scheme.

* * * * *

Herewith the file about Tuticorin.

G. S. Forbes.

To the Private Secretary.

Seen and returned with thanks.

A. E. H[avelock]—6-3-97.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated 10th March 1897, No. 46.

I return the Tuticorin water-supply papers. Jones has been to see me and I understand him to agree that the storage reservoir should have its bed puddled $1\frac{1}{2}$ feet deep. With regard to the distance between the reservoir and the road, the men who is carrying out the work, can see that enough space is left. I think there should be 300 feet.

2. It seems that it is considered inadvisable to lower the bed of the filter beds. It is not for me to say. Assuming them 7·40 I suppose a conduit $1\frac{3}{4}$ feet diameter is required. This is for Campbell to decide. All I am concerned about is that the reservoir and conduit or at least the latter should be built soon. I am afraid anybody who expects the Public Works Department to build the conduit in one dry season will be disappointed.

To the Local and Municipal Department.

Local and Municipal Department.

As the adoption of any particular scheme must depend largely on the amount of contribution or aid, Government can afford to give to the Municipality, this file must, until the financial position is clearer, lie over.

G. S. Forbes—28-5-97.

Yes, he should.
A. E. H[avelock]—25-5-98.

I don't think the draft is enough. The Sanitary Engineer should be asked what he has been doing since the issue of G.O., No. 1571 M., dated 16th September 1896.

H. W. B[liss]—20-5-98.

I concur.

2. The Tuticorin water-supply is, as far as my information guides me, the most pressing and important of those before us. In the linked file, the Tuticorin water-supply scheme and all others are ordered to lie over until our financial position is clearer. Our revenue is coming in well. Perhaps Sir H. Bliss would consider whether a further step towards getting this Tuticorin scheme set on foot might now be taken.

A. E. H[avelock]—20-5-98.

Circulated to the Honourable Member again.

H. Tremenheere—21-5-98.

I am afraid there is very little chance at present of our having funds to forward any water and drainage schemes other than those entered in the budget (Tirupati, Rs. 77,400, Vizagapatam, Rs. 20,500 and Cocanada, Rs. 52,100). It is true that our revenue is coming in well, but (1) if we get an extra and unanticipated 20 lakhs this year, we could not use it, for we are limited as to expenditure to the provision made on the expenditure side of the budget, and (2) the first charge on any increase of revenue we may get will be provision for restoring our balance to the stipulated minimum of 20 lakhs. As the budget for 1898-99 stands, we shall close the year with a balance of 6·08 only. We have therefore a sum of Rs. 13·92 to make good from our annual surpluses of revenue over expenditure before we shall be restored to a state of solvency.

2. Another reason why we cannot at present help forward Municipal water and drainage schemes is that no allotment has been made us at present wherefrom we can grant loans to Municipalities. The Municipal Councils will therefore have to raise money in the open market, instead of borrowing from Government at 4 or $4\frac{1}{4}$ per cent. with the bank rate at 12 per cent., it is unnecessary to labour the point that they cannot hope to raise loans in the open market on any terms which they can afford.

3 Our position will not improbably be raised during the year by the fact that we shall not need to spend on famine relief the whole sum of Rs. 8·50 which has been provided. But on the other hand, we only provided half a lakh, I think, for plague expenditure, which won't be anything like enough. We shall probably spend 2 or 2½ lakhs on plague preventive measures, even if plague does not actually break out: if it does, no one can say how much, perhaps 10 to 15 lakhs. Moreover, if we have any savings out of the budget provision for famine, they are already appropriated to the scheme for the better payment of the taluk establishments, if sanctioned by the Secretary of State, as I have little doubt they will be.

·50 under 24. Medical—Provincial.
C. M. SCHMIDT.

Also additional Munsif's Courts.
C.M.S.

4. I have written the above partly from memory and partly from reference to the original (preliminary) issue* of the civil estimates, so the Financial Department had better see before this goes to His Excellency and correct any errors I may have made.

* Dated 14th January 1898.

H. W. B[LISS]—21-5-98.

To the Financial Department with reference to the Honourable Member's note.

H. TREMENHEERE—23-5-98.

FINANCIAL DEPARTMENT.

Honourable Member's figures have been corrected with reference to the figures in the Financial statement.

C. M. SCHMIDT—23-5-98.

A. T. A[RUNDEL]—23-5-98.

I accept, with regret, the draft Government Order. But, I should be glad if this matter be brought to notice after the lapse of four months, when perhaps our financial position may have become more assured.

A. E. H[AVELOCK]—25-5-98.

To the Local and Municipal Department.

LOCAL AND MUNICIPAL DEPARTMENT.

Issue the draft.

G. S. FORBES—6-6-98.

[G.O., No. 1031 M., dated 8th June 1898.]

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd } 1898. *Enclosures*
Regd. } *Spare copies*

G.O., No. 1031 M., 8th June 1898.

Tuticorin water-supply scheme.

Stating, with remarks, that Government can do nothing with regard to the — until its financial position is clearer and requesting the Sanitary Engineer to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers :—

I

Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

Read—the following papers :—

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. JONES, Esq., MEM INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. HUGHES, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level. I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
No.—1412.

I have the honour to acknowledge and thank you for your No. 505 T.N of 4th May 1896.

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

Letter—from J. A. JONES, Esq., MEM., INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 19th June 1896.
No.—1913.

I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer, to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
No.—801-T. W.

With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

Year.	July.	August.	September.	October.	November.	December.
1886	12·94	12·71	15·54	15·42	15·35	14·67
1887	..	..	..	15·43	14·97	16·38
1888	13·23	11·83	..	15·95	16·00	16·86
1889	12·50	12·62	15·06	16·78	16·20	14·96
1890	..	..	..	14·65	14·30	16·83
1891	13·98	12·93	12·10	15·56	17·25	18·34
1892	12·30	..	..	..	..	..
1893	12·72	..	..	14·50	16·50	18·00
1894	..	..	..	11·55	14·85	14·30
1895	12·14	..	..	16·49	17·79	18·29

Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained :—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1895.
B	Pumping scheme for 10 gallons per head with 4 months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones, calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	
F	Municipal Chairman's scheme ..	Not known.	Not known.	
G	District Board Engineer's scheme ..			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows :—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

(True Extract).

R. PARSONS,
Secretary.

To the Secretary to Government, Local and Municipa Department, with papers.

II

Letter—from G. ZELLWEGER, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.
Dated—the 10th May 1898.
No.—227.

I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

4. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town, and would point out in conclusion that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
(through the Collector of Tinnevelly).
,, Sanitary Board.
,, ,, Engineer.

LOCAL AND MUNICIPAL DEPARTMENT.

NOTES CONNECTED WITH G.O., No. 1031 M., DATED 8TH JUNE 1898.

[SUBJECT.—*Tuticorin water-supply scheme.*]

From the Sanitary Board, dated 21st November 1896, No. 263-S.

The history of the schemes for the water-supply of Tuticorin originally proposed by the Sanitary Engineer, is given in the note for orders stitched with G.O., No. 75 M., dated 16th January 1896. In that order the pumping scheme approved by the Sanitary Board was declared to be impracticable on financial grounds and the Board was requested to consider the two gravitation schemes estimated to cost Rs. 1,00,000 and Rs. 1,61,850 respectively, proposed by the Chairman of the Municipal Council and the Local Fund Engineer. On this, however, the Sanitary Board in its resolution No. 538, dated 24th February 1896, came to the conclusion that it was impossible to arrange for a satisfactory supply of water to Tuticorin without pumping and recommended that the original pumping scheme of the Sanitary Engineer might be revised by reducing the supply per head from 15 to 10 gallons. This recommendation of the Sanitary Board was approved by Government and in their order No. 435 M., dated 16th March 1896, the Sanitary Engineer was requested to submit revised estimates. The Municipal Council in its resolution thereon expressed the opinion that even on sanitary grounds 10 gallons per head would be quite insufficient and that fully 15 gallons would be required for each person in the town and as it still thought that pumping might with advantage be dispensed with, the Government were requested to reconsider their decision in the matter. But this letter was recorded in G.O., No. 1277 M, dated 31st July 1896, pending receipt of the revised estimate called for from the Sanitary Engineer.

2. With reference however to the Government Order of March 1896 quoted above, the Sanitary Engineer in the first instance submitted for the approval of the Sanitary Board, two schemes, one for Rs. 2,73,140 retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply and the other for Rs. 3,30,000 providing in addition to the modifications of the original scheme referred to above for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended, and

(2) chambers for Gill's arrangements for filters.

The Sanitary Board, however, considered these two schemes as impracticable for financial reasons and asked the Sanitary Engineer to state if a cheaper scheme could not be devised. On this, the Sanitary Engineer proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoirs. As this amount was also considered by the Board to be large, the Sanitary Engineer submitted a gravitation scheme, which though more expensive in the first instance than the pumping scheme costing Rs. 2,68,334, involved a cheaper annual cost. In this scheme the service reservoir, the filters, the pumping house and engines are all omitted.

discharge when there is a higher flood than the Oopar oday dam can dispose of or when there is danger to the bund. The water from this goes past Korampallam village and crosses the fresh water channel in the low ground not very far from the sluice. There should be a space of a few hundred feet left between the road and the reservoir bank. The next point is that the site is for the most part wet land for which no compensation is provided in the estimate. I do not know whether it is intended to make the bund of earth dug close by. The rate apparently provides for bringing earth from a good distance. In my letter of 4th May, which is in the file, I gave reasons for thinking that the waste by leakage and evaporation from the Korampallam tank is probably $1\frac{1}{2}$ feet a month. Mr. Jones has taken no notice of this but apparently adheres to his estimate of 5 inches a month loss from the new tank, evidently expecting to stop all leakage by the puddle wall extending to 4 feet below the tank bed. Perhaps he has had excavations made and found a clay bed at that level. If he has not done so, I think a thorough examination of the place should be made, or a leaky tank would be useless, and if the matter cannot be placed beyond doubt in any other way a small tank might be made as an experiment and filled by baling from the fresh water channel.

B

C

There is notoriously great leakage.
G. S. FORBES.

D

3. Regarding the conduit which it is proposed to build in the bed of the fresh water channel, I think it might be found impossible to build the whole four miles in one season while the Korampallam tank is dry and in time to allow it to set before the supply begins. It will take 2,500 tons of bricks which have to be carted about 20 miles or railed 30 and carted 3, but of course they could be prepared in advance. Why not have 15″ or 18″ cement or glazed earthenware pipe which could be laid in a very short time and would be stronger than and as water-tight as the culvert, while costing very much less.

E

I return the papers and plans.

Demi-official from G. S. Forbes, Esq., I.C.S., Secretary to Government, Local and Municipal Department, to the Sanitary Engineer to Government, dated the 26th February 1897, No. 22.

Please see Hughes' letter.

2. The Honourable Member asked me to consult him. Can you throw light on his difficulties—see specially points marked **A, B, C, D, E.**

Demi-official from J. A. Jones, Esq., Sanitary Engineer to Government, to the Secretary to Government, Local and Municipal Department, dated 1st March 1897, No. 406.

Herewith notes on Mr. Hughes' remarks as to Tuticorin water-supply scheme, which I think fully reply to his criticisms.

Tuticorin Water-supply.

1. **A**—Bye-wash near the left flank of the Korampallam tank.—There is a space of not less than 150 feet below the road and reservoir bund. The bund of the new tank is farther from the road than the channel so that there has been no interference with any course through which water may be discharged from the bye-wash. The crossing is evidently by the channel crossing the fresh water channel, and this has not been interfered with.

2. **B**—The site is for the most part wet land and for which no compensation is allowed in the estimate.—Compensation for land taken up for the reserve tank *is* provided in the estimate—*vide* Sanitary Engineer's estimate, page 12, dated 27th July 1896. Again look at paragraph 8 of report, dated 27th July 1896, where *an increased* allotment for land is referred to.

3. **C**—Whether it is intended to make the bund of earth dug close by.—In paragraph 19 of the Sanitary Engineer's letter No. 1538, dated 27th July 1893, embodied in G.O., Mis. No. 159 M., dated 14th February 1894, he says "The tank is proposed to be formed of simple banks without pitching, the slopes are $2\frac{1}{2}$ to 1 both inside and out with a puddle wall in the centre. The soil is very sandy and there is no economy to be obtained by making the banks with steeper slopes as sand hills and other excavations in the bed of the tank give the quantity of earth sufficient to make the banks of the section proposed. The banks will be *turfed* and the top of the tank will be 4 feet above the maximum water level of the tank.

The data for the rate of Rs. 6-8-0 per 1,000 cubic feet are—

	RS.	A.	P.
One thousand cubic feet earthwork	2	12	0
One hundred and eighty yards lead at As. 6 for 20 yards	3	6	0
Two yards lift at As. 3	0	6	0
Total ..	6	8	0

4. **D**—Perhaps he (Sanitary Engineer) has had excavations made and found a clay bed at that level.—In estimating the area of the proposed tank, the Sanitary Engineer in his report, dated 27th July 1896, says: "*Evaporation has not been allowed for, as scheme is for* 34,000 *people whereas there are only* 25,000 *to be provided for* at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable."

5. There is no evidence of any clay bed below the sandy soil, and it would be inexpedient to arrange for tank taking into account a high evaporation and leakage for 34,000 when only 25,000 will use water at first and will probably not use even 10 gallons, and when it may be the case that by the time 34,000 people have to be provided for, the Korampallam tank may be filled to its proper level. The area of the tank altered is based on only a level of 16·00 and not 19·40 which is the proper full tank level.

6. **E**—Why not have 15″ or 18″ cement or glazed earthenware pipe which could be laid in a very short time and would be stronger than, and as water-tight as, the culvert while costing very much less.—Mr. Hughes suggests a 15″ or 18″ pipe. A 12″ pipe or less might be similarly suggested, but what is required is a 21″ pipe or else the full quantity of water for 34,000 people will not be obtainable. And this is a portion of the work which must be made full size at once. But even if an 18″ pipe was allowable, the cost would be more than what is proposed—*vide* the following:—

The cost of 21″ masonry culvert for a length of 22,100 feet as estimated is Rs. 44,472 or, say, Rs. 2 a foot.

The cost per foot of cement and stoneware pipes is as below:—

	RS.	A.	P.
21″ cement pipes (laid)	3	0	0
21″ stoneware pipes, Burn & Co.'s at Calcutta (exclusive of conveying charges and laying)	4	0	0
18″ stoneware pipes, Burn & Co.'s (delivery at Calcutta exclusive of conveying charges and laying)	2	8	0
18″ Doulton's stoneware pipes (delivered at Bombay)	3	8	0
15″ do. do.	2	8	0

7. The above rates clearly show that cement or stoneware pipes cannot be substituted for a masonry conduit, so that even if the fall were increased and much expenditure incurred in excavation and extra cost for filter, for service reservoir, for engine and for pumping and pipes so small as 15″ used, there would be no economy but the reverse.

8. Bricks quite good enough for the conduit are obtainable 10 miles from Korampallam. The culvert would be built in lengths, the channel being replaced by iron pipes during the building of the lower portion so that the building might occupy any length of time and the supply still go on.

Demi-official from H. A. Sim, Esq., I.C.S., Private Secretary to His Excellency the Governor, to the Secretary to Government, Local and Municipal Department, dated 2nd March 1897, No. 39.

With reference to the enclosed, which please return, I shall be glad if you will send up the papers regarding the Tuticorin water-supply scheme for His Excellency's information.

Enclosures.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Private Secretary to His Excellency the Governor, dated 16th February 1897, No. 97.

I beg to submit a copy of my motion and the resolution of the Municipal Council, dated 12th instant, and request you will be so good as to let me know whether His Excellency will be pleased to grant an interview to the members of the deputation.

2. The members intend starting to Madras as early as possible before the end of this month.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Municipal Councillors, Tuticorin.

It is now so many years since a water-supply scheme to our town has been proposed, discussed, and submitted and over and over we represented to the Government the miseries and hardships of the people especially in times of droughts which are so frequent but up to date nothing definite has been done.

2. There has been some consolation to us when we heard from Government a few months ago that the Sanitary Engineer has been asked to prepare estimates to a less expensive water scheme on gravitation principle. There it lies and God knows when it is going to come.

3. It is a wonder that epidemics of most serious nature did not break out in this town; because, exclusive of the impurity of the water which the people have to drink, in times of water-supply failures, even the water we get from Korampallam tank by open channel is impure and subject to various pollutions. It will be unsafe no doubt to expect such special protections of Providence any more, unless the scheme is taken up at once. I am afraid most serious consequences are in store for this unfortunate town. Many towns which are very much less in importance receive the attention of Government, and water schemes are sanctioned and carried out without delay; whereas this town which is only next in importance of trade to the metropolis is ignored altogether. I am sure His Excellency the Governor will be only pleased to sanction the water scheme if he is only properly informed of the sufferings and miseries of the people for want of water-supply.

4. I therefore beg to propose that three members of the Council be selected and requested to wait on a deputation on His Excellency the Governor and lay before him the real state of affairs in this town for want of a water scheme.

Extract from the Proceedings of the Municipal Council, Tuticorin, dated 12th February 1897.

* * * * *

Read motion from the Chairman regarding water-supply scheme to this town.

Resolution No. 7.—Resolved that Captain Baker, the Chairman, and Rev. Mr. Gnanakan be requested to wait on His Excellency the Governor on deputation regarding the water scheme.

* * * * *

Herewith the file about Tuticorin.

G. S. Forbes.

To the Private Secretary.

Seen and returned with thanks.

A. E. H[avelock]—6-3-97.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated 10th March 1897, No. 46.

I return the Tuticorin water-supply papers. Jones has been to see me and I understand him to agree that the storage reservoir should have its bed puddled $1\frac{1}{2}$ feet deep. With regard to the distance between the reservoir and the road, the men who is carrying out the work, can see that enough space is left. I think there should be 300 feet.

2. It seems that it is considered inadvisable to lower the bed of the filter beds. It is not for me to say. Assuming them 7·40 I suppose a conduit $1\frac{3}{4}$ feet diameter is required. This is for Campbell to decide. All I am concerned about is that the reservoir and conduit or at least the latter should be built soon. I am afraid anybody who expects the Public Works Department to build the conduit in one dry season will be disappointed.

To the Local and Municipal Department.

Local and Municipal Department.

As the adoption of any particular scheme must depend largely on the amount of contribution or aid, Government can afford to give to the Municipality, this file must, until the financial position is clearer, lie over.

G. S. Forbes—28-5-97.

Yes, he should.
A. E. H[avelock]—25-5-98.

I don't think the draft is enough. The Sanitary Engineer should be asked what he has been doing since the issue of G.O., No. 1571 M., dated 16th September 1896.

H. W. B[liss]—20-5-98.

I concur.

2. The Tuticorin water-supply is, as far as my information guides me, the most pressing and important of those before us. In the linked file, the Tuticorin water-supply scheme and all others are ordered to lie over until our financial position is clearer. Our revenue is coming in well. Perhaps Sir H. Bliss would consider whether a further step towards getting this Tuticorin scheme set on foot might now be taken.

A. E. H[avelock]—20-5-98.

Circulated to the Honourable Member again.

H. Tremenheere—21-5-98.

I am afraid there is very little chance at present of our having funds to forward any water and drainage schemes other than those entered in the budget (Tirupati, Rs. 77,400, Vizagapatam, Rs. 20,500 and Cocanada, Rs. 52,100). It is true that our revenue is coming in well, but (1) if we get an extra and unanticipated 20 lakhs this year, we could not use it, for we are limited as to expenditure to the provision made on the expenditure side of the budget, and (2) the first charge on any increase of revenue we may get will be provision for restoring our balance to the stipulated minimum of 20 lakhs. As the budget for 1898-99 stands, we shall close the year with a balance of 6·08 only. We have therefore a sum of Rs. 13·92 to make good from our annual surpluses of revenue over expenditure before we shall be restored to a state of solvency.

2. Another reason why we cannot at present help forward Municipal water and drainage schemes is that no allotment has been made us at present wherefrom we can grant loans to Municipalities. The Municipal Councils will therefore have to raise money in the open market, instead of borrowing from Government at 4 or $4\frac{1}{4}$ per cent. with the bank rate at 12 per cent., it is unnecessary to labour the point that they cannot hope to raise loans in the open market on any terms which they can afford.

3 Our position will not improbably be raised during the year by the fact that we shall not need to spend on famine relief the whole sum of Rs. 8·50 which has been provided. But on the other hand, we only provided half a lakh, I think, for plague expenditure, which won't be anything like enough. We shall probably spend 2 or 2½ lakhs on plague preventive measures, even if plague does not actually break out: if it does, no one can say how much, perhaps 10 to 15 lakhs. Moreover, if we have any savings out of the budget provision for famine, they are already appropriated to the scheme for the better payment of the taluk establishments, if sanctioned by the Secretary of State, as I have little doubt they will be.

·50 under 24. Medical—Provincial.
C. M. SCHMIDT.

Also additional Munsif's Courts.
C.M.S.

4. I have written the above partly from memory and partly from reference to the original (preliminary) issue* of the civil estimates, so the Financial Department had better see before this goes to His Excellency and correct any errors I may have made.

* Dated 14th January 1898.

H. W. B[LISS]—21-5-98.

To the Financial Department with reference to the Honourable Member's note.

H. TREMENHEERE—23-5-98.

FINANCIAL DEPARTMENT.

Honourable Member's figures have been corrected with reference to the figures in the Financial statement.

C. M. SCHMIDT—23-5-98.

A. T. A[RUNDEL]—23-5-98.

I accept, with regret, the draft Government Order. But, I should be glad if this matter be brought to notice after the lapse of four months, when perhaps our financial position may have become more assured.

A. E. H[AVELOCK]—25-5-98.

To the Local and Municipal Department.

LOCAL AND MUNICIPAL DEPARTMENT.

Issue the draft.

G. S. FORBES—6-6-98.

[G.O., No. 1031 M., dated 8th June 1898.]

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd } 1898. *Enclosures*
Regd. } *Spare copies*

G.O., No. 1031 M., 8th June 1898.

Tuticorin water-supply scheme.

Stating, with remarks, that Government can do nothing with regard to the — until its financial position is clearer and requesting the Sanitary Engineer to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers :—

I

Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

Read—the following papers :—

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. JONES, Esq., MEM INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. HUGHES, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
No.—1412.

I have the honour to acknowledge and thank you for your No. 505 T.N of 4th May 1896.

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

Letter—from J. A. JONES, Esq., MEM., INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 19th June 1896.
No.—1913.

I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
No.—801-T. W.

With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

Year.	July.	August.	September.	October.	November.	December.
1886	..	..	..	..	..	..
1887	12·94	12·71	15·54	15·42	15·35	14·67
1888	..	..	..	15·43	14·97	16·38
1889	13·23	11·83	..	15·95	16·00	16·86
1890	12·50	12·62	15·06	16·78	16·20	14·96
1891	..	..	..	14·65	14·30	16·83
1892	13·98	12·93	12·10	15·56	17·25	18·34
1893	12·80	..	..	..	..	..
1894	12·72	..	..	14·50	16·50	18·00
1895	..	..	..	11·55	14·85	14·30
	12·14	..	..	16·49	17·79	18·29

Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained :—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1895.
B	Pumping scheme for 10 gallons per head with 4 months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones' calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	
F	Municipal Chairman's scheme ..	Not known.	Not known.	
G	District Board Engineer's scheme ..			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1898, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows :—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

(True Extract).

R. PARSONS,
Secretary.

To the Secretary to Government, Local and Municipa Department, with papers.

II

Letter—from G. ZELLWEGER, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.
Dated—the 10th May 1898.
No.—227.

I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

4. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town, and would point out in conclusion that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
(through the Collector of Tinnevelly).
,, Sanitary Board.
,, ,, Engineer.

LOCAL AND MUNICIPAL DEPARTMENT.

NOTES CONNECTED WITH G.O., No. 1031 M., DATED 8TH JUNE 1898.

[SUBJECT.—*Tuticorin water-supply scheme.*]

From the Sanitary Board, dated 21st November 1896, No. 263-S.

The history of the schemes for the water-supply of Tuticorin originally proposed by the Sanitary Engineer, is given in the note for orders stitched with G.O., No. 75 M., dated 16th January 1896. In that order the pumping scheme approved by the Sanitary Board was declared to be impracticable on financial grounds and the Board was requested to consider the two gravitation schemes estimated to cost Rs. 1,00,000 and Rs. 1,61,850 respectively, proposed by the Chairman of the Municipal Council and the Local Fund Engineer. On this, however, the Sanitary Board in its resolution No. 538, dated 24th February 1896, came to the conclusion that it was impossible to arrange for a satisfactory supply of water to Tuticorin without pumping and recommended that the original pumping scheme of the Sanitary Engineer might be revised by reducing the supply per head from 15 to 10 gallons. This recommendation of the Sanitary Board was approved by Government and in their order No. 435 M., dated 16th March 1896, the Sanitary Engineer was requested to submit revised estimates. The Municipal Council in its resolution thereon expressed the opinion that even on sanitary grounds 10 gallons per head would be quite insufficient and that fully 15 gallons would be required for each person in the town and as it still thought that pumping might with advantage be dispensed with, the Government were requested to reconsider their decision in the matter. But this letter was recorded in G.O., No. 1277 M, dated 31st July 1896, pending receipt of the revised estimate called for from the Sanitary Engineer.

2. With reference however to the Government Order of March 1896 quoted above, the Sanitary Engineer in the first instance submitted for the approval of the Sanitary Board, two schemes, one for Rs. 2,73,140 retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply and the other for Rs. 3,30,000 providing in addition to the modifications of the original scheme referred to above for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended, and

(2) chambers for Gill's arrangements for filters.

The Sanitary Board, however, considered these two schemes as impracticable for financial reasons and asked the Sanitary Engineer to state if a cheaper scheme could not be devised. On this, the Sanitary Engineer proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoirs. As this amount was also considered by the Board to be large, the Sanitary Engineer submitted a gravitation scheme, which though more expensive in the first instance than the pumping scheme costing Rs. 2,68,334, involved a cheaper annual cost. In this scheme the service reservoir, the filters, the pumping house and engines are all omitted.

3. The following statement given by the Sanitary Board shows the cost and working charges of the several schemes above referred to:—

Items.	Scheme.	Capital cost.	Annual working charges.	Remarks.
		RS.	RS.	
A.	Pumping scheme for 15 gallons per head with four months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office-note No. 2070-S., dated 18th November 1895.
B.	Pumping scheme for 10 gallons per head with four months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in statement are based on Jones' calculations in the case of schemes D and E.
C.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank.	3,30,000	18,310	
D.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	*Note.*—The capital cost in each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896 referred to by Mr. Jones in his comparative statement.
E.	Gravitation scheme for 10 gallons per head with nine months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	....
F.	Municipal Chairman's scheme	1,00,000	Not known.	....
G.	District Board Engineer's	1,61,850	Do.	....

4. After a careful consideration of all the schemes the Sanitary Board agrees with the Sanitary Engineer in recommending scheme D, if Government considers scheme C too expensive.

5. If scheme D, being the cheaper of the two schemes approved by the Sanitary Board, is undertaken and if the Government makes a grant to the Council of half the cost as already promised and lends the balance at $4\frac{1}{4}$ per cent. interest, the amount required to liquidate the loan in 30 years would be Rs. 7,996, which together with the working charges of Rs. 14,970 represents an annual expenditure of Rs. 22,966. This would however be reduced by Rs. 596, if a sum of Rs. 10,000 out of the current balance reserved for the water-supply scheme is deducted from the loan now required.

6. In the existing state of affairs this sum is beyond the means of the Municipality; but if the proposal to raise the rates of the taxes on houses and lands and the water-tax from $7\frac{1}{2}$ to $8\frac{1}{2}$ and 4 to 8 per cent. respectively is passed into law and if the tax on arts is extended to all the classes of the schedule, then the additional income which may be expected would be—

	RS.
Water-tax	15,799
House and land tax	4,443
Arts tax	585
Total ..	20,827

Thus the total amount available from all the sources will be Rs. 20,827 or Rs. 1,543 less than the amount required by the Municipal Council. Leaving altogether out of account the annual income expected from the South Indian Railway Company, the above deficit can easily be met by thoroughly revising the taxes on buildings and lands—*vide* the notes stitched with G.O., No. 180 M., dated 6th February 1895.

7. In these circumstances it is submitted that the Sanitary Board's recommendation to undertake scheme D may be approved.

V. RAGHAVA CHARLU—16-1-97.

Scheme C should, if possible, be approved. I have always been of opinion that Tuticorin is very much under-assessed all round: but I do not believe we shall have the assessment properly imposed unless (as I suggested when I was Collector of Tinnevelly) a special officer is deputed to do the work.

2. Would it not also be reasonable to ask Port funds to make a contribution?

G. S. FORBES—18-1-97.

I don't find any report of the Sanitary Engineer's forwarding scheme E and explaining the estimated cost of maintenance, under that scheme, of Rs. 11,100. I should like further information, for I don't understand why that scheme should be so summarily rejected. Nor, I may say, do I comprehend the intrinsic superiority of a pumping to a gravitation scheme, which seems to be assumed as a fact.

2. Why have schemes F and G not been examined?

3. Please send up some sort of plans by means of which I may be able to understand the various schemes.

4. Also please state whether, in view of the fact that, as I understand, the Korampallam tank has just breached, it is worth while to go on with any of these schemes. My impression is that the Korampallam tank or the channel supplying it breaches every two or three years. If so, why shouldn't Mr. Jones' proposed nine months' supply tank breach also and all the proposed expenditure be wasted? Mr. Hughes probably knows more about all these matters than any one else. Please consult him personally and let me know what he thinks.

5. It is all very well to say that the assessments at Tuticorin might be brought to a much higher standard if a special officer were put on. I daresay they might be. But it would not, I think, be safe to sanction a scheme for the supply of Tuticorin on the chance.

H. W. B[LISS]—19-1-97.

Draft demi-official to Mr. Hughes.

G. S. FORBES.

Please see draft demi-official put up.

V. RAGHAVA CHARLU—22-1-97.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated the 25th February 1897.

I received the plans of the Tuticorin water-supply scheme two days ago, but have not been able to examine them until to-day. I do not wish to offer any opinion on the proposed distribution works and confine my remarks to the works which concern me as an Irrigation officer, viz., the reserve tank and conduit.

2. At first Government charged for all the water issued from Korampallam tank but afterwards, for reasons into which I need not enter, it was conceded that only the water reaching the service reservoir should be charged for. I cannot say whether water is now paid for on measurement or otherwise. The quantity issued from the tank is about six times what reaches the town, and irrigation under the tank is carried on with much difficulty and greatly restricted owing to the large supply drawn off for Tuticorin and the system of giving the town the preference as long as the supply lasts. In this way I think Government loses Rs. 2,000 to Rs. 3,000 per annum. The construction of a water-tight conduit should have been insisted on long ago. The proposal now is to make a reserve tank, to be filled from the Korampallam tank and keep the water for use when the Korampallam supply gives out. The reserve tank is undoubtedly required if the town is to be supplied throughout the year and I have already expressed my opinion that it should be made large enough to contain nine months' supply. It will not however be filled every year but receive partial fillings during freshes and be filled at some time each year to the highest level reached in the Korampallam tank. Regarding the site of the reservoir I notice that it does not appear to have been taken into account that there is a bye-wash near the left flank of the Korampallam tank which is intended to

A

discharge when there is a higher flood than the Oopar oday dam can dispose of or when there is danger to the bund. The water from this goes past Korampallam village and crosses the fresh water channel in the low ground not very far from the sluice. There should be a space of a few hundred feet left between the road and the reservoir bank. The next point is that the site is for the most part wet land for which no compensation is provided in the estimate. I do not know whether it is intended to make the bund of earth dug close by. The rate apparently provides for bringing earth from a good distance. In my letter of 4th May, which is in the file, I gave reasons for thinking that the waste by leakage and evaporation from the Korampallam tank is probably $1\frac{1}{2}$ feet a month. Mr. Jones has taken no notice of this but apparently adheres to his estimate of 5 inches a month loss from the new tank, evidently expecting to stop all leakage by the puddle wall extending to 4 feet below the tank bed. Perhaps he has had excavations made and found a clay bed at that level. If he has not done so, I think a thorough examination of the place should be made, or a leaky tank would be useless, and if the matter cannot be placed beyond doubt in any other way a small tank might be made as an experiment and filled by baling from the fresh water channel.

B | **C** | **D**

There is notoriously great leakage.
G. S. FORBES.

3. Regarding the conduit which it is proposed to build in the bed of the fresh water channel, I think it might be found impossible to build the whole four miles in one season while the Korampallam tank is dry and in time to allow it to set before the supply begins. It will take 2,500 tons of bricks which have to be carted about 20 miles or railed 30 and carted 3, but of course they could be prepared in advance.

E | Why not have 15″ or 18″ cement or glazed earthenware pipe which could be laid in a very short time and would be stronger than and as water-tight as the culvert, while costing very much less.

I return the papers and plans.

Demi-official from G. S. Forbes, Esq., I.C.S., Secretary to Government, Local and Municipal Department, to the Sanitary Engineer to Government, dated the 26th February 1897, No. 22.

Please see Hughes' letter.

2. The Honourable Member asked me to consult him. Can you throw light on his difficulties—see specially points marked **A, B, C, D, E.**

Demi-official from J. A. Jones, Esq., Sanitary Engineer to Government, to the Secretary to Government, Local and Municipal Department, dated 1st March 1897, No. 406.

Herewith notes on Mr. Hughes' remarks as to Tuticorin water-supply scheme, which I think fully reply to his criticisms.

Tuticorin Water-supply.

1. **A**—Bye-wash near the left flank of the Korampallam tank.—There is a space of not less than 150 feet below the road and reservoir bund. The bund of the new tank is farther from the road than the channel so that there has been no interference with any course through which water may be discharged from the bye-wash. The crossing is evidently by the channel crossing the fresh water channel, and this has not been interfered with.

2. **B**—The site is for the most part wet land and for which no compensation is allowed in the estimate.—Compensation for land taken up for the reserve tank *is* provided in the estimate—*vide* Sanitary Engineer's estimate, page 12, dated 27th July 1896. Again look at paragraph 8 of report, dated 27th July 1896, where *an increased* allotment for land is referred to.

3. **C**—Whether it is intended to make the bund of earth dug close by.—In paragraph 19 of the Sanitary Engineer's letter No. 1538, dated 27th July 1893, embodied in G.O., Mis. No. 159 M., dated 14th February 1894, he says "The tank is proposed to be formed of simple banks without pitching, the slopes are $2\frac{1}{2}$ to 1 both inside and out with a puddle wall in the centre. The soil is very sandy and there is no economy to be obtained by making the banks with steeper slopes as sand hills and other excavations in the bed of the tank give the quantity of earth sufficient to make the banks of the section proposed. The banks will be *turfed* and the top of the tank will be 4 feet above the maximum water level of the tank.

The data for the rate of Rs. 6-8-0 per 1,000 cubic feet are—

	RS.	A.	P.
One thousand cubic feet earthwork	2	12	0
One hundred and eighty yards lead at As. 6 for 20 yards	3	6	0
Two yards lift at As. 3	0	6	0
Total ..	6	8	0

4. **D**—Perhaps he (Sanitary Engineer) has had excavations made and found a clay bed at that level.—In estimating the area of the proposed tank, the Sanitary Engineer in his report, dated 27th July 1896, says: "*Evaporation has not been allowed for, as scheme is for* 34,000 *people whereas there are only* 25,000 *to be provided for* at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable."

5. There is no evidence of any clay bed below the sandy soil, and it would be inexpedient to arrange for tank taking into account a high evaporation and leakage for 34,000 when only 25,000 will use water at first and will probably not use even 10 gallons, and when it may be the case that by the time 34,000 people have to be provided for, the Korampallam tank may be filled to its proper level. The area of the tank altered is based on only a level of 16·00 and not 19·40 which is the proper full tank level.

6. **E**—Why not have 15″ or 18″ cement or glazed earthenware pipe which could be laid in a very short time and would be stronger than, and as water-tight as, the culvert while costing very much less.—Mr. Hughes suggests a 15″ or 18″ pipe. A 12″ pipe or less might be similarly suggested, but what is required is a 21″ pipe or else the full quantity of water for 34,000 people will not be obtainable. And this is a portion of the work which must be made full size at once. But even if an 18″ pipe was allowable, the cost would be more than what is proposed—*vide* the following:—

The cost of 21″ masonry culvert for a length of 22,100 feet as estimated is Rs. 44,472 or, say, Rs. 2 a foot.

The cost per foot of cement and stoneware pipes is as below:—

	RS.	A.	P.
21″ cement pipes (laid)	3	0	0
21″ stoneware pipes, Burn & Co.'s at Calcutta (exclusive of conveying charges and laying)	4	0	0
18″ stoneware pipes, Burn & Co.'s (delivery at Calcutta exclusive of conveying charges and laying)	2	8	0
18″ Doulton's stoneware pipes (delivered at Bombay)	3	8	0
15″ do. do.	2	8	0

7. The above rates clearly show that cement or stoneware pipes cannot be substituted for a masonry conduit, so that even if the fall were increased and much expenditure incurred in excavation and extra cost for filter, for service reservoir, for engine and for pumping and pipes so small as 15″ used, there would be no economy but the reverse.

8. Bricks quite good enough for the conduit are obtainable 10 miles from Korampallam. The culvert would be built in lengths, the channel being replaced by iron pipes during the building of the lower portion so that the building might occupy any length of time and the supply still go on.

Demi-official from H. A. Sim, Esq., I.C.S., Private Secretary to His Excellency the Governor, to the Secretary to Government, Local and Municipal Department, dated 2nd March 1897, No. 39.

With reference to the enclosed, which please return, I shall be glad if you will send up the papers regarding the Tuticorin water-supply scheme for His Excellency's information.

Enclosures.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Private Secretary to His Excellency the Governor, dated 16th February 1897, No. 97.

I beg to submit a copy of my motion and the resolution of the Municipal Council, dated 12th instant, and request you will be so good as to let me know whether His Excellency will be pleased to grant an interview to the members of the deputation.

2. The members intend starting to Madras as early as possible before the end of this month.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Municipal Councillors, Tuticorin.

It is now so many years since a water-supply scheme to our town has been proposed, discussed, and submitted and over and over we represented to the Government the miseries and hardships of the people especially in times of droughts which are so frequent but up to date nothing definite has been done.

2. There has been some consolation to us when we heard from Government a few months ago that the Sanitary Engineer has been asked to prepare estimates to a less expensive water scheme on gravitation principle. There it lies and God knows when it is going to come.

3. It is a wonder that epidemics of most serious nature did not break out in this town; because, exclusive of the impurity of the water which the people have to drink, in times of water-supply failures, even the water we get from Korampallam tank by open channel is impure and subject to various pollutions. It will be unsafe no doubt to expect such special protections of Providence any more, unless the scheme is taken up at once. I am afraid most serious consequences are in store for this unfortunate town. Many towns which are very much less in importance receive the attention of Government, and water schemes are sanctioned and carried out without delay; whereas this town which is only next in importance of trade to the metropolis is ignored altogether. I am sure His Excellency the Governor will be only pleased to sanction the water scheme if he is only properly informed of the sufferings and miseries of the people for want of water-supply.

4. I therefore beg to propose that three members of the Council be selected and requested to wait on a deputation on His Excellency the Governor and lay before him the real state of affairs in this town for want of a water scheme.

Extract from the Proceedings of the Municipal Council, Tuticorin, dated 12th February 1897.

* * * * *

Read motion from the Chairman regarding water-supply scheme to this town.

Resolution No. 7.—Resolved that Captain Baker, the Chairman, and Rev. Mr. Gnanakan be requested to wait on His Excellency the Governor on deputation regarding the water scheme.

* * * * *

Herewith the file about Tuticorin.

G. S. Forbes.

To the Private Secretary.

Seen and returned with thanks.

A. E. H[avelock]—6-3-97.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated 10th March 1897, No. 46.

I return the Tuticorin water-supply papers. Jones has been to see me and I understand him to agree that the storage reservoir should have its bed puddled $1\frac{1}{2}$ feet deep. With regard to the distance between the reservoir and the road, the men, who is carrying out the work, can see that enough space is left. I think there should be 300 feet.

2. It seems that it is considered inadvisable to lower the bed of the filter beds. It is not for me to say. Assuming them 7·40 I suppose a conduit $1\frac{3}{4}$ feet diameter is required. This is for Campbell to decide. All I am concerned about is that the reservoir and conduit or at least the latter should be built soon. I am afraid anybody who expects the Public Works Department to build the conduit in one dry season will be disappointed.

To the Local and Municipal Department.

Local and Municipal Department.

As the adoption of any particular scheme must depend largely on the amount of contribution or aid, Government can afford to give to the Municipality, this file must, until the financial position is clearer, lie over.

G. S. Forbes—28-5-97.

Yes, he should.
A. E. H[avelock]—25-5-98.

I don't think the draft is enough. The Sanitary Engineer should be asked what he has been doing since the issue of G.O., No. 1571 M., dated 16th September 1896.

H. W. B[liss]—20-5-98.

I concur.

2. The Tuticorin water-supply is, as far as my information guides me, the most pressing and important of those before us. In the linked file, the Tuticorin water-supply scheme and all others are ordered to lie over until our financial position is clearer. Our revenue is coming in well. Perhaps Sir H. Bliss would consider whether a further step towards getting this Tuticorin scheme set on foot might now be taken.

A. E. H[avelock]—20-5-98.

Circulated to the Honourable Member again.

H. Tremenheere—21-5-98.

I am afraid there is very little chance at present of our having funds to forward any water and drainage schemes other than those entered in the budget (Tirupati, Rs. 77,400, Vizagapatam, Rs. 20,500 and Cocanada, Rs. 52,100). It is true that our revenue is coming in well, but (1) if we get an extra and unanticipated 20 lakhs this year, we could not use it, for we are limited as to expenditure to the provision made on the expenditure side of the budget, and (2) the first charge on any increase of revenue we may get will be provision for restoring our balance to the stipulated minimum of 20 lakhs. As the budget for 1898-99 stands, we shall close the year with a balance of 6·08 only. We have therefore a sum of Rs. 13·92 to make good from our annual surpluses of revenue over expenditure before we shall be restored to a state of solvency.

2. Another reason why we cannot at present help forward Municipal water and drainage schemes is that no allotment has been made us at present wherefrom we can grant loans to Municipalities. The Municipal Councils will therefore have to raise money in the open market, instead of borrowing from Government at 4 or $4\frac{1}{4}$ per cent. with the bank rate at 12 per cent., it is unnecessary to labour the point that they cannot hope to raise loans in the open market on any terms which they can afford.

3 Our position will not improbably be raised during the year by the fact that we shall not need to spend on famine relief the whole sum of Rs. 8·50 which has been provided. But on the other hand, we only provided half a lakh, I think, for plague expenditure, which won't be anything like enough. We shall probably spend 2 or 2½ lakhs on plague preventive measures, even if plague does not actually break out: if it does, no one can say how much, perhaps 10 to 15 lakhs. Moreover, if we have any savings out of the budget provision for famine, they are already appropriated to the scheme for the better payment of the taluk establishments, if sanctioned by the Secretary of State, as I have little doubt they will be.

·50 under 24. Medical—Provincial.
C. M. SCHMIDT.

Also additional Munsif's Courts.
C.M.S.

4. I have written the above partly from memory and partly from reference to the original (preliminary) issue* of the civil estimates, so the Financial Department had better see before this goes to His Excellency and correct any errors I may have made.

* Dated 14th January 1898.

H. W. B[LISS]—21-5-98.

To the Financial Department with reference to the Honourable Member's note.

H. TREMENHEERE—23-5-98.

FINANCIAL DEPARTMENT.

Honourable Member's figures have been corrected with reference to the figures in the Financial statement.

C. M. SCHMIDT—23-5-98.

A. T. A[RUNDEL]—23-5-98.

I accept, with regret, the draft Government Order. But, I should be glad if this matter be brought to notice after the lapse of four months, when perhaps our financial position may have become more assured.

A. E. H[AVELOCK]—25-5-98.

To the Local and Municipal Department.

LOCAL AND MUNICIPAL DEPARTMENT.

Issue the draft.

G. S. FORBES—6-6-98.

[G.O., No. 1031 M., dated 8th June 1898.]

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd } 1898. *Enclosures*
Regd. } *Spare copies*

G.O., No. 1031 M., 8th June 1898.

Tuticorin water-supply scheme.

Stating, with remarks, that Government can do nothing with regard to the — until its financial position is clearer and requesting the Sanitary Engineer to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

Read—the following papers :—

I

Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

Read—the following papers :—

Letter—from J. A. Jones, Esq., mem. inst. c.e., f.r.s.e., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. Jones, Esq., mem inst. c.e., f.r.s.e., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. Hughes, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. Jones, Esq., mem. inst. c.e., f.r.s.e., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
No.—1412.

I have the honour to acknowledge and thank you for your No. 505 T.N of 4th May 1896.

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

Letter—from J. A. Jones, Esq., mem., inst. c.e., f.r.s.e., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 19th June 1896.
No.—1913.

I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
No.—801-T. W.

With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

Year.	July.	August.	September.	October.	November.	December.
1886	12·94	12·71	15·54	15·42	15·35	14·67
1887	..	..	..	15·43	14·97	16·38
1888	13·23	11·83	..	15·95	16·00	16·86
1889	12·50	12·62	15·06	16·78	16·20	14·96
1890	..	..	..	14·65	14·30	16·83
1891	13·98	12·93	12·10	15·56	17·25	18·34
1892	12·30	..	..	..	..	..
1893	12·72	..	..	14·50	16·50	18·00
1894	..	..	..	11·55	14·85	14·30
1895	12·14	..	..	16·49	17·79	18·29

Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained :—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1895.
B	Pumping scheme for 10 gallons per head with 4 months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones' calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	
F	Municipal Chairman's scheme ..	Not known.	Not known.	
G	District Board Engineer's scheme ..			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows :—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

(True Extract).

R. PARSONS,
Secretary.

To the Secretary to Government, Local and Municipa Department,
with papers.

II

Letter—from G. ZELLWEGER, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.
Dated—the 10th May 1898.
No.—227.

I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

4. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town, and would point out in conclusion that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. Forbes,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
(through the Collector of Tinnevelly).
,, Sanitary Board.
,, ,, Engineer.

NOTES CONNECTED WITH G.O., No. 1031 M., DATED 8th JUNE 1898.

[Subject.—*Tuticorin water-supply scheme.*]

From the Sanitary Board, dated 21st November 1896, *No.* 263-*S.*

The history of the schemes for the water-supply of Tuticorin originally proposed by the Sanitary Engineer, is given in the note for orders stitched with G.O., No. 75 M., dated 16th January 1896. In that order the pumping scheme approved by the Sanitary Board was declared to be impracticable on financial grounds and the Board was requested to consider the two gravitation schemes estimated to cost Rs. 1,00,000 and Rs. 1,61,850 respectively, proposed by the Chairman of the Municipal Council and the Local Fund Engineer. On this, however, the Sanitary Board in its resolution No. 538, dated 24th February 1896, came to the conclusion that it was impossible to arrange for a satisfactory supply of water to Tuticorin without pumping and recommended that the original pumping scheme of the Sanitary Engineer might be revised by reducing the supply per head from 15 to 10 gallons. This recommendation of the Sanitary Board was approved by Government and in their order No. 435 M., dated 16th March 1896, the Sanitary Engineer was requested to submit revised estimates. The Municipal Council in its resolution thereon expressed the opinion that even on sanitary grounds 10 gallons per head would be quite insufficient and that fully 15 gallons would be required for each person in the town and as it still thought that pumping might with advantage be dispensed with, the Government were requested to reconsider their decision in the matter. But this letter was recorded in G.O., No. 1277 M, dated 31st July 1896, pending receipt of the revised estimate called for from the Sanitary Engineer.

2. With reference however to the Government Order of March 1896 quoted above, the Sanitary Engineer in the first instance submitted for the approval of the Sanitary Board, two schemes, one for Rs. 2,73,140 retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply and the other for Rs. 3,30,000 providing in addition to the modifications of the originai scheme referred to above for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended, and

(2) chambers for Gill's arrangements for filters.

The Sanitary Board, however, considered these two schemes as impracticable for financial reasons and asked the Sanitary Engineer to state if a cheaper scheme could not be devised. On this, the Sanitary Engineer proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoirs. As this amount was also considered by the Board to be large, the Sanitary Engineer submitted a gravitation scheme, which though more expensive in the first instance than the pumping scheme costing Rs. 2,68,334, involved a cheaper annual cost. In this scheme the service reservoir, the filters, the pumping house and engines are all omitted.

3. The following statement given by the Sanitary Board shows the cost and working charges of the several schemes above referred to:—

Items.	Scheme.	Capital cost.	Annual working charges.	Remarks.
		Rs.	Rs.	
A.	Pumping scheme for 15 gallons per head with four months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office-note No. 2070-S., dated 18th November 1895.
B.	Pumping scheme for 10 gallons per head with four months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in statement are based on Jones' calculations in the case of schemes D and E.
C.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank.	3,30,000	18,310	
D.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	*Note.*—The capital cost in each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896 referred to by Mr. Jones in his comparative statement.
E.	Gravitation scheme for 10 gallons per head with nine months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	....
F.	Municipal Chairman's scheme	1,00,000	Not known.	....
G.	District Board Engineer's	1,61,850	Do.	....

4. After a careful consideration of all the schemes the Sanitary Board agrees with the Sanitary Engineer in recommending scheme D, if Government considers scheme C too expensive.

5. If scheme D, being the cheaper of the two schemes approved by the Sanitary Board, is undertaken and if the Government makes a grant to the Council of half the cost as already promised and lends the balance at $4\frac{1}{4}$ per cent. interest, the amount required to liquidate the loan in 30 years would be Rs. 7,996, which together with the working charges of Rs. 14,970 represents an annual expenditure of Rs. 22,966. This would however be reduced by Rs. 596, if a sum of Rs. 10,000 out of the current balance reserved for the water-supply scheme is deducted from the loan now required.

6. In the existing state of affairs this sum is beyond the means of the Municipality; but if the proposal to raise the rates of the taxes on houses and lands and the water-tax from $7\frac{1}{2}$ to $8\frac{1}{2}$ and 4 to 8 per cent. respectively is passed into law and if the tax on arts is extended to all the classes of the schedule, then the additional income which may be expected would be—

	Rs.
Water-tax	15,799
House and land tax	4,443
Arts tax	585
Total ..	20,827

Thus the total amount available from all the sources will be Rs. 20,827 or Rs. 1,543 less than the amount required by the Municipal Council. Leaving altogether out of account the annual income expected from the South Indian Railway Company, the above deficit can easily be met by thoroughly revising the taxes on buildings and lands—*vide* the notes stitched with G.O., No. 180 M., dated 6th February 1895.

7. In these circumstances it is submitted that the Sanitary Board's recommendation to undertake scheme D may be approved.

V. RAGHAVA CHARLU—16-1-97.

Scheme C should, if possible, be approved. I have always been of opinion that Tuticorin is very much under-assessed all round: but I do not believe we shall have the assessment properly imposed unless (as I suggested when I was Collector of Tinnevelly) a special officer is deputed to do the work.

2. Would it not also be reasonable to ask Port funds to make a contribution?

G. S. FORBES—18-1-97.

I don't find any report of the Sanitary Engineer's forwarding scheme E and explaining the estimated cost of maintenance, under that scheme, of Rs. 11,100. I should like further information, for I don't understand why that scheme should be so summarily rejected. Nor, I may say, do I comprehend the intrinsic superiority of a pumping to a gravitation scheme, which seems to be assumed as a fact.

2. Why have schemes F and G not been examined?

3. Please send up some sort of plans by means of which I may be able to understand the various schemes.

4. Also please state whether, in view of the fact that, as I understand, the Korampallam tank has just breached, it is worth while to go on with any of these schemes. My impression is that the Korampallam tank or the channel supplying it breaches every two or three years. If so, why shouldn't Mr. Jones' proposed nine months' supply tank breach also and all the proposed expenditure be wasted? Mr. Hughes probably knows more about all these matters than any one else. Please consult him personally and let me know what he thinks.

5. It is all very well to say that the assessments at Tuticorin might be brought to a much higher standard if a special officer were put on. I daresay they might be. But it would not, I think, be safe to sanction a scheme for the supply of Tuticorin on the chance.

H. W. B[LISS]—19-1-97.

Draft demi-official to Mr. Hughes.

G. S. FORBES.

Please see draft demi-official put up.

V. RAGHAVA CHARLU—22-1-97.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated the 25th February 1897.

I received the plans of the Tuticorin water-supply scheme two days ago, but have not been able to examine them until to-day. I do not wish to offer any opinion on the proposed distribution works and confine my remarks to the works which concern me as an Irrigation officer, viz., the reserve tank and conduit.

2. At first Government charged for all the water issued from Korampallam tank but afterwards, for reasons into which I need not enter, it was conceded that only the water reaching the service reservoir should be charged for. I cannot say whether water is now paid for on measurement or otherwise. The quantity issued from the tank is about six times what reaches the town, and irrigation under the tank is carried on with much difficulty and greatly restricted owing to the large supply drawn off for Tuticorin and the system of giving the town the preference as long as the supply lasts. In this way I think Government loses Rs. 2,000 to Rs. 3,000 per annum. The construction of a water-tight conduit should have been insisted on long ago. The proposal now is to make a reserve tank, to be filled from the Korampallam tank and keep the water for use when the Korampallam supply gives out. The reserve tank is undoubtedly required if the town is to be supplied throughout the year and I have already expressed my opinion that it should be made large enough to contain nine months' supply. It will not however be filled every year but receive partial fillings during freshes and be filled at some time each year to the highest level reached in the Korampallam tank. Regarding the site of the reservoir I notice that it does not appear to have been taken into account that there is a bye-wash near the left flank of the Korampallam tank which is intended to

A

discharge when there is a higher flood than the Oopar oday dam can dispose of or when there is danger to the bund. The water from this goes past Korampallam village and crosses the fresh water channel in the low ground not very far from the sluice. There should be a space of a few hundred feet left between the road and the reservoir bank. The next point is that the site is for the most part wet land for which no compensation is provided in the estimate. I do not know whether it is intended to make the bund of earth dug close by. The rate apparently provides for bringing earth from a good distance. In my letter of 4th May, which is in the file, I gave reasons for thinking that the waste by leakage and evaporation from the Korampallam tank is probably $1\frac{1}{2}$ feet a month. Mr. Jones has taken no notice of this but apparently adheres to his estimate of 5 inches a month loss from the new tank, evidently expecting to stop all leakage by the puddle wall extending to 4 feet below the tank bed. Perhaps he has had excavations made and found a clay bed at that level. If he has not done so, I think a thorough examination of the place should be made, or a leaky tank would be useless, and if the matter cannot be placed beyond doubt in any other way a small tank might be made as an experiment and filled by baling from the fresh water channel.

B **C** **D**

There is notoriously great leakage.
G. S. Forbes.

3. Regarding the conduit which it is proposed to build in the bed of the fresh water channel, I think it might be found impossible to build the whole four miles in one season while the Korampallam tank is dry and in time to allow it to set before the supply begins. It will take 2,500 tons of bricks which have to be carted about 20 miles or railed 30 and carted 3, but of course they could be prepared in advance.

E Why not have 15″ or 18″ cement or glazed earthenware pipe which could be laid in a very short time and would be stronger than and as water-tight as the culvert, while costing very much less.

I return the papers and plans.

Demi-official from G. S. Forbes, Esq., I.C.S., Secretary to Government, Local and Municipal Department, to the Sanitary Engineer to Government, dated the 26th February 1897, No. 22.

Please see Hughes' letter.

2. The Honourable Member asked me to consult him. Can you throw light on his difficulties—see specially points marked **A, B, C, D, E,**

Demi-official from J. A. Jones, Esq., Sanitary Engineer to Government, to the Secretary to Government, Local and Municipal Department, dated 1st March 1897, No. 406.

Herewith notes on Mr. Hughes' remarks as to Tuticorin water-supply scheme, which I think fully reply to his criticisms.

Tuticorin Water-supply.

1. **A**—Bye-wash near the left flank of the Korampallam tank.—There is a space of not less than 150 feet below the road and reservoir bund. The bund of the new tank is farther from the road than the channel so that there has been no interference with any course through which water may be discharged from the bye-wash. The crossing is evidently by the channel crossing the fresh water channel, and this has not been interfered with.

2. **B**—The site is for the most part wet land and for which no compensation is allowed in the estimate.—Compensation for land taken up for the reserve tank *is* provided in the estimate—*vide* Sanitary Engineer's estimate, page 12, dated 27th July 1896. Again look at paragraph 8 of report, dated 27th July 1896, where *an increased* allotment for land is referred to.

3. **C**—Whether it is intended to make the bund of earth dug close by.—In paragraph 19 of the Sanitary Engineer's letter No. 1538, dated 27th July 1893, embodied in G.O., Mis. No. 159 M., dated 14th February 1894, he says "The tank is proposed to be formed of simple banks without pitching, the slopes are $2\frac{1}{2}$ to 1 both inside and out with a puddle wall in the centre. The soil is very sandy and there is no economy to be obtained by making the banks with steeper slopes as sand hills and other excavations in the bed of the tank give the quantity of earth sufficient to make the banks of the section proposed. The banks will be *turfed* and the top of the tank will be 4 feet above the maximum water level of the tank.

The data for the rate of Rs. 6-8-0 per 1,000 cubic feet are—

	Rs.	A.	P.
One thousand cubic feet earthwork	2	12	0
One hundred and eighty yards lead at As. 6 for 20 yards	3	6	0
Two yards lift at As. 3	0	6	0
Total ..	6	8	0

4. **D**—Perhaps he (Sanitary Engineer) has had excavations made and found a clay bed at that level.—In estimating the area of the proposed tank, the Sanitary Engineer in his report, dated 27th July 1896, says: "*Evaporation has not been allowed for, as scheme is for* 34,000 *people whereas there are only* 25,000 *to be provided for* at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable."

5. There is no evidence of any clay bed below the sandy soil, and it would be inexpedient to arrange for tank taking into account a high evaporation and leakage for 34,000 when only 25,000 will use water at first and will probably not use even 10 gallons, and when it may be the case that by the time 34,000 people have to be provided for, the Korampallam tank may be filled to its proper level. The area of the tank altered is based on only a level of 16·00 and not 19·40 which is the proper full tank level.

6. **E**—Why not have 15″ or 18″ cement or glazed earthenware pipe which could be laid in a very short time and would be stronger than, and as water-tight as, the culvert while costing very much less.—Mr. Hughes suggests a 15″ or 18″ pipe. A 12″ pipe or less might be similarly suggested, but what is required is a 21″ pipe or else the full quantity of water for 34,000 people will not be obtainable. And this is a portion of the work which must be made full size at once. But even if an 18″ pipe was allowable, the cost would be more than what is proposed—*vide* the following:—

The cost of 21″ masonry culvert for a length of 22,100 feet as estimated is Rs. 44,472 or, say, Rs. 2 a foot.

The cost per foot of cement and stoneware pipes is as below:—

	Rs.	A.	P.
21″ cement pipes (laid)	3	0	0
21″ stoneware pipes, Burn & Co.'s at Calcutta (exclusive of conveying charges and laying)	4	0	0
18″ stoneware pipes, Burn & Co.'s (delivery at Calcutta exclusive of conveying charges and laying)	2	8	0
18″ Doulton's stoneware pipes (delivered at Bombay)	3	8	0
15″ do. do.	2	8	0

7. The above rates clearly show that cement or stoneware pipes cannot be substituted for a masonry conduit, so that even if the fall were increased and much expenditure incurred in excavation and extra cost for filter, for service reservoir, for engine and for pumping and pipes so small as 15″ used, there would be no economy but the reverse.

8. Bricks quite good enough for the conduit are obtainable 10 miles from Korampallam. The culvert would be built in lengths, the channel being replaced by iron pipes during the building of the lower portion so that the building might occupy any length of time and the supply still go on.

Demi-official from H. A. Sim, Esq., I.C.S., Private Secretary to His Excellency the Governor, to the Secretary to Government, Local and Municipal Department, dated 2nd March 1897, No. 39.

With reference to the enclosed, which please return, I shall be glad if you will send up the papers regarding the Tuticorin water-supply scheme for His Excellency's information.

Enclosures.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Private Secretary to His Excellency the Governor, dated 16th February 1897, No. 97.

I beg to submit a copy of my motion and the resolution of the Municipal Council, dated 12th instant, and request you will be so good as to let me know whether His Excellency will be pleased to grant an interview to the members of the deputation.

2. The members intend starting to Madras as early as possible before the end of this month.

Letter from M.R.Rx. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Municipal Councillors, Tuticorin.

It is now so many years since a water-supply scheme to our town has been proposed, discussed, and submitted and over and over we represented to the Government the miseries and hardships of the people especially in times of droughts which are so frequent but up to date nothing definite has been done.

2. There has been some consolation to us when we heard from Government a few months ago that the Sanitary Engineer has been asked to prepare estimates to a less expensive water scheme on gravitation principle. There it lies and God knows when it is going to come.

3. It is a wonder that epidemics of most serious nature did not break out in this town; because, exclusive of the impurity of the water which the people have to drink, in times of water-supply failures, even the water we get from Korampallam tank by open channel is impure and subject to various pollutions. It will be unsafe no doubt to expect such special protections of Providence any more, unless the scheme is taken up at once. I am afraid most serious consequences are in store for this unfortunate town. Many towns which are very much less in importance receive the attention of Government, and water schemes are sanctioned and carried out without delay; whereas this town which is only next in importance of trade to the metropolis is ignored altogether. I am sure His Excellency the Governor will be only pleased to sanction the water scheme if he is only properly informed of the sufferings and miseries of the people for want of water-supply.

4. I therefore beg to propose that three members of the Council be selected and requested to wait on a deputation on His Excellency the Governor and lay before him the real state of affairs in this town for want of a water scheme.

Extract from the Proceedings of the Municipal Council, Tuticorin, dated 12th February 1897.

* * * * *

Read motion from the Chairman regarding water-supply scheme to this town.

Resolution No. 7.—Resolved that Captain Baker, the Chairman, and Rev. Mr. Gnanakan be requested to wait on His Excellency the Governor on deputation regarding the water scheme.

* * * * *

Herewith the file about Tuticorin.

G. S. Forbes.

To the Private Secretary.

Seen and returned with thanks.

A. E. H[avelock]—6-3-97.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated 10th March 1897, No. 46.

I return the Tuticorin water-supply papers. Jones has been to see me and I understand him to agree that the storage reservoir should have its bed puddled $1\frac{1}{2}$ feet deep. With regard to the distance between the reservoir and the road, the men, who is carrying out the work, can see that enough space is left. I think there should be 300 feet.

2. It seems that it is considered inadvisable to lower the bed of the filter beds. It is not for me to say. Assuming them 7·40 I suppose a conduit $1\frac{3}{4}$ feet diameter is required. This is for Campbell to decide. All I am concerned about is that the reservoir and conduit or at least the latter should be built soon. I am afraid anybody who expects the Public Works Department to build the conduit in one dry season will be disappointed.

To the Local and Municipal Department.

Local and Municipal Department.

As the adoption of any particular scheme must depend largely on the amount of contribution or aid, Government can afford to give to the Municipality, this file must, until the financial position is clearer, lie over.

G. S. Forbes—28-5-97.

Yes, he should.
A. E. H[avelock]—25-5-98.

I don't think the draft is enough. The Sanitary Engineer should be asked what he has been doing since the issue of G.O., No. 1571 M., dated 16th September 1896.

H. W. B[liss]—20-5-98.

I concur.

2. The Tuticorin water-supply is, as far as my information guides me, the most pressing and important of those before us. In the linked file, the Tuticorin water-supply scheme and all others are ordered to lie over until our financial position is clearer. Our revenue is coming in well. Perhaps Sir H. Bliss would consider whether a further step towards getting this Tuticorin scheme set on foot might now be taken.

A. E. H[avelock]—20-5-98.

Circulated to the Honourable Member again.

H. Tremenheere—21-5-98.

I am afraid there is very little chance at present of our having funds to forward any water and drainage schemes other than those entered in the budget (Tirupati, Rs. 77,400, Vizagapatam, Rs. 20,500 and Cocanada, Rs. 52,100). It is true that our revenue is coming in well, but (1) if we get an extra and unanticipated 20 lakhs this year, we could not use it, for we are limited as to expenditure to the provision made on the expenditure side of the budget, and (2) the first charge on any increase of revenue we may get will be provision for restoring our balance to the stipulated minimum of 20 lakhs. As the budget for 1898-99 stands, we shall close the year with a balance of 6·08 only. We have therefore a sum of Rs. 13·92 to make good from our annual surpluses of revenue over expenditure before we shall be restored to a state of solvency.

2. Another reason why we cannot at present help forward Municipal water and drainage schemes is that no allotment has been made us at present wherefrom we can grant loans to Municipalities. The Municipal Councils will therefore have to raise money in the open market, instead of borrowing from Government at 4 or $4\frac{1}{4}$ per cent. with the bank rate at 12 per cent., it is unnecessary to labour the point that they cannot hope to raise loans in the open market on any terms which they can afford.

3 Our position will not improbably be raised during the year by the fact that we shall not need to spend on famine relief the whole sum of Rs. 8·50 which has been provided. But on the other hand, we only provided half a lakh, I think, for plague expenditure, which won't be anything like enough. We shall probably spend 2 or 2½ lakhs on plague preventive measures, even if plague does not actually break out: if it does, no one can say how much, perhaps 10 to 15 lakhs. Moreover, if we have any savings out of the budget provision for famine, they are already appropriated to the scheme for the better payment of the taluk establishments, if sanctioned by the Secretary of State, as I have little doubt they will be.

·50 under 24. Medical—Provincial.

C. M. SCHMIDT.

Also additional Munsif's Courts.

C.M.S.

4. I have written the above partly from memory and partly from reference to the original (preliminary) issue* of the civil estimates, so the Financial Department had better see before this goes to His Excellency and correct any errors I may have made.

*Dated 14th January 1898.

H. W. B[LISS]—21-5-98.

To the Financial Department with reference to the Honourable Member's note.

H. TREMENHEERE—23-5-98.

FINANCIAL DEPARTMENT.

Honourable Member's figures have been corrected with reference to the figures in the Financial statement.

C. M. SCHMIDT—23-5-98.

A. T. A[RUNDEL]—23-5-98.

I accept, with regret, the draft Government Order. But, I should be glad if this matter be brought to notice after the lapse of four months, when perhaps our financial position may have become more assured.

A. E. H[AVELOCK]—25-5-98.

To the Local and Municipal Department.

LOCAL AND MUNICIPAL DEPARTMENT.

Issue the draft.

G. S. FORBES—6-6-98.

[G.O., No. 1031 M., dated 8th June 1898.]

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd } 1898. *Enclosures*

Regd. } *Spare copies*

G.O., No. 1031 M., 8th June 1898.

Tuticorin water-supply scheme.

Stating, with remarks, that Government can do nothing with regard to the — until its financial position is clearer and requesting the Sanitary Engineer to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers :—

I

Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

Read—the following papers :—

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. JONES, Esq., MEM INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. HUGHES, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
No.—1412.

I have the honour to acknowledge and thank you for your No. 505 T.N of 4th May 1896.

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

Letter—from J. A. JONES, Esq., MEM., INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 19th June 1896.
No.—1913.

I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
No.—801-T. W.

With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

Year.	July.	August.	September.	October.	November.	December.
1886	12·94	12·71	15·54	15·42	15·35	14·67
1887	..	..	..	15·43	14·97	16·38
1888	13·23	11·83	..	15·95	16·00	16·86
1889	12·50	12·62	15·06	16·78	16·20	14·96
1890	..	..	..	14·65	14·30	16·83
1891	13·98	12·93	12·10	15·56	17·25	18·34
1892	12·80	..	..	..	..	..
1893	12·72	..	..	14·50	16·50	18·00
1894	..	..	..	11·55	14·85	14·30
1895	12·14	..	..	16·49	17·79	18·29

Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained :—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1895.
B	Pumping scheme for 10 gallons per head with 4 months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones, calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	
F	Municipal Chairman's scheme ..	Not known.	Not known.	
G	District Board Engineer's scheme ..			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows :—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

(True Extract).

R. Parsons,
Secretary.

To the Secretary to Government, Local and Municipa Department, with papers.

II

Letter—from G. Zellweger, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.
Dated—the 10th May 1898.
No.—227.

I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

4. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town, and would point out in conclusion that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
(through the Collector of Tinnevelly).
,, Sanitary Board.
,, ,, Engineer.

LOCAL AND MUNICIPAL DEPARTMENT.

NOTES CONNECTED WITH G.O., No. 1031 M., DATED 8TH JUNE 1898.

[SUBJECT.—*Tuticorin water-supply scheme.*]

From the Sanitary Board, dated 21st November 1896, *No.* 263-*S.*

The history of the schemes for the water-supply of Tuticorin originally proposed by the Sanitary Engineer, is given in the note for orders stitched with G.O., No. 75 M., dated 16th January 1896. In that order the pumping scheme approved by the Sanitary Board was declared to be impracticable on financial grounds and the Board was requested to consider the two gravitation schemes estimated to cost Rs. 1,00,000 and Rs. 1,61,850 respectively, proposed by the Chairman of the Municipal Council and the Local Fund Engineer. On this, however, the Sanitary Board in its resolution No. 538, dated 24th February 1896, came to the conclusion that it was impossible to arrange for a satisfactory supply of water to Tuticorin without pumping and recommended that the original pumping scheme of the Sanitary Engineer might be revised by reducing the supply per head from 15 to 10 gallons. This recommendation of the Sanitary Board was approved by Government and in their order No. 435 M., dated 16th March 1896, the Sanitary Engineer was requested to submit revised estimates. The Municipal Council in its resolution thereon expressed the opinion that even on sanitary grounds 10 gallons per head would be quite insufficient and that fully 15 gallons would be required for each person in the town and as it still thought that pumping might with advantage be dispensed with, the Government were requested to reconsider their decision in the matter. But this letter was recorded in G.O., No. 1277 M., dated 31st July 1896, pending receipt of the revised estimate called for from the Sanitary Engineer.

2. With reference however to the Government Order of March 1896 quoted above, the Sanitary Engineer in the first instance submitted for the approval of the Sanitary Board, two schemes, one for Rs. 2,73,140 retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply and the other for Rs. 3,30,000 providing in addition to the modifications of the original scheme referred to above for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended, and

(2) chambers for Gill's arrangements for filters.

The Sanitary Board, however, considered these two schemes as impracticable for financial reasons and asked the Sanitary Engineer to state if a cheaper scheme could not be devised. On this, the Sanitary Engineer proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoirs. As this amount was also considered by the Board to be large, the Sanitary Engineer submitted a gravitation scheme, which though more expensive in the first instance than the pumping scheme costing Rs. 2,68,334, involved a cheaper annual cost. In this scheme the service reservoir, the filters, the pumping house and engines are all omitted.

3. The following statement given by the Sanitary Board shows the cost and working charges of the several schemes above referred to :—

Items.	Scheme.	Capital cost.	Annual working charges.	Remarks.
		Rs.	Rs.	
A.	Pumping scheme for 15 gallons per head with four months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office-note No. 2070-S., dated 18th November 1895.
B.	Pumping scheme for 10 gallons per head with four months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in statement are based on Jones' calculations in the case of schemes D and E.
C.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank.	3,30,000	18,310	
D.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	*Note.*—The capital cost in each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896 referred to by Mr. Jones in his comparative statement.
E.	Gravitation scheme for 10 gallons per head with nine months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	....
F.	Municipal Chairman's scheme	1,00,000	Not known.	....
G.	District Board Engineer's	1,61,850	Do.	....

4. After a careful consideration of all the schemes the Sanitary Board agrees with the Sanitary Engineer in recommending scheme D, if Government considers scheme C too expensive.

5. If scheme D, being the cheaper of the two schemes approved by the Sanitary Board, is undertaken and if the Government makes a grant to the Council of half the cost as already promised and lends the balance at $4\frac{1}{4}$ per cent. interest, the amount required to liquidate the loan in 30 years would be Rs. 7,996, which together with the working charges of Rs. 14,970 represents an annual expenditure of Rs. 22,966. This would however be reduced by Rs. 596, if a sum of Rs. 10,000 out of the current balance reserved for the water-supply scheme is deducted from the loan now required, but if the proposal to raise the rates of the taxes on houses and lands and the water-tax from $7\frac{1}{2}$ to $8\frac{1}{2}$ and 4 to 8 per cent. respectively is passed into law and if the tax on arts is extended to all the classes of the schedule, then the additional income which may be expected would be—

	Rs.
Water-tax	15,799
House and land tax	4,443
Arts tax	585
Total ..	20,827

Thus the total amount available from all the sources will be Rs. 20,827 or Rs. 1,543 less than the amount required by the Municipal Council. Leaving altogether out of account the annual income expected from the South Indian Railway Company, the above deficit can easily be met by thoroughly revising the taxes on buildings and lands—*vide* the notes stitched with G.O., No. 180 M., dated 6th February 1895.

7. In these circumstances it is submitted that the Sanitary Board's recommendation to undertake scheme D may be approved.

V. RAGHAVA CHARLU—16-1-97.

Scheme C should, if possible, be approved. I have always been of opinion that Tuticorin is very much under-assessed all round: but I do not believe we shall have the assessment properly imposed unless (as I suggested when I was Collector of Tinnevelly) a special officer is deputed to do the work.

2. Would it not also be reasonable to ask Port funds to make a contribution?

G. S. FORBES—18-1-97.

I don't find any report of the Sanitary Engineer's forwarding scheme E and explaining the estimated cost of maintenance, under that scheme, of Rs. 11,100. I should like further information, for I don't understand why that scheme should be so summarily rejected. Nor, I may say, do I comprehend the intrinsic superiority of a pumping to a gravitation scheme, which seems to be assumed as a fact.

2. Why have schemes F and G not been examined?

3. Please send up some sort of plans by means of which I may be able to understand the various schemes.

4. Also please state whether, in view of the fact that, as I understand, the Korampallam tank has just breached, it is worth while to go on with any of these schemes. My impression is that the Korampallam tank or the channel supplying it breaches every two or three years. If so, why shouldn't Mr. Jones' proposed nine months' supply tank breach also and all the proposed expenditure be wasted? Mr. Hughes probably knows more about all these matters than any one else. Please consult him personally and let me know what he thinks.

5. It is all very well to say that the assessments at Tuticorin might be brought to a much higher standard if a special officer were put on. I daresay they might be. But it would not, I think, be safe to sanction a scheme for the supply of Tuticorin on the chance.

H. W. B[LISS]—19-1-97.

Draft demi-official to Mr. Hughes. G. S. FORBES.

Please see draft demi-official put up.

V. RAGHAVA CHARLU—22-1-97.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated the 25th February 1897.

I received the plans of the Tuticorin water-supply scheme two days ago, but have not been able to examine them until to-day. I do not wish to offer any opinion on the proposed distribution works and confine my remarks to the works which concern me as an Irrigation officer, viz., the reserve tank and conduit.

2. At first Government charged for all the water issued from Korampallam tank but afterwards, for reasons into which I need not enter, it was conceded that only the water reaching the service reservoir should be charged for. I cannot say whether water is now paid for on measurement or otherwise. The quantity issued from the tank is about six times what reaches the town, and irrigation under the tank is carried on with much difficulty and greatly restricted owing to the large supply drawn off for Tuticorin and the system of giving the town the preference as long as the supply lasts. In this way I think Government loses Rs. 2,000 to Rs. 3,000 per annum. The construction of a water-tight conduit should have been insisted on long ago. The proposal now is to make a reserve tank, to be filled from the Korampallam tank and keep the water for use when the Korampallam supply gives out. The reserve tank is undoubtedly required if the town is to be supplied throughout the year and I have already expressed my opinion that it should be made large enough to contain nine months' supply. It will not however be filled every year but receive partial fillings during freshes and be filled at some time each year to the highest level reached in the Korampallam tank. Regarding the site of the reservoir I notice that it does not appear to have been taken into account that there is a bye-wash near the left flank of the Korampallam tank which is intended to

A

discharge when there is a higher flood than the Oopar oday dam can dispose of or when there is danger to the bund. The water from this goes past Korampallam village and crosses the fresh water channel in the low ground not very far from the sluice. There should be a space of a few hundred feet left between the road and the reservoir bank. **B** The next point is that the site is for the most part wet land for which no compensation is provided in the estimate. I do not know whether it is intended to make the bund of earth dug close by. **C** The rate apparently provides for bringing earth from a good distance. In my letter of 4th May, which is in the file, I gave reasons for thinking that the waste by leakage and evaporation from the Korampallam tank is probably $1\frac{1}{2}$ feet a month. Mr. Jones has taken no notice of this but apparently adheres to his estimate of 5 inches a month loss from the new tank, evidently expecting to stop all leakage by the puddle wall extending to 4 feet below the tank bed. **D** Perhaps he has had excavations made and found a clay bed at that level. If he has not done so, I think a thorough examination of the place should be made, or a leaky tank would be useless, and if the matter cannot be placed beyond doubt in any other way a small tank might be made as an experiment and filled by baling from the fresh water channel.

There is notoriously great leakage.
G. S. Forbes.

3. Regarding the conduit which it is proposed to build in the bed of the fresh water channel, I think it might be found impossible to build the whole four miles in one season while the Korampallam tank is dry and in time to allow it to set before the supply begins. It will take 2,500 tons of bricks which have to be carted about 20 miles or railed 30 and carted 3, but of course they could be prepared in advance. **E** Why not have 15″ or 18″ cement or glazed earthenware pipe which could be laid in a very short time and would be stronger than and as water-tight as the culvert, while costing very much less.

I return the papers and plans.

Demi-official from G. S. Forbes, Esq., I.C.S., Secretary to Government, Local and Municipal Department, to the Sanitary Engineer to Government, dated the 26th February 1897, No. 22.

Please see Hughes' letter.

2. The Honourable Member asked me to consult him. Can you throw light on his difficulties—see specially points marked **A, B, C, D, E.**

Demi-official from J. A. Jones, Esq., Sanitary Engineer to Government, to the Secretary to Government, Local and Municipal Department, dated 1st March 1897, No. 406.

Herewith notes on Mr. Hughes' remarks as to Tuticorin water-supply scheme, which I think fully reply to his criticisms.

Tuticorin Water-supply.

1. **A**—Bye-wash near the left flank of the Korampallam tank.—There is a space of not less than 150 feet below the road and reservoir bund. The bund of the new tank is farther from the road than the channel so that there has been no interference with any course through which water may be discharged from the bye-wash. The crossing is evidently by the channel crossing the fresh water channel, and this has not been interfered with.

2. **B**—The site is for the most part wet land and for which no compensation is allowed in the estimate.—Compensation for land taken up for the reserve tank *is* provided in the estimate—*vide* Sanitary Engineer's estimate, page 12, dated 27th July 1896. Again look at paragraph 8 of report, dated 27th July 1896, where *an increased* allotment for land is referred to.

3. **C**—Whether it is intended to make the bund of earth dug close by.—In paragraph 19 of the Sanitary Engineer's letter No. 1538, dated 27th July 1893, embodied in G.O., Mis. No. 159 M., dated 14th February 1894, he says "The tank is proposed to be formed of simple banks without pitching, the slopes are $2\frac{1}{2}$ to 1 both inside and out with a puddle wall in the centre. The soil is very sandy and there is no economy to be obtained by making the banks with steeper slopes as sand hills and other excavations in the bed of the tank give the quantity of earth sufficient to make the banks of the section proposed. The banks will be *turfed* and the top of the tank will be 4 feet above the maximum water level of the tank.

The data for the rate of Rs. 6–8–0 per 1,000 cubic feet are—

	Rs.	A.	P.
One thousand cubic feet earthwork	2	12	0
One hundred and eighty yards lead at As. 6 for 20 yards	3	6	0
Two yards lift at As. 3	0	6	0
Total ..	6	8	0

4. **D**—Perhaps he (Sanitary Engineer) has had excavations made and found a clay bed at that level.—In estimating the area of the proposed tank, the Sanitary Engineer in his report, dated 27th July 1896, says: "*Evaporation has not been allowed for, as scheme is for* 34,000 *people whereas there are only* 25,000 *to be provided for* at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable."

5. There is no evidence of any clay bed below the sandy soil, and it would be inexpedient to arrange for tank taking into account a high evaporation and leakage for 34,000 when only 25,000 will use water at first and will probably not use even 10 gallons, and when it may be the case that by the time 34,000 people have to be provided for, the Korampallam tank may be filled to its proper level. The area of the tank altered is based on only a level of 16·00 and not 19·40 which is the proper full tank level.

6. **E**—Why not have 15″ or 18″ cement or glazed earthenware pipe which could be laid in a very short time and would be stronger than, and as water-tight as, the culvert while costing very much less.—Mr. Hughes suggests a 15″ or 18″ pipe. A 12″ pipe or less might be similarly suggested, but what is required is a 21″ pipe or else the full quantity of water for 34,000 people will not be obtainable. And this is a portion of the work which must be made full size at once. But even if an 18″ pipe was allowable, the cost would be more than what is proposed—*vide* the following:—

The cost of 21″ masonry culvert for a length of 22,100 feet as estimated is Rs. 44,472 or, say, Rs. 2 a foot.

The cost per foot of cement and stoneware pipes is as below:—

	Rs.	A.	P.
21″ cement pipes (laid)	3	0	0
21″ stoneware pipes, Burn & Co.'s at Calcutta (exclusive of conveying charges and laying)	4	0	0
18″ stoneware pipes, Burn & Co.'s (delivery at Calcutta exclusive of conveying charges and laying)	2	8	0
18″ Doulton's stoneware pipes (delivered at Bombay)	3	8	0
15″ do. do.	2	8	0

7. The above rates clearly show that cement or stoneware pipes cannot be substituted for a masonry conduit, so that even if the fall were increased and much expenditure incurred in excavation and extra cost for filter, for service reservoir, for engine and for pumping and pipes so small as 15″ used, there would be no economy but the reverse.

8. Bricks quite good enough for the conduit are obtainable 10 miles from Korampallam. The culvert would be built in lengths, the channel being replaced by iron pipes during the building of the lower portion so that the building might occupy any length of time and the supply still go on.

No. 1031 M., 8TH JUNE 1898.

Demi-official from H. A. Sim, Esq., I.C.S., Private Secretary to His Excellency the Governor, to the Secretary to Government, Local and Municipal Department, dated 2nd March 1897, *No.* 39.

With reference to the enclosed, which please return, I shall be glad if you will send up the papers regarding the Tuticorin water-supply scheme for His Excellency's information.

ENCLOSURES.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Private Secretary to His Excellency the Governor, dated 16th February 1897, *No.* 97.

I beg to submit a copy of my motion and the resolution of the Municipal Council, dated 12th instant, and request you will be so good as to let me know whether His Excellency will be pleased to grant an interview to the members of the deputation.

2. The members intend starting to Madras as early as possible before the end of this month.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Municipal Councillors, Tuticorin.

It is now so many years since a water-supply scheme to our town has been proposed, discussed, and submitted and over and over we represented to the Government the miseries and hardships of the people especially in times of droughts which are so frequent but up to date nothing definite has been done.

2. There has been some consolation to us when we heard from Government a few months ago that the Sanitary Engineer has been asked to prepare estimates to a less expensive water scheme on gravitation principle. There it lies and God knows when it is going to come.

3. It is a wonder that epidemics of most serious nature did not break out in this town; because, exclusive of the impurity of the water which the people have to drink, in times of water-supply failures, even the water we get from Korampallam tank by open channel is impure and subject to various pollutions. It will be unsafe no doubt to expect such special protections of Providence any more, unless the scheme is taken up at once. I am afraid most serious consequences are in store for this unfortunate town. Many towns which are very much less in importance receive the attention of Government, and water schemes are sanctioned and carried out without delay; whereas this town which is only next in importance of trade to the metropolis is ignored altogether. I am sure His Excellency the Governor will be only pleased to sanction the water scheme if he is only properly informed of the sufferings and miseries of the people for want of water-supply.

4. I therefore beg to propose that three members of the Council be selected and requested to wait on a deputation on His Excellency the Governor and lay before him the real state of affairs in this town for want of a water scheme.

Extract from the Proceedings of the Municipal Council, Tuticorin, dated 12th February 1897.

* * * * *

Read motion from the Chairman regarding water-supply scheme to this town.

Resolution No. 7.—Resolved that Captain Baker, the Chairman, and Rev. Mr. Gnanakan be requested to wait on His Excellency the Governor on deputation regarding the water scheme.

* * * * *

Herewith the file about Tuticorin.

G. S. FORBES.

To the Private Secretary.

Seen and returned with thanks.

A. E. H[AVELOCK]—6-3-97.

No. 1031 M., 8TH JUNE 1898.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated 10th March 1897, *No.* 46.

I return the Tuticorin water-supply papers. Jones has been to see me and I understand him to agree that the storage reservoir should have its bed puddled 1½ feet deep. With regard to the distance between the reservoir and the road, the men who is carrying out the work, can see that enough space is left. I think there should be 300 feet.

2. It seems that it is considered inadvisable to lower the bed of the filter beds. It is not for me to say. Assuming them 7·40 I suppose a conduit 1¾ feet diameter is required. This is for Campbell to decide. All I am concerned about is that the reservoir and conduit or at least the latter should be built soon. I am afraid anybody who expects the Public Works Department to build the conduit in one dry season will be disappointed.

To the Local and Municipal Department.

LOCAL AND MUNICIPAL DEPARTMENT.

As the adoption of any particular scheme must depend largely on the amount of contribution or aid, Government can afford to give to the Municipality, this file must, until the financial position is clearer, lie over.

G. S. FORBES—28-5-97.

Yes, he should.

A. E. H[AVELOCK]—25-5-98.

I don't think the draft is enough. The Sanitary Engineer should be asked what he has been doing since the issue of G.O., No. 1571 M., dated 16th September 1896.

H. W. B[LISS]—20-5-98.

I concur.

2. The Tuticorin water-supply is, as far as my information guides me, the most pressing and important of those before us. In the linked file, the Tuticorin water-supply scheme and all others are ordered to lie over until our financial position is clearer. Our revenue is coming in well. Perhaps Sir H. Bliss would consider whether a further step towards getting this Tuticorin scheme set on foot might now be taken.

A. E. H[AVELOCK]—20-5-98.

Circulated to the Honourable Member again.

H. TREMENHEERE—21-5-98.

I am afraid there is very little chance at present of our having funds to forward any water and drainage schemes other than those entered in the budget (Tirupati, Rs. 77,400, Vizagapatam, Rs. 20,500 and Cocanada, Rs. 52,100). It is true that our revenue is coming in well, but (1) if we get an extra and unanticipated 20 lakhs this year, we could not use it, for we are limited as to expenditure to the provision made on the expenditure side of the budget, and (2) the first charge on any increase of revenue we may get will be provision for restoring our balance to the stipulated minimum of 20 lakhs. As the budget for 1898-99 stands, we shall close the year with a balance of 6·08 only. We have therefore a sum of Rs. 13·92 to make good from our annual surpluses of revenue over expenditure before we shall be restored to a state of solvency.

2. Another reason why we cannot at present help forward Municipal water and drainage schemes is that no allotment has been made us at present wherefrom we can grant loans to Municipalities. The Municipal Councils will therefore have to raise money in the open market, instead of borrowing from Government at 4 or 4¼ per cent. with the bank rate at 12 per cent., it is unnecessary to labour the point that they cannot hope to raise loans in the open market on any terms which they can afford.

3 Our position will not improbably be raised during the year by the fact that we shall not need to spend on famine relief the whole sum of Rs. 8·50 which has been provided. But on the other hand, we only provided half a lakh, I think, for plague expenditure, which won't be anything like enough. We shall probably spend 2 or 2½ lakhs on plague preventive measures, even if plague does not actually break out: if it does, no one can say how much, perhaps 10 to 15 lakhs. Moreover, if we have any savings out of the budget provision for famine, they are already appropriated to the scheme for the better payment of the taluk establishments, if sanctioned by the Secretary of State, as I have little doubt they will be.

·50 under 24. Medical—Provincial.
C. M. SCHMIDT.

Also additional Munsif's Courts.
C.M.S.

4. I have written the above partly from memory and partly from reference to the original (preliminary) issue* of the civil estimates, so the Financial Department had better see before this goes to His Excellency and correct any errors I may have made.

* Dated 14th January 1898.

H. W. B[LISS]—21-5-98.

To the Financial Department with reference to the Honourable Member's note.

H. TREMENHEERE—23-5-98.

FINANCIAL DEPARTMENT.

Honourable Member's figures have been corrected with reference to the figures in the Financial statement.

C. M. SCHMIDT—23-5-98.

A. T. A[RUNDEL]—23-5-98.

I accept, with regret, the draft Government Order. But, I should be glad if this matter be brought to notice after the lapse of four months, when perhaps our financial position may have become more assured.

A. E. H[AVELOCK]—25-5-98.

To the Local and Municipal Department.

LOCAL AND MUNICIPAL DEPARTMENT.

Issue the draft.

G. S. FORBES—6-6-98.

[G.O., No. 1031 M., dated 8th June 1898.]

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd / *Regd.* } 1898. *Enclosures* / *Spare copies*

G.O., No. 1031 M., 8th June 1898.

Tuticorin water-supply scheme.

Stating, with remarks, that Government can do nothing with regard to the — until its financial position is clearer and requesting the Sanitary Engineer to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers :—

I

Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

Read—the following papers :—

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. JONES, Esq., MEM INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. HUGHES, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
No.—1412.

I have the honour to acknowledge and thank you for your No. 505 T.N of 4th May 1896.

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

Letter—from J. A. JONES, Esq., MEM., INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 19th June 1896.
No.—1913.

I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
No.—801-T. W.

With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

Year.	July.	August.	September.	October.	November.	December.
1886	12·94	12·71	15·54	15·42	15·35	14·67
1887	..	..	..	15·43	14·97	16·38
1888	13·23	11·83	..	15·95	16·00	16·86
1889	12·50	12·62	15·06	16·78	16·20	14·96
1890	..	..	..	14·65	14·30	16·83
1891	13·98	12·93	12·10	15·56	17·25	18·34
1892	12·80	..	..	..	..	..
1893	12·72	..	..	14·50	16·50	18·00
1894	..	..	..	11·55	14·85	14·30
1895	12·14	..	..	16·49	17·79	18·29

Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained :—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1895.
B	Pumping scheme for 10 gallons per head with 4 months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones' calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	
F	Municipal Chairman's scheme ..	Not known.	Not known.	
G	District Board Engineer's scheme ..			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows :—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

(True Extract).

R. Parsons,
Secretary.

To the Secretary to Government, Local and Municipa Department, with papers.

II

Letter—from G. Zellweger, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.
Dated—the 10th May 1898.
No.—227.

I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

4. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town, and would point out in conclusion that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
(through the Collector of Tinnevelly).
,, Sanitary Board.
,, ,, Engineer.

LOCAL AND MUNICIPAL DEPARTMENT.

NOTES CONNECTED WITH G.O., No. 1031 M., DATED 8TH JUNE 1898.

[SUBJECT.—*Tuticorin water-supply scheme.*]

From the Sanitary Board, dated 21st November 1896, No. 263-S.

The history of the schemes for the water-supply of Tuticorin originally proposed by the Sanitary Engineer, is given in the note for orders stitched with G.O., No. 75 M., dated 16th January 1896. In that order the pumping scheme approved by the Sanitary Board was declared to be impracticable on financial grounds and the Board was requested to consider the two gravitation schemes estimated to cost Rs. 1,00,000 and Rs. 1,61,850 respectively, proposed by the Chairman of the Municipal Council and the Local Fund Engineer. On this, however, the Sanitary Board in its resolution No. 538, dated 24th February 1896, came to the conclusion that it was impossible to arrange for a satisfactory supply of water to Tuticorin without pumping and recommended that the original pumping scheme of the Sanitary Engineer might be revised by reducing the supply per head from 15 to 10 gallons. This recommendation of the Sanitary Board was approved by Government and in their order No. 435 M., dated 16th March 1896, the Sanitary Engineer was requested to submit revised estimates. The Municipal Council in its resolution thereon expressed the opinion that even on sanitary grounds 10 gallons per head would be quite insufficient and that fully 15 gallons would be required for each person in the town and as it still thought that pumping might with advantage be dispensed with, the Government were requested to reconsider their decision in the matter. But this letter was recorded in G.O., No. 1277 M., dated 31st July 1896, pending receipt of the revised estimate called for from the Sanitary Engineer.

2. With reference however to the Government Order of March 1896 quoted above, the Sanitary Engineer in the first instance submitted for the approval of the Sanitary Board, two schemes, one for Rs. 2,73,140 retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply and the other for Rs. 3,30,000 providing in addition to the modifications of the original scheme referred to above for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended, and

(2) chambers for Gill's arrangements for filters.

The Sanitary Board, however, considered these two schemes as impracticable for financial reasons and asked the Sanitary Engineer to state if a cheaper scheme could not be devised. On this, the Sanitary Engineer proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoirs. As this amount was also considered by the Board to be large, the Sanitary Engineer submitted a gravitation scheme, which though more expensive in the first instance than the pumping scheme costing Rs. 2,68,334, involved a cheaper annual cost. In this scheme the service reservoir, the filters, the pumping house and engines are all omitted.

3. The following statement given by the Sanitary Board shows the cost and working charges of the several schemes above referred to:—

Items.	Scheme.	Capital cost.	Annual working charges.	Remarks.
		Rs.	Rs.	
A.	Pumping scheme for 15 gallons per head with four months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office-note No. 2070-S., dated 18th November 1895.
B.	Pumping scheme for 10 gallons per head with four months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in statement are based on Jones' calculations in the case of schemes D and E.
C.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank.	3,30,000	18,310	
D.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	*Note.*—The capital cost in each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896 referred to by Mr. Jones in his comparative statement.
E.	Gravitation scheme for 10 gallons per head with nine months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	....
F.	Municipal Chairman's scheme	1,00,000	Not known.	....
G.	District Board Engineer's	1,61,850	Do.	....

4. After a careful consideration of all the schemes the Sanitary Board agrees with the Sanitary Engineer in recommending scheme D, if Government considers scheme C too expensive.

5. If scheme D, being the cheaper of the two schemes approved by the Sanitary Board, is undertaken and if the Government makes a grant to the Council of half the cost as already promised and lends the balance at $4\frac{1}{4}$ per cent. interest, the amount required to liquidate the loan in 30 years would be Rs. 7,996, which together with the working charges of Rs. 14,970 represents an annual expenditure of Rs. 22,966. This would however be reduced by Rs. 596, if a sum of Rs. 10,000 out of the current balance reserved for the water-supply scheme is deducted from the loan now required.

6. In the existing state of affairs this sum is beyond the means of the Municipality; but if the proposal to raise the rates of the taxes on houses and lands and the water-tax from $7\frac{1}{2}$ to $8\frac{1}{2}$ and 4 to 8 per cent. respectively is passed into law and if the tax on arts is extended to all the classes of the schedule, then the additional income which may be expected would be—

	Rs.
Water-tax	15,799
House and land tax	4,443
Arts tax	585
Total ..	20,827

Thus the total amount available from all the sources will be Rs. 20,827 or Rs. 1,543 less than the amount required by the Municipal Council. Leaving altogether out of account the annual income expected from the South Indian Railway Company, the above deficit can easily be met by thoroughly revising the taxes on buildings and lands—*vide* the notes stitched with G.O., No. 180 M., dated 6th February 1895.

7. In these circumstances it is submitted that the Sanitary Board's recommendation to undertake scheme D may be approved.

V. RAGHAVA CHARLU—16-1-97.

Scheme C should, if possible, be approved. I have always been of opinion that Tuticorin is very much under-assessed all round: but I do not believe we shall have the assessment properly imposed unless (as I suggested when I was Collector of Tinnevelly) a special officer is deputed to do the work.

2. Would it not also be reasonable to ask Port funds to make a contribution?

G. S. FORBES—18-1-97.

I don't find any report of the Sanitary Engineer's forwarding scheme E and explaining the estimated cost of maintenance, under that scheme, of Rs. 11,100. I should like further information, for I don't understand why that scheme should be so summarily rejected. Nor, I may say, do I comprehend the intrinsic superiority of a pumping to a gravitation scheme, which seems to be assumed as a fact.

2. Why have schemes F and G not been examined?

3. Please send up some sort of plans by means of which I may be able to understand the various schemes.

4. Also please state whether, in view of the fact that, as I understand, the Korampallam tank has just breached, it is worth while to go on with any of these schemes. My impression is that the Korampallam tank or the channel supplying it breaches every two or three years. If so, why shouldn't Mr. Jones' proposed nine months' supply tank breach also and all the proposed expenditure be wasted? Mr. Hughes probably knows more about all these matters than any one else. Please consult him personally and let me know what he thinks.

5. It is all very well to say that the assessments at Tuticorin might be brought to a much higher standard if a special officer were put on. I daresay they might be. But it would not, I think, be safe to sanction a scheme for the supply of Tuticorin on the chance.

H. W. B[LISS]—19-1-97.

Draft demi-official to Mr. Hughes. G. S. FORBES.

Please see draft demi-official put up.

V. RAGHAVA CHARLU—22-1-97.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated the 25th February 1897.

I received the plans of the Tuticorin water-supply scheme two days ago, but have not been able to examine them until to-day. I do not wish to offer any opinion on the proposed distribution works and confine my remarks to the works which concern me as an Irrigation officer, viz., the reserve tank and conduit.

2. At first Government charged for all the water issued from Korampallam tank but afterwards, for reasons into which I need not enter, it was conceded that only the water reaching the service reservoir should be charged for. I cannot say whether water is now paid for on measurement or otherwise. The quantity issued from the tank is about six times what reaches the town, and irrigation under the tank is carried on with much difficulty and greatly restricted owing to the large supply drawn off for Tuticorin and the system of giving the town the preference as long as the supply lasts. In this way I think Government loses Rs. 2,000 to Rs. 3,000 per annum. The construction of a water-tight conduit should have been insisted on long ago. The proposal now is to make a reserve tank, to be filled from the Korampallam tank and keep the water for use when the Korampallam supply gives out. The reserve tank is undoubtedly required if the town is to be supplied throughout the year and I have already expressed my opinion that it should be made large enough to contain nine months' supply. It will not however be filled every year but receive partial fillings during freshes and be filled at some time each year to the highest level reached in the Korampallam tank. Regarding the site of the reservoir I notice that it does not appear to have been taken into account that there is a bye-wash near the left flank of the Korampallam tank which is intended to

A

discharge when there is a higher flood than the Oopar oday dam can dispose of or when there is danger to the bund. The water from this goes past Korampallam village and crosses the fresh water channel in the low ground not very far from the sluice. There should be a space of a few hundred feet left between the road and the reservoir bank. The next point is that the site is for the most part wet land for which no compensation is provided in the estimate. I do not know whether it is intended to make the bund of earth dug close by. The rate apparently provides for bringing earth from a good distance. In my letter of 4th May, which is in the file, I gave reasons for thinking that the waste by leakage and evaporation from the Korampallam tank is probably $1\frac{1}{2}$ feet a month. Mr. Jones has taken no notice of this but apparently adheres to his estimate of 5 inches a month loss from the new tank, evidently expecting to stop all leakage by the puddle wall extending to 4 feet below the tank bed. Perhaps he has had excavations made and found a clay bed at that level. If he has not done so, I think a thorough examination of the place should be made, or a leaky tank would be useless, and if the matter cannot be placed beyond doubt in any other way a small tank might be made as an experiment and filled by baling from the fresh water channel.

B

C

There is notoriously great leakage.
G. S. FORBES.

D

3. Regarding the conduit which it is proposed to build in the bed of the fresh water channel, I think it might be found impossible to build the whole four miles in one season while the Korampallam tank is dry and in time to allow it to set before the supply begins. It will take 2,500 tons of bricks which have to be carted about 20 miles or railed 30 and carted 3, but of course they could be prepared in advance. Why not have 15″ or 18″ cement or glazed earthenware pipe which could be laid in a very short time and would be stronger than and as water-tight as the culvert, while costing very much less.

E

I return the papers and plans.

Demi-official from G. S. Forbes, Esq., I.C.S., Secretary to Government, Local and Municipal Department, to the Sanitary Engineer to Government, dated the 26th February 1897, *No.* 22.

Please see Hughes' letter.

2. The Honourable Member asked me to consult him. Can you throw light on his difficulties—see specially points marked **A, B, C, D, E.**

Demi-official from J. A. Jones, Esq., Sanitary Engineer to Government, to the Secretary to Government, Local and Municipal Department, dated 1st March 1897, *No.* 406.

Herewith notes on Mr. Hughes' remarks as to Tuticorin water-supply scheme, which I think fully reply to his criticisms.

Tuticorin Water-supply.

1. **A**—Bye-wash near the left flank of the Korampallam tank.—There is a space of not less than 150 feet below the road and reservoir bund. The bund of the new tank is farther from the road than the channel so that there has been no interference with any course through which water may be discharged from the bye-wash. The crossing is evidently by the channel crossing the fresh water channel, and this has not been interfered with.

2. **B**—The site is for the most part wet land and for which no compensation is allowed in the estimate.—Compensation for land taken up for the reserve tank *is* provided in the estimate—*vide* Sanitary Engineer's estimate, page 12, dated 27th July 1896. Again look at paragraph 8 of report, dated 27th July 1896, where *an increased* allotment for land is referred to.

3. **C**—Whether it is intended to make the bund of earth dug close by.—In paragraph 19 of the Sanitary Engineer's letter No. 1538, dated 27th July 1893, embodied in G.O., Mis. No. 159 M., dated 14th February 1894, he says "The tank is proposed to be formed of simple banks without pitching, the slopes are $2\frac{1}{2}$ to 1 both inside and out with a puddle wall in the centre. The soil is very sandy and there is no economy to be obtained by making the banks with steeper slopes as sand hills and other excavations in the bed of the tank give the quantity of earth sufficient to make the banks of the section proposed. The banks will be *turfed* and the top of the tank will be 4 feet above the maximum water level of the tank.

The data for the rate of Rs. 6-8-0 per 1,000 cubic feet are—

	RS.	A.	P.
One thousand cubic feet earthwork	2	12	0
One hundred and eighty yards lead at As. 6 for 20 yards	3	6	0
Two yards lift at As. 3	0	6	0
Total ..	6	8	0

4. **D**—Perhaps he (Sanitary Engineer) has had excavations made and found a clay bed at that level.—In estimating the area of the proposed tank, the Sanitary Engineer in his report, dated 27th July 1896, says: "*Evaporation has not been allowed for, as scheme is for* 34,000 *people whereas there are only* 25,000 *to be provided for* at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable."

5. There is no evidence of any clay bed below the sandy soil, and it would be inexpedient to arrange for tank taking into account a high evaporation and leakage for 34,000 when only 25,000 will use water at first and will probably not use even 10 gallons, and when it may be the case that by the time 34,000 people have to be provided for, the Korampallam tank may be filled to its proper level. The area of the tank altered is based on only a level of 16·00 and not 19·40 which is the proper full tank level.

6. **E**—Why not have 15″ or 18″ cement or glazed earthenware pipe which could be laid in a very short time and would be stronger than, and as water-tight as, the culvert while costing very much less.—Mr. Hughes suggests a 15″ or 18″ pipe. A 12″ pipe or less might be similarly suggested, but what is required is a 21″ pipe or else the full quantity of water for 34,000 people will not be obtainable. And this is a portion of the work which must be made full size at once. But even if an 18″ pipe was allowable, the cost would be more than what is proposed—*vide* the following:—

The cost of 21″ masonry culvert for a length of 22,100 feet as estimated is Rs. 44,472 or, say, Rs. 2 a foot.

The cost per foot of cement and stoneware pipes is as below;—

	RS.	A.	P.
21″ cement pipes (laid)	3	0	0
21″ stoneware pipes, Burn & Co.'s at Calcutta (exclusive of conveying charges and laying)	4	0	0
18″ stoneware pipes, Burn & Co.'s (delivery at Calcutta exclusive of conveying charges and laying)	2	8	0
18″ Doulton's stoneware pipes (delivered at Bombay)	3	8	0
15″ do. do.	2	8	0

7. The above rates clearly show that cement or stoneware pipes cannot be substituted for a masonry conduit, so that even if the fall were increased and much expenditure incurred in excavation and extra cost for filter, for service reservoir, for engine and for pumping and pipes so small as 15″ used, there would be no economy but the reverse.

8. Bricks quite good enough for the conduit are obtainable 10 miles from Korampallam. The culvert would be built in lengths, the channel being replaced by iron pipes during the building of the lower portion so that the building might occupy any length of time and the supply still go on.

No. 1031 M., 8TH JUNE 1898.

Demi-official from H. A. Sim, Esq., I.C.S., Private Secretary to His Excellency the Governor, to the Secretary to Government, Local and Municipal Department, dated 2nd March 1897, No. 39.

With reference to the enclosed, which please return, I shall be glad if you will send up the papers regarding the Tuticorin water-supply scheme for His Excellency's information.

ENCLOSURES.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Private Secretary to His Excellency the Governor, dated 16th February 1897, No. 97.

I beg to submit a copy of my motion and the resolution of the Municipal Council, dated 12th instant, and request you will be so good as to let me know whether His Excellency will be pleased to grant an interview to the members of the deputation.

2. The members intend starting to Madras as early as possible before the end of this month.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Municipal Councillors, Tuticorin.

It is now so many years since a water-supply scheme to our town has been proposed, discussed, and submitted and over and over we represented to the Government the miseries and hardships of the people especially in times of droughts which are so frequent but up to date nothing definite has been done.

2. There has been some consolation to us when we heard from Government a few months ago that the Sanitary Engineer has been asked to prepare estimates to a less expensive water scheme on gravitation principle. There it lies and God knows when it is going to come.

3. It is a wonder that epidemics of most serious nature did not break out in this town; because, exclusive of the impurity of the water which the people have to drink, in times of water-supply failures, even the water we get from Korampallam tank by open channel is impure and subject to various pollutions. It will be unsafe no doubt to expect such special protections of Providence any more, unless the scheme is taken up at once. I am afraid most serious consequences are in store for this unfortunate town. Many towns which are very much less in importance receive the attention of Government, and water schemes are sanctioned and carried out without delay; whereas this town which is only next in importance of trade to the metropolis is ignored altogether. I am sure His Excellency the Governor will be only pleased to sanction the water scheme if he is only properly informed of the sufferings and miseries of the people for want of water-supply.

4. I therefore beg to propose that three members of the Council be selected and requested to wait on a deputation on His Excellency the Governor and lay before him the real state of affairs in this town for want of a water scheme.

Extract from the Proceedings of the Municipal Council, Tuticorin, dated 12th February 1897.

* * * * *

Read motion from the Chairman regarding water-supply scheme to this town.

Resolution No. 7.—Resolved that Captain Baker, the Chairman, and Rev. Mr. Gnanakan be requested to wait on His Excellency the Governor on deputation regarding the water scheme.

* * * * *

Herewith the file about Tuticorin.

To the Private Secretary. G. S. FORBES.

Seen and returned with thanks.

A. E. H[AVELOCK]—6-3-97.

No. 1031 M., 8TH JUNE 1898.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated 10th March 1897, No. 46.

I return the Tuticorin water-supply papers. Jones has been to see me and I understand him to agree that the storage reservoir should have its bed puddled 1½ feet deep. With regard to the distance between the reservoir and the road, the men, who is carrying out the work, can see that enough space is left. I think there should be 300 feet.

2. It seems that it is considered inadvisable to lower the bed of the filter beds. It is not for me to say. Assuming them 7·40 I suppose a conduit 1¾ feet diameter is required. This is for Campbell to decide. All I am concerned about is that the reservoir and conduit or at least the latter should be built soon. I am afraid anybody who expects the Public Works Department to build the conduit in one dry season will be disappointed.

To the Local and Municipal Department.

LOCAL AND MUNICIPAL DEPARTMENT.

As the adoption of any particular scheme must depend largely on the amount of contribution or aid, Government can afford to give to the Municipality, this file must, until the financial position is clearer, lie over.

G. S. FORBES—28-5-97.

Yes, he should.

A. E. H[AVELOCK]—25-5-98.

I don't think the draft is enough. The Sanitary Engineer should be asked what he has been doing since the issue of G.O., No. 1571 M., dated 16th September 1896.

H. W. B[LISS]—20-5-98.

I concur.

2. The Tuticorin water-supply is, as far as my information guides me, the most pressing and important of those before us. In the linked file, the Tuticorin water-supply scheme and all others are ordered to lie over until our financial position is clearer. Our revenue is coming in well. Perhaps Sir H. Bliss would consider whether a further step towards getting this Tuticorin scheme set on foot might now be taken.

A. E. H[AVELOCK]—20-5-98.

Circulated to the Honourable Member again.

H. TREMENHEERE—21-5-98.

I am afraid there is very little chance at present of our having funds to forward any water and drainage schemes other than those entered in the budget (Tirupati, Rs. 77,400, Vizagapatam, Rs. 20,500 and Cocanada, Rs. 52,100). It is true that our revenue is coming in well, but (1) if we get an extra and unanticipated 20 lakhs this year, we could not use it, for we are limited as to expenditure to the provision made on the expenditure side of the budget, and (2) the first charge on any increase of revenue we may get will be provision for restoring our balance to the stipulated minimum of 20 lakhs. As the budget for 1898-99 stands, we shall close the year with a balance of 6·08 only. We have therefore a sum of Rs. 13·92 to make good from our annual surpluses of revenue over expenditure before we shall be restored to a state of solvency.

2. Another reason why we cannot at present help forward Municipal water and drainage schemes is that no allotment has been made us at present wherefrom we can grant loans to Municipalities. The Municipal Councils will therefore have to raise money in the open market, instead of borrowing from Government at 4 or 4¼ per cent. with the bank rate at 12 per cent., it is unnecessary to labour the point that they cannot hope to raise loans in the open market on any terms which they can afford.

3 Our position will not improbably be raised during the year by the fact that we shall not need to spend on famine relief the whole sum of Rs. 8·50 which has been provided. But on the other hand, we only provided half a lakh, I think, for plague expenditure, which won't be anything like enough. We shall probably spend 2 or 2½ lakhs on plague preventive measures, even if plague does not actually break out: if it does, no one can say how much, perhaps 10 to 15 lakhs. Moreover, if we have any savings out of the budget provision for famine, they are already appropriated to the scheme for the better payment of the taluk establishments, if sanctioned by the Secretary of State, as I have little doubt they will be.

·50 under 24. Medical—Provincial.
C. M. SCHMIDT.

Also additional Munsif's Courts.
C.M.S.

4. I have written the above partly from memory and partly from reference to the original (preliminary) issue* of the civil estimates, so the Financial Department had better see before this goes to His Excellency and correct any errors I may have made.

*Dated 14th January 1898.

H. W. B[LISS]—21-5-98.

To the Financial Department with reference to the Honourable Member's note.

H. TREMENHEERE—23-5-98.

FINANCIAL DEPARTMENT.

Honourable Member's figures have been corrected with reference to the figures in the Financial statement.

C. M. SCHMIDT—23-5-98.

A. T. A[RUNDEL]—23-5-98.

I accept, with regret, the draft Government Order. But, I should be glad if this matter be brought to notice after the lapse of four months, when perhaps our financial position may have become more assured.

A. E. H[AVELOCK]—25-5-98.

To the Local and Municipal Department.

LOCAL AND MUNICIPAL DEPARTMENT.

Issue the draft.

G. S. FORBES—6-6-98.

[G.O., No. 1031 M., dated 8th June 1898.]

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd } 1898. *Enclosures*
Regd. } *Spare copies*

G.O., No. 1031 M., 8th June 1898.

Tuticorin water-supply scheme.

Stating, with remarks, that Government can do nothing with regard to the — until its financial position is clearer and requesting the Sanitary Engineer to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers :—

I

Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

Read—the following papers :—

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. JONES, Esq., MEM INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. HUGHES, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level. I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
No.—1412.

I have the honour to acknowledge and thank you for your No. 505 T.N of 4th May 1896.

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

Letter—from J. A. JONES, Esq., MEM., INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 19th June 1896.
No.—1913.

I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

No. 1031 M., 8TH JUNE 1898.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
No.—801-T. W.

With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

Year.	July.	August.	September.	October.	November.	December.
1886	..	..	..	..	..	..
1887	12·94	12·71	15·54	15·42	15·35	14·67
1888	..	..	..	15·43	14·97	16·38
1889	13·23	11·83	..	15·95	16·00	16·86
1890	12·50	12·62	15·06	16·78	16·20	14·96
1891	..	..	..	14·65	14·30	16·85
1892	13·98	12·93	12·10	15·56	17·25	18·34
1893	12·80	..	..	..	..	..
1894	12·72	..	..	14·50	16·50	18·00
1895	..	..	..	11·55	14·85	14·30
	12·14	..	..	16·49	17·79	18·29

Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained :—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1895.
B	Pumping scheme for 10 gallons per head with 4 months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones's calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,370	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	
F	Municipal Chairman's scheme ..	Not known.	Not known.	
G	District Board Engineer's scheme ..			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1898, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows :—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

(True Extract).

R. Parsons,
Secretary.

To the Secretary to Government, Local and Municipa Department, with papers.

II

Letter—from G. Zellweger, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.
Dated—the 10th May 1898.
No.—227.

I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

4. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town, and would point out in conclusion that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
(through the Collector of Tinnevelly).
" Sanitary Board.
" " Engineer.

LOCAL AND MUNICIPAL DEPARTMENT.

NOTES CONNECTED WITH G.O., No. 1031 M., DATED 8TH JUNE 1898.

[SUBJECT.—*Tuticorin water-supply scheme.*]

From the Sanitary Board, dated 21st November 1896, No. 263-S.

The history of the schemes for the water-supply of Tuticorin originally proposed by the Sanitary Engineer, is given in the note for orders stitched with G.O., No. 75 M., dated 16th January 1896. In that order the pumping scheme approved by the Sanitary Board was declared to be impracticable on financial grounds and the Board was requested to consider the two gravitation schemes estimated to cost Rs. 1,00,000 and Rs. 1,61,850 respectively, proposed by the Chairman of the Municipal Council and the Local Fund Engineer. On this, however, the Sanitary Board in its resolution No. 538, dated 24th February 1896, came to the conclusion that it was impossible to arrange for a satisfactory supply of water to Tuticorin without pumping and recommended that the original pumping scheme of the Sanitary Engineer might be revised by reducing the supply per head from 15 to 10 gallons. This recommendation of the Sanitary Board was approved by Government and in their order No. 435 M., dated 16th March 1896, the Sanitary Engineer was requested to submit revised estimates. The Municipal Council in its resolution thereon expressed the opinion that even on sanitary grounds 10 gallons per head would be quite insufficient and that fully 15 gallons would be required for each person in the town and as it still thought that pumping might with advantage be dispensed with, the Government were requested to reconsider their decision in the matter. But this letter was recorded in G.O., No. 1277 M, dated 31st July 1896, pending receipt of the revised estimate called for from the Sanitary Engineer.

2. With reference however to the Government Order of March 1896 quoted above, the Sanitary Engineer in the first instance submitted for the approval of the Sanitary Board, two schemes, one for Rs. 2,73,140 retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply and the other for Rs. 3,30,000 providing in addition to the modifications of the original scheme referred to above for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended, and

(2) chambers for Gill's arrangements for filters.

The Sanitary Board, however, considered these two schemes as impracticable for financial reasons and asked the Sanitary Engineer to state if a cheaper scheme could not be devised. On this, the Sanitary Engineer proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoirs. As this amount was also considered by the Board to be large, the Sanitary Engineer submitted a gravitation scheme, which though more expensive in the first instance than the pumping scheme costing Rs. 2,68,334, involved a cheaper annual cost. In this scheme the service reservoir, the filters, the pumping house and engines are all omitted.

3. The following statement given by the Sanitary Board shows the cost and working charges of the several schemes above referred to:—

Items.	Scheme.	Capital cost.	Annual working charges.	Remarks.
		RS.	RS.	
A.	Pumping scheme for 15 gallons per head with four months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office-note No. 2070-S., dated 18th November 1895.
B.	Pumping scheme for 10 gallons per head with four months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in statement are based on Jones' calculations in the case of schemes D and E.
C.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank.	3,30,000	18,310	
D.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	*Note.*—The capital cost in each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896 referred to by Mr. Jones in his comparative statement.
E.	Gravitation scheme for 10 gallons per head with nine months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,009	11,100	....
F.	Municipal Chairman's scheme	1,00,000	Not known.	....
G.	District Board Engineer's	1,61,850	Do.	....

4. After a careful consideration of all the schemes the Sanitary Board agrees with the Sanitary Engineer in recommending scheme D, if Government considers scheme C too expensive.

5. If scheme D, being the cheaper of the two schemes approved by the Sanitary Board, is undertaken and if the Government makes a grant to the Council of half the cost as already promised and lends the balance at $4\frac{1}{4}$ per cent. interest, the amount required to liquidate the loan in 30 years would be Rs. 7,996, which together with the working charges of Rs. 14,970 represents an annual expenditure of Rs. 22,966. This would however be reduced by Rs. 596, if a sum of Rs. 10,000 out of the current balance reserved for the water-supply scheme is deducted from the loan now required.

6. In the existing state of affairs this sum is beyond the means of the Municipality; but if the proposal to raise the rates of the taxes on houses and lands and the water-tax from $7\frac{1}{2}$ to $8\frac{1}{2}$ and 4 to 8 per cent. respectively is passed into law and if the tax on arts is extended to all the classes of the schedule, then the additional income which may be expected would be—

	RS.
Water-tax	15,799
House and land tax	4,443
Arts tax	585
Total ..	20,827

Thus the total amount available from all the sources will be Rs. 20,827 or Rs. 1,543 less than the amount required by the Municipal Council. Leaving altogether out of account the annual income expected from the South Indian Railway Company, the above deficit can easily be met by thoroughly revising the taxes on buildings and lands—*vide* the notes stitched with G.O., No. 180 M., dated 6th February 1895.

7. In these circumstances it is submitted that the Sanitary Board's recommendation to undertake scheme D may be approved.

V. RAGHAVA CHARLU—16-1-97.

Scheme C should, if possible, be approved. I have always been of opinion that Tuticorin is very much under-assessed all round: but I do not believe we shall have the assessment properly imposed unless (as I suggested when I was Collector of Tinnevelly) a special officer is deputed to do the work.

2. Would it not also be reasonable to ask Port funds to make a contribution?

G. S. FORBES—18-1-97.

I don't find any report of the Sanitary Engineer's forwarding scheme E and explaining the estimated cost of maintenance, under that scheme, of Rs. 11,100. I should like further information, for I don't understand why that scheme should be so summarily rejected. Nor, I may say, do I comprehend the intrinsic superiority of a pumping to a gravitation scheme, which seems to be assumed as a fact.

2. Why have schemes F and G not been examined?

3. Please send up some sort of plans by means of which I may be able to understand the various schemes.

4. Also please state whether, in view of the fact that, as I understand, the Korampallam tank has just breached, it is worth while to go on with any of these schemes. My impression is that the Korampallam tank or the channel supplying it breaches every two or three years. If so, why shouldn't Mr. Jones' proposed nine months' supply tank breach also and all the proposed expenditure be wasted? Mr. Hughes probably knows more about all these matters than any one else. Please consult him personally and let me know what he thinks.

5. It is all very well to say that the assessments at Tuticorin might be brought to a much higher standard if a special officer were put on. I daresay they might be. But it would not, I think, be safe to sanction a scheme for the supply of Tuticorin on the chance.

H. W. B[LISS]—19-1-97.

Draft demi-official to Mr. Hughes.

G. S. FORBES.

Please see draft demi-official put up.

V. RAGHAVA CHARLU—22-1-97.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated the 25th February 1897.

I received the plans of the Tuticorin water-supply scheme two days ago, but have not been able to examine them until to-day. I do not wish to offer any opinion on the proposed distribution works and confine my remarks to the works which concern me as an Irrigation officer, viz., the reserve tank and conduit.

2. At first Government charged for all the water issued from Korampallam tank but afterwards, for reasons into which I need not enter, it was conceded that only the water reaching the service reservoir should be charged for. I cannot say whether water is now paid for on measurement or otherwise. The quantity issued from the tank is about six times what reaches the town, and irrigation under the tank is carried on with much difficulty and greatly restricted owing to the large supply drawn off for Tuticorin and the system of giving the town the preference as long as the supply lasts. In this way I think Government loses Rs. 2,000 to Rs. 3,000 per annum. The construction of a water-tight conduit should have been insisted on long ago. The proposal now is to make a reserve tank, to be filled from the Korampallam tank and keep the water for use when the Korampallam supply gives out. The reserve tank is undoubtedly required if the town is to be supplied throughout the year and I have already expressed my opinion that it should be made large enough to contain nine months' supply. It will not however be filled every year but receive partial fillings during freshes and be filled at some time each year to the highest level reached in the Korampallam tank. Regarding the site of the reservoir I notice that it does not appear to have been taken into account that there is a bye-wash near the left flank of the Korampallam tank which is intended to

A

discharge when there is a higher flood than the Oopar oday dam can dispose of or when there is danger to the bund. The water from this goes past Korampallam village and crosses the fresh water channel in the low ground not very far from the sluice. There should be a space of a few hundred feet left between the road and the reservoir bank. The next point is that the site is for the most part wet land for which no compensation is provided in the estimate. I do not know whether it is intended to make the bund of earth dug close by. The rate apparently provides for bringing earth from a good distance. In my letter of 4th May, which is in the file, I gave reasons for thinking that the waste by leakage and evaporation from the Korampallam tank is probably 1½ feet a month. Mr. Jones has taken no notice of this but apparently adheres to his estimate of 5 inches a month loss from the new tank, evidently expecting to stop all leakage by the puddle wall extending to 4 feet below the tank bed. Perhaps he has had excavations made and found a clay bed at that level. If he has not done so, I think a thorough examination of the place should be made, or a leaky tank would be useless, and if the matter cannot be placed beyond doubt in any other way a small tank might be made as an experiment and filled by baling from the fresh water channel.

B **C** **D**

There is notoriously great leakage.
G. S. Forbes.

3. Regarding the conduit which it is proposed to build in the bed of the fresh water channel, I think it might be found impossible to build the whole four miles in one season while the Korampallam tank is dry and in time to allow it to set before the supply begins. It will take 2,500 tons of bricks which have to be carted about 20 miles or railed 30 and carted 3, but of course they could be prepared in advance. Why not have 15″ or 18″ cement or glazed earthenware pipe which could be laid in a very short time and would be stronger than and as water-tight as the culvert, while costing very much less.

E

I return the papers and plans.

Demi-official from G. S. Forbes, Esq., I.C.S., Secretary to Government, Local and Municipal Department, to the Sanitary Engineer to Government, dated the 26th February 1897, No. 22.

Please see Hughes' letter.

2. The Honourable Member asked me to consult him. Can you throw light on his difficulties—see specially points marked **A, B, C, D, E.**

Demi-official from J. A. Jones, Esq., Sanitary Engineer to Government, to the Secretary to Government, Local and Municipal Department, dated 1st March 1897, No. 406.

Herewith notes on Mr. Hughes' remarks as to Tuticorin water-supply scheme, which I think fully reply to his criticisms.

Tuticorin Water-supply.

1. **A**—Bye-wash near the left flank of the Korampallam tank.—There is a space of not less than 150 feet below the road and reservoir bund. The bund of the new tank is farther from the road than the channel so that there has been no interference with any course through which water may be discharged from the bye-wash. The crossing is evidently by the channel crossing the fresh water channel, and this has not been interfered with.

2. **B**—The site is for the most part wet land and for which no compensation is allowed in the estimate.—Compensation for land taken up for the reserve tank *is* provided in the estimate—*vide* Sanitary Engineer's estimate, page 12, dated 27th July 1896. Again look at paragraph 8 of report, dated 27th July 1896, where *an increased* allotment for land is referred to.

3. **C**—Whether it is intended to make the bund of earth dug close by.—In paragraph 19 of the Sanitary Engineer's letter No. 1538, dated 27th July 1893, embodied in G.O., Mis. No. 159 M., dated 14th February 1894, he says "The tank is proposed to be formed of simple banks without pitching, the slopes are 2½ to 1 both inside and out with a puddle wall in the centre. The soil is very sandy and there is no economy to be obtained by making the banks with steeper slopes as sand hills and other excavations in the bed of the tank give the quantity of earth sufficient to make the banks of the section proposed. The banks will be *turfed* and the top of the tank will be 4 feet above the maximum water level of the tank.

The data for the rate of Rs. 6-8-0 per 1,000 cubic feet are—

	Rs.	A.	P.
One thousand cubic feet earthwork	2	12	0
One hundred and eighty yards lead at As. 6 for 20 yards	3	6	0
Two yards lift at As. 3	0	6	0
Total ..	6	8	0

4. **D**—Perhaps he (Sanitary Engineer) has had excavations made and found a clay bed at that level.—In estimating the area of the proposed tank, the Sanitary Engineer in his report, dated 27th July 1896, says: "*Evaporation has not been allowed for, as scheme is for* 34,000 *people whereas there are only* 25,000 *to be provided for* at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable."

5. There is no evidence of any clay bed below the sandy soil, and it would be inexpedient to arrange for tank taking into account a high evaporation and leakage for 34,000 when only 25,000 will use water at first and will probably not use even 10 gallons, and when it may be the case that by the time 34,000 people have to be provided for, the Korampallam tank may be filled to its proper level. The area of the tank altered is based on only a level of 16·00 and not 19·40 which is the proper full tank level.

6. **E**—Why not have 15″ or 18″ cement or glazed earthenware pipe which could be laid in a very short time and would be stronger than, and as water-tight as, the culvert while costing very much less.—Mr. Hughes suggests a 15″ or 18″ pipe. A 12″ pipe or less might be similarly suggested, but what is required is a 21″ pipe or else the full quantity of water for 34,000 people will not be obtainable. And this is a portion of the work which must be made full size at once. But even if an 18″ pipe was allowable, the cost would be more than what is proposed—*vide* the following:—

The cost of 21″ masonry culvert for a length of 22,100 feet as estimated is Rs. 44,472 or, say, Rs. 2 a foot.

The cost per foot of cement and stoneware pipes is as below:—

	Rs.	A.	P.
21″ cement pipes (laid)	3	0	0
21″ stoneware pipes, Burn & Co.'s at Calcutta (exclusive of conveying charges and laying)	4	0	0
18″ stoneware pipes, Burn & Co.'s (delivery at Calcutta exclusive of conveying charges and laying)	2	8	0
18″ Doulton's stoneware pipes (delivered at Bombay)	3	8	0
15″ do. do.	2	8	0

7. The above rates clearly show that cement or stoneware pipes cannot be substituted for a masonry conduit, so that even if the fall were increased and much expenditure incurred in excavation and extra cost for filter, for service reservoir, for engine and for pumping and pipes so small as 15″ used, there would be no economy but the reverse.

8. Bricks quite good enough for the conduit are obtainable 10 miles from Korampallam. The culvert would be built in lengths, the channel being replaced by iron pipes during the building of the lower portion so that the building might occupy any length of time and the supply still go on.

Demi-official from H. A. Sim, Esq., I.C.S., Private Secretary to His Excellency the Governor, to the Secretary to Government, Local and Municipal Department, dated 2nd March 1897, No. 39.

With reference to the enclosed, which please return, I shall be glad if you will send up the papers regarding the Tuticorin water-supply scheme for His Excellency's information.

Enclosures.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Private Secretary to His Excellency the Governor, dated 16th February 1897, No. 97.

I beg to submit a copy of my motion and the resolution of the Municipal Council, dated 12th instant, and request you will be so good as to let me know whether His Excellency will be pleased to grant an interview to the members of the deputation.

2. The members intend starting to Madras as early as possible before the end of this month.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Municipal Councillors, Tuticorin.

It is now so many years since a water-supply scheme to our town has been proposed, discussed, and submitted and over and over we represented to the Government the miseries and hardships of the people especially in times of droughts which are so frequent but up to date nothing definite has been done.

2. There has been some consolation to us when we heard from Government a few months ago that the Sanitary Engineer has been asked to prepare estimates to a less expensive water scheme on gravitation principle. There it lies and God knows when it is going to come.

3. It is a wonder that epidemics of most serious nature did not break out in this town; because, exclusive of the impurity of the water which the people have to drink, in times of water-supply failures, even the water we get from Korampallam tank by open channel is impure and subject to various pollutions. It will be unsafe no doubt to expect such special protections of Providence any more, unless the scheme is taken up at once. I am afraid most serious consequences are in store for this unfortunate town. Many towns which are very much less in importance receive the attention of Government, and water schemes are sanctioned and carried out without delay; whereas this town which is only next in importance of trade to the metropolis is ignored altogether. I am sure His Excellency the Governor will be only pleased to sanction the water scheme if he is only properly informed of the sufferings and miseries of the people for want of water-supply.

4. I therefore beg to propose that three members of the Council be selected and requested to wait on a deputation on His Excellency the Governor and lay before him the real state of affairs in this town for want of a water scheme.

Extract from the Proceedings of the Municipal Council, Tuticorin, dated 12th February 1897.

* * * * *

Read motion from the Chairman regarding water-supply scheme to this town.

Resolution No. 7.—Resolved that Captain Baker, the Chairman, and Rev. Mr. Gnanakan be requested to wait on His Excellency the Governor on deputation regarding the water scheme.

* * * * *

Herewith the file about Tuticorin.

G. S. Forbes.

To the Private Secretary.

Seen and returned with thanks.

A. E. H[avelock]—6-3-97.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated 10th March 1897, No. 46.

I return the Tuticorin water-supply papers. Jones has been to see me and I understand him to agree that the storage reservoir should have its bed puddled 1½ feet deep. With regard to the distance between the reservoir and the road, the men who is carrying out the work, can see that enough space is left. I think there should be 300 feet.

2. It seems that it is considered inadvisable to lower the bed of the filter beds. It is not for me to say. Assuming them 7·40 I suppose a conduit 1¾ feet diameter is required. This is for Campbell to decide. All I am concerned about is that the reservoir and conduit or at least the latter should be built soon. I am afraid anybody who expects the Public Works Department to build the conduit in one dry season will be disappointed.

To the Local and Municipal Department.

Local and Municipal Department.

As the adoption of any particular scheme must depend largely on the amount of contribution or aid, Government can afford to give to the Municipality, this file must, until the financial position is clearer, lie over.

G. S. Forbes—28-5-97.

Yes, he should.
A. E. H[avelock]—25-5-98.

I don't think the draft is enough. The Sanitary Engineer should be asked what he has been doing since the issue of G.O., No. 1571 M., dated 16th September 1896.

H. W. B[liss]—20-5-98.

I concur.

2. The Tuticorin water-supply is, as far as my information guides me, the most pressing and important of those before us. In the linked file, the Tuticorin water-supply scheme and all others are ordered to lie over until our financial position is clearer. Our revenue is coming in well. Perhaps Sir H. Bliss would consider whether a further step towards getting this Tuticorin scheme set on foot might now be taken.

A. E. H[avelock]—20-5-98.

Circulated to the Honourable Member again.

H. Tremenheere—21-5-98.

I am afraid there is very little chance at present of our having funds to forward any water and drainage schemes other than those entered in the budget (Tirupati, Rs. 77,400, Vizagapatam, Rs. 20,500 and Cocanada, Rs. 52,100). It is true that our revenue is coming in well, but (1) if we get an extra and unanticipated 20 lakhs this year, we could not use it, for we are limited as to expenditure to the provision made on the expenditure side of the budget, and (2) the first charge on any increase of revenue we may get will be provision for restoring our balance to the stipulated minimum of 20 lakhs. As the budget for 1898-99 stands, we shall close the year with a balance of 6·08 only. We have therefore a sum of Rs. 13·92 to make good from our annual surpluses of revenue over expenditure before we shall be restored to a state of solvency.

2. Another reason why we cannot at present help forward Municipal water and drainage schemes is that no allotment has been made us at present wherefrom we can grant loans to Municipalities. The Municipal Councils will therefore have to raise money in the open market, instead of borrowing from Government at 4 or 4¼ per cent. with the bank rate at 12 per cent., it is unnecessary to labour the point that they cannot hope to raise loans in the open market on any terms which they can afford.

3 Our position will not improbably be raised during the year by the fact that we shall not need to spend on famine relief the whole sum of Rs. 8·50 which has been provided. But on the other hand, we only provided half a lakh, I think, for plague expenditure, which won't be anything like enough. We shall probably spend 2 or 2½ lakhs on plague preventive measures, even if plague does not actually break out: if it does, no one can say how much, perhaps 10 to 15 lakhs. Moreover, if we have any savings out of the budget provision for famine, they are already appropriated to the scheme for the better payment of the taluk establishments, if sanctioned by the Secretary of State, as I have little doubt they will be.

·50 under 24. Medical—Provincial.
C. M. Schmidt.

Also additional Munsif's Courts.
C.M.S.

4. I have written the above partly from memory and partly from reference to the original (preliminary) issue* of the civil estimates, so the Financial Department had better see before this goes to His Excellency and correct any errors I may have made.

* Dated 14th January 1898.

H. W. B[liss]—21-5-98.

To the Financial Department with reference to the Honourable Member's note.

H. Tremenheere—23-5-98.

Financial Department.

Honourable Member's figures have been corrected with reference to the figures in the Financial statement.

C. M. Schmidt—23-5-98.

A. T. A[rundel]—23-5-98.

I accept, with regret, the draft Government Order. But, I should be glad if this matter be brought to notice after the lapse of four months, when perhaps our financial position may have become more assured.

A. E. H[avelock]—25-5-98.

To the Local and Municipal Department.

Local and Municipal Department.

Issue the draft.

G. S. Forbes—6-6-98.

[G.O., No. 1031 M., dated 8th June 1898.]

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Read / *Regd.* } 1898. *Enclosures* / *Spare copies*

G.O., No. 1031 M., 8th June 1898.

Tuticorin water-supply scheme.

Stating, with remarks, that Government can do nothing with regard to the — until its financial position is clearer and requesting the Sanitary Engineer to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers :—

I

Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

Read—the following papers :—

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. JONES, Esq., MEM INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. HUGHES, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
No.—1412.

I have the honour to acknowledge and thank you for your No. 505 T.N of 4th May 1896.

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

Letter—from J. A. JONES, Esq., MEM., INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 19th June 1896.
No.—1913.

I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
No.—801-T. W.

With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

Year.	July.	August.	September.	October.	November.	December.
1886	12·94	12·71	15·54	15·42	15·35	14·67
1887	..	..	..	15·43	14·97	16·38
1888	13·23	11·83	..	15·95	16·00	16·86
1889	12·50	12·62	15·06	16·78	16·20	14·96
1890	..	..	..	14·65	14·30	16·83
1891	13·98	12·93	12·10	15·56	17·25	18·34
1892	12·80	..	..	..	..	..
1893	12·72	..	..	14·50	16·50	18·00
1894	..	..	..	11·55	14·85	14·30
1895	12·14	..	..	16·49	17·79	18·29

Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained :—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1895.
B	Pumping scheme for 10 gallons per head with 4[months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones, calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	
F	Municipal Chairman's scheme ..	Not known.	Not known.	
G	District Board Engineer's scheme ..			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows :—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

(True Extract).

R. Parsons,
Secretary.

To the Secretary to Government, Local and Municipa Department,
with papers.

II

Letter—from G. Zellweger, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.
Dated—the 10th May 1898.
No.—227.

I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

4. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town, and would point out in conclusion that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. Forbes,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
(through the Collector of Tinnevelly).
,, Sanitary Board.
,, ,, Engineer.

Local and Municipal Department.

NOTES CONNECTED WITH G.O., No. 1031 M., DATED 8th JUNE 1898.

[Subject.—*Tuticorin water-supply scheme.*]

From the Sanitary Board, dated 21st November 1896, *No.* 263-*S.*

The history of the schemes for the water-supply of Tuticorin originally proposed by the Sanitary Engineer, is given in the note for orders stitched with G.O., No. 75 M., dated 16th January 1896. In that order the pumping scheme approved by the Sanitary Board was declared to be impracticable on financial grounds and the Board was requested to consider the two gravitation schemes estimated to cost Rs. 1,00,000 and Rs. 1,61,850 respectively, proposed by the Chairman of the Municipal Council and the Local Fund Engineer. On this, however, the Sanitary Board in its resolution No. 538, dated 24th February 1896, came to the conclusion that it was impossible to arrange for a satisfactory supply of water to Tuticorin without pumping and recommended that the original pumping scheme of the Sanitary Engineer might be revised by reducing the supply per head from 15 to 10 gallons. This recommendation of the Sanitary Board was approved by Government and in their order No. 435 M., dated 16th March 1896, the Sanitary Engineer was requested to submit revised estimates. The Municipal Council in its resolution thereon expressed the opinion that even on sanitary grounds 10 gallons per head would be quite insufficient and that fully 15 gallons would be required for each person in the town and as it still thought that pumping might with advantage be dispensed with, the Government were requested to reconsider their decision in the matter. But this letter was recorded in G.O., No. 1277 M, dated 31st July 1896, pending receipt of the revised estimate called for from the Sanitary Engineer.

2. With reference however to the Government Order of March 1896 quoted above, the Sanitary Engineer in the first instance submitted for the approval of the Sanitary Board, two schemes, one for Rs. 2,73,140 retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply and the other for Rs. 3,30,000 providing in addition to the modifications of the original scheme referred to above for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended, and

(2) chambers for Gill's arrangements for filters.

The Sanitary Board, however, considered these two schemes as impracticable for financial reasons and asked the Sanitary Engineer to state if a cheaper scheme could not be devised. On this, the Sanitary Engineer proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoirs. As this amount was also considered by the Board to be large, the Sanitary Engineer submitted a gravitation scheme, which though more expensive in the first instance than the pumping scheme costing Rs. 2,68,334, involved a cheaper annual cost. In this scheme the service reservoir, the filters, the pumping house and engines are all omitted.

3. The following statement given by the Sanitary Board shows the cost and working charges of the several schemes above referred to:—

Items.	Scheme.	Capital cost.	Annual working charges.	Remarks.
		Rs.	Rs.	
A.	Pumping scheme for 15 gallons per head with four months' supply in the reserve tank.	3,13,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office-note No. 2070-S., dated 18th November 1895.
B.	Pumping scheme for 10 gallons per head with four months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in statement are based on Jones' calculations in the case of schemes D and E.
C.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank.	3,30,000	18,310	
D.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	*Note.*—The capital cost in each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896 referred to by Mr. Jones in his comparative statement.
E.	Gravitation scheme for 10 gallons per head with nine months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	....
F.	Municipal Chairman's scheme	1,00,000	Not known.	....
G.	District Board Engineer's	1,61,850	Do.	....

4. After a careful consideration of all the schemes the Sanitary Board agrees with the Sanitary Engineer in recommending scheme D, if Government considers scheme C too expensive.

5. If scheme D, being the cheaper of the two schemes approved by the Sanitary Board, is undertaken and if the Government makes a grant to the Council of half the cost as already promised and lends the balance at $4\frac{1}{4}$ per cent. interest, the amount required to liquidate the loan in 30 years would be Rs. 7,996, which together with the working charges of Rs. 14,970 represents an annual expenditure of Rs. 22,966. This would however be reduced by Rs. 596, if a sum of Rs. 10,000 out of the current balance reserved for the water-supply scheme is deducted from the loan now required.

6. In the existing state of affairs this sum is beyond the means of the Municipality; but if the proposal to raise the rates of the taxes on houses and lands and the water-tax from $7\frac{1}{2}$ to $8\frac{1}{2}$ and 4 to 8 per cent. respectively is passed into law and if the tax on arts is extended to all the classes of the schedule, then the additional income which may be expected would be—

	Rs.
Water-tax	15,799
House and land tax	4,443
Arts tax	585
Total ..	20,827

Thus the total amount available from all the sources will be Rs. 20,827 or Rs. 1,543 less than the amount required by the Municipal Council. Leaving altogether out of account the annual income expected from the South Indian Railway Company, the above deficit can easily be met by thoroughly revising the taxes on buildings and lands—*vide* the notes stitched with G.O., No. 180 M., dated 6th February 1895.

7. In these circumstances it is submitted that the Sanitary Board's recommendation to undertake scheme D may be approved.

V. RAGHAVA CHARLU—16-1-97.

Scheme C should, if possible, be approved. I have always been of opinion that Tuticorin is very much under-assessed all round: but I do not believe we shall have the assessment properly imposed unless (as I suggested when I was Collector of Tinnevelly) a special officer is deputed to do the work.

2. Would it not also be reasonable to ask Port funds to make a contribution?

G. S. FORBES—18-1-97.

I don't find any report of the Sanitary Engineer's forwarding scheme E and explaining the estimated cost of maintenance, under that scheme, of Rs. 11,100. I should like further information, for I don't understand why that scheme should be so summarily rejected. Nor, I may say, do I comprehend the intrinsic superiority of a pumping to a gravitation scheme, which seems to be assumed as a fact.

2. Why have schemes F and G not been examined?

3. Please send up some sort of plans by means of which I may be able to understand the various schemes.

4. Also please state whether, in view of the fact that, as I understand, the Korampallam tank has just breached, it is worth while to go on with any of these schemes. My impression is that the Korampallam tank or the channel supplying it breaches every two or three years. If so, why shouldn't Mr. Jones' proposed nine months' supply tank breach also and all the proposed expenditure be wasted? Mr. Hughes probably knows more about all these matters than any one else. Please consult him personally and let me know what he thinks.

5. It is all very well to say that the assessments at Tuticorin might be brought to a much higher standard if a special officer were put on. I daresay they might be. But it would not, I think, be safe to sanction a scheme for the supply of Tuticorin on the chance.

H. W. B[LISS]—19-1-97.

Draft demi-official to Mr. Hughes.

G. S. FORBES.

Please see draft demi-official put up.

V. RAGHAVA CHARLU—22-1-97.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated the 25th February 1897.

I received the plans of the Tuticorin water-supply scheme two days ago, but have not been able to examine them until to-day. I do not wish to offer any opinion on the proposed distribution works and confine my remarks to the works which concern me as an Irrigation officer, viz., the reserve tank and conduit.

2. At first Government charged for all the water issued from Korampallam tank but afterwards, for reasons into which I need not enter, it was conceded that only the water reaching the service reservoir should be charged for. I cannot say whether water is now paid for on measurement or otherwise. The quantity issued from the tank is about six times what reaches the town, and irrigation under the tank is carried on with much difficulty and greatly restricted owing to the large supply drawn off for Tuticorin and the system of giving the town the preference as long as the supply lasts. In this way I think Government loses Rs. 2,000 to Rs. 3,000 per annum. The construction of a water-tight conduit should have been insisted on long ago. The proposal now is to make a reserve tank, to be filled from the Korampallam tank and keep the water for use when the Korampallam supply gives out. The reserve tank is undoubtedly required if the town is to be supplied throughout the year and I have already expressed my opinion that it should be made large enough to contain nine months' supply. It will not however be filled every year but receive partial fillings during freshes and be filled at some time each year to the highest level reached in the Korampallam tank. Regarding the site of the reservoir I notice that it does not appear to have been taken into account that there is a bye-wash near the left flank of the Korampallam tank which is intended to

discharge when there is a higher flood than the Oopar oday dam can dispose of or when there is danger to the bund. The water from this goes past Korampallam village and crosses the fresh water channel in the low ground not very far from the sluice. There should be a space of a few hundred feet left between the road and the reservoir bank. **B** The next point is that the site is for the most part wet land for which no compensation is provided in the estimate. I do not know whether it is **C** intended to make the bund of earth dug close by. The rate apparently provides for bringing earth from a good distance. In my letter of 4th May, which is in the file, I gave reasons for thinking that the waste by leakage and evaporation from the Korampallam tank is probably $1\frac{1}{2}$ feet a month. Mr. Jones has taken no notice of this but apparently adheres to his estimate of 5 inches a month loss from the new tank, evidently expecting to stop all leakage by the puddle wall extending to 4 feet below the tank bed. **D** Perhaps he has had excavations made and found a clay bed at that level. If he has not done so, I think a thorough examination of the place should be made, or a leaky tank would be useless, and if the matter cannot be placed beyond doubt in any other way, a small tank might be made as an experiment and filled by baling from the fresh water channel.

There is notoriously great leakage.
G. S. Forbes.

3. Regarding the conduit which it is proposed to build in the bed of the fresh water channel, I think it might be found impossible to build the whole four miles in one season while the Korampallam tank is dry and in time to allow it to set before the supply begins. It will take 2,500 tons of bricks which have to be carted about 20 miles or railed 30 and carted 3, but of course they could be prepared in advance. **E** Why not have 15″ or 18″ cement or glazed earthenware pipe which could be laid in a very short time and would be stronger than and as water-tight as the culvert, while costing very much less.

I return the papers and plans.

Demi-official from G. S. Forbes, Esq., I.C.S., Secretary to Government, Local and Municipal Department, to the Sanitary Engineer to Government, dated the 26th February 1897, No. 22.

Please see Hughes' letter.

2. The Honourable Member asked me to consult him. Can you throw light on his difficulties—see specially points marked **A, B, C, D, E.**

Demi-official from J. A. Jones, Esq., Sanitary Engineer to Government, to the Secretary to Government, Local and Municipal Department, dated 1st March 1897, No. 406.

Herewith notes on Mr. Hughes' remarks as to Tuticorin water-supply scheme, which I think fully reply to his criticisms.

Tuticorin Water-supply.

1. **A**—Bye-wash near the left flank of the Korampallam tank.—There is a space of not less than 150 feet below the road and reservoir bund. The bund of the new tank is farther from the road than the channel so that there has been no interference with any course through which water may be discharged from the bye-wash. The crossing is evidently by the channel crossing the fresh water channel, and this has not been interfered with.

2. **B**—The site is for the most part wet land and for which no compensation is allowed in the estimate.—Compensation for land taken up for the reserve tank *is* provided in the estimate—*vide* Sanitary Engineer's estimate, page 12, dated 27th July 1896. Again look at paragraph 8 of report, dated 27th July 1896, where *an increased* allotment for land is referred to.

3. **C**—Whether it is intended to make the bund of earth dug close by.—In paragraph 19 of the Sanitary Engineer's letter No. 1538, dated 27th July 1893, embodied in G.O., Mis. No. 159 M., dated 14th February 1894, he says "The tank is proposed to be formed of simple banks without pitching, the slopes are $2\frac{1}{2}$ to 1 both inside and out with a puddle wall in the centre. The soil is very sandy and there is no economy to be obtained by making the banks with steeper slopes as sand hills and other excavations in the bed of the tank give the quantity of earth sufficient to make the banks of the section proposed. The banks will be *turfed* and the top of the tank will be 4 feet above the maximum water level of the tank.

The data for the rate of Rs. 6-8-0 per 1,000 cubic feet are—

	Rs.	A.	P.
One thousand cubic feet earthwork	2	12	0
One hundred and eighty yards lead at As. 6 for 20 yards	3	6	0
Two yards lift at As. 3	0	6	0
Total ..	6	8	0

4. **D**—Perhaps he (Sanitary Engineer) has had excavations made and found a clay bed at that level.—In estimating the area of the proposed tank, the Sanitary Engineer in his report, dated 27th July 1896, says: "*Evaporation has not been allowed for, as scheme is for* 34,000 *people whereas there are only* 25,000 *to be provided for* at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable."

5. There is no evidence of any clay bed below the sandy soil, and it would be inexpedient to arrange for tank taking into account a high evaporation and leakage for 34,000 when only 25,000 will use water at first and will probably not use even 10 gallons, and when it may be the case that by the time 34,000 people have to be provided for, the Korampallam tank may be filled to its proper level. The area of the tank altered is based on only a level of 16·00 and not 19·40 which is the proper full tank level.

6. **E**—Why not have 15″ or 18″ cement or glazed earthenware pipe which could be laid in a very short time and would be stronger than, and as water-tight as, the culvert while costing very much less.—Mr. Hughes suggests a 15″ or 18″ pipe. A 12″ pipe or less might be similarly suggested, but what is required is a 21″ pipe or else the full quantity of water for 34,000 people will not be obtainable. And this is a portion of the work which must be made full size at once. But even if an 18″ pipe was allowable, the cost would be more than what is proposed—*vide* the following:—

The cost of 21″ masonry culvert for a length of 22,100 feet as estimated is Rs. 44,472 or, say, Rs. 2 a foot.

The cost per foot of cement and stoneware pipes is as below:—

	Rs.	A.	P.
21″ cement pipes (laid)	3	0	0
21″ stoneware pipes, Burn & Co.'s at Calcutta (exclusive of conveying charges and laying)	4	0	0
18″ stoneware pipes, Burn & Co.'s (delivery at Calcutta exclusive of conveying charges and laying)	2	8	0
18″ Doulton's stoneware pipes (delivered at Bombay)	3	8	0
15″ do. do.	2	8	0

7. The above rates clearly show that cement or stoneware pipes cannot be substituted for a masonry conduit, so that even if the fall were increased and much expenditure incurred in excavation and extra cost for filter, for service reservoir, for engine and for pumping and pipes so small as 15″ used, there would be no economy but the reverse.

8. Bricks quite good enough for the conduit are obtainable 10 miles from Korampallam. The culvert would be built in lengths, the channel being replaced by iron pipes during the building of the lower portion so that the building might occupy any length of time and the supply still go on.

Demi-official from H. A. Sim, Esq., I.C.S., Private Secretary to His Excellency the Governor, to the Secretary to Government, Local and Municipal Department, dated 2nd March 1897, No. 39.

With reference to the enclosed, which please return, I shall be glad if you will send up the papers regarding the Tuticorin water-supply scheme for His Excellency's information.

Enclosures.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Private Secretary to His Excellency the Governor, dated 16th February 1897, No. 97.

I beg to submit a copy of my motion and the resolution of the Municipal Council, dated 12th instant, and request you will be so good as to let me know whether His Excellency will be pleased to grant an interview to the members of the deputation.

2. The members intend starting to Madras as early as possible before the end of this month.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Municipal Councillors, Tuticorin.

It is now so many years since a water-supply scheme to our town has been proposed, discussed, and submitted and over and over we represented to the Government the miseries and hardships of the people especially in times of droughts which are so frequent but up to date nothing definite has been done.

2. There has been some consolation to us when we heard from Government a few months ago that the Sanitary Engineer has been asked to prepare estimates to a less expensive water scheme on gravitation principle. There it lies and God knows when it is going to come.

3. It is a wonder that epidemics of most serious nature did not break out in this town; because, exclusive of the impurity of the water which the people have to drink, in times of water-supply failures, even the water we get from Korampallam tank by open channel is impure and subject to various pollutions. It will be unsafe no doubt to expect such special protections of Providence any more, unless the scheme is taken up at once. I am afraid most serious consequences are in store for this unfortunate town. Many towns which are very much less in importance receive the attention of Government, and water schemes are sanctioned and carried out without delay; whereas this town which is only next in importance of trade to the metropolis is ignored altogether. I am sure His Excellency the Governor will be only pleased to sanction the water scheme if he is only properly informed of the sufferings and miseries of the people for want of water-supply.

4. I therefore beg to propose that three members of the Council be selected and requested to wait on a deputation on His Excellency the Governor and lay before him the real state of affairs in this town for want of a water scheme.

Extract from the Proceedings of the Municipal Council, Tuticorin, dated 12th February 1897.

* * * * *

Read motion from the Chairman regarding water-supply scheme to this town.

Resolution No. 7.—Resolved that Captain Baker, the Chairman, and Rev. Mr. Gnanakan be requested to wait on His Excellency the Governor on deputation regarding the water scheme.

* * * * *

Herewith the file about Tuticorin.

G. S. Forbes.

To the Private Secretary.

Seen and returned with thanks.

A. E. H[avelock]—6-3-97.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated 10th March 1897, No. 46.

I return the Tuticorin water-supply papers. Jones has been to see me and I understand him to agree that the storage reservoir should have its bed puddled $1\frac{1}{2}$ feet deep. With regard to the distance between the reservoir and the road, the men. who is carrying out the work, can see that enough space is left. I think there should be 300 feet.

2. It seems that it is considered inadvisable to lower the bed of the filter beds. It is not for me to say. Assuming them 7·40 I suppose a conduit $1\frac{3}{4}$ feet diameter is required. This is for Campbell to decide. All I am concerned about is that the reservoir and conduit or at least the latter should be built soon. I am afraid anybody who expects the Public Works Department to build the conduit in one dry season will be disappointed.

To the Local and Municipal Department.

Local and Municipal Department.

As the adoption of any particular scheme must depend largely on the amount of contribution or aid, Government can afford to give to the Municipality, this file must, until the financial position is clearer, lie over.

G. S. Forbes—28-5-97.

Yes, he should.

A. E. H[avelock]—25-5-98.

I don't think the draft is enough. The Sanitary Engineer should be asked what he has been doing since the issue of G.O., No. 1571 M., dated 16th September 1896.

H. W. B[liss]—20-5-98.

I concur.

2. The Tuticorin water-supply is, as far as my information guides me, the most pressing and important of those before us. In the linked file, the Tuticorin water-supply scheme and all others are ordered to lie over until our financial position is clearer. Our revenue is coming in well. Perhaps Sir H. Bliss would consider whether a further step towards getting this Tuticorin scheme set on foot might now be taken.

A. E. H[avelock]—20-5-98.

Circulated to the Honourable Member again.

H. Tremenheere—21-5-98.

I am afraid there is very little chance at present of our having funds to forward any water and drainage schemes other than those entered in the budget (Tirupati, Rs. 77,400, Vizagapatam, Rs. 20,500 and Cocanada, Rs. 52,100). It is true that our revenue is coming in well, but (1) if we get an extra and unanticipated 20 lakhs this year, we could not use it, for we are limited as to expenditure to the provision made on the expenditure side of the budget, and (2) the first charge on any increase of revenue we may get will be provision for restoring our balance to the stipulated minimum of 20 lakhs. As the budget for 1898-99 stands, we shall close the year with a balance of 6·08 only. We have therefore a sum of Rs. 13·92 to make good from our annual surpluses of revenue over expenditure before we shall be restored to a state of solvency.

2. Another reason why we cannot at present help forward Municipal water and drainage schemes is that no allotment has been made us at present wherefrom we can grant loans to Municipalities. The Municipal Councils will therefore have to raise money in the open market, instead of borrowing from Government at 4 or $4\frac{1}{4}$ per cent. with the bank rate at 12 per cent., it is unnecessary to labour the point that they cannot hope to raise loans in the open market on any terms which they can afford.

3 Our position will not improbably be raised during the year by the fact that we shall not need to spend on famine relief the whole sum of Rs. 8·50 which has been provided. But on the other hand, we only provided half a lakh, I think, for plague expenditure, which won't be anything like enough. We shall probably spend 2 or 2½ lakhs on plague preventive measures, even if plague does not actually break out: if it does, no one can say how much, perhaps 10 to 15 lakhs. Moreover, if we have any savings out of the budget provision for famine, they are already appropriated to the scheme for the better payment of the taluk establishments, if sanctioned by the Secretary of State, as I have little doubt they will be.

·50 under 24. Medical—Provincial. C. M. Schmidt.

Also additional Munsif's Courts. C.M.S.

4. I have written the above partly from memory and partly from reference to the original (preliminary) issue* of the civil estimates, so the Financial Department had better see before this goes to His Excellency and correct any errors I may have made.

*Dated 14th January 1898.

H. W. B[liss]—21-5-98.

To the Financial Department with reference to the Honourable Member's note.

H. Tremenheere—23-5-98.

Financial Department.

Honourable Member's figures have been corrected with reference to the figures in the Financial statement.

C. M. Schmidt—23-5-98.

A. T. A[rundel]—23-5-98.

I accept, with regret, the draft Government Order. But, I should be glad if this matter be brought to notice after the lapse of four months, when perhaps our financial position may have become more assured.

A. E. H[avelock]—25-5-98.

To the Local and Municipal Department.

Local and Municipal Department.

Issue the draft.

G. S. Forbes—6-6-98.

[G.O., No. 1031 M., dated 8th June 1898.]

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd / *Regd.* } 1898. *Enclosures* / *Spare copies*

G.O., No. 1031 M., 8th June 1898.

Tuticorin water-supply scheme.

Stating, with remarks, that Government can do nothing with regard to the — until its financial position is clearer and requesting the Sanitary Engineer to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

No. 1031 M., 8TH JUNE 1898.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers :—

I

Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

Read—the following papers :—

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. JONES, Esq., MEM INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. HUGHES, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
No.—1412.

I have the honour to acknowledge and thank you for your No. 505 T.N of 4th May 1896.

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

Letter—from J. A. JONES, Esq., MEM., INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 19th June 1896.
No.—1913.

I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
No.—801-T. W.

With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

Year.	July.	August.	September.	October.	November.	December.
1886	12·94	12·71	15·54	15·42	15·35	14·67
1887	..	..	..	15·43	14·97	16·38
1888	13·23	11·83	..	15·95	16·00	16·86
1889	12·50	12·62	15·06	16·78	16·20	14·96
1890	..	..	..	14·65	14·30	16·83
1891	13·98	12·93	12·10	15·56	17·25	15·34
1892	12·30	..	..	..	..	..
1893	12·72	..	..	14·50	16·50	18·00
1894	..	..	..	11·55	14·85	14·30
1895	12·14	..	..	16·49	17·79	15·29

Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained :—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1895.
B	Pumping scheme for 10 gallons per head with 4 months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones' calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	
F	Municipal Chairman's scheme ..	Not known.	Not known.	
G	District Board Engineer's scheme ..			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows :—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

(True Extract).

R. Parsons,
Secretary.

To the Secretary to Government, Local and Municipa Department,
with papers.

II

Letter—from G. Zellweger, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.
Dated—the 10th May 1898.
No.—227.

I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

4. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town, and would point out in conclusion that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
(through the Collector of Tinnevelly).
,, Sanitary Board.
,, ,, Engineer.

LOCAL AND MUNICIPAL DEPARTMENT.

NOTES CONNECTED WITH G.O., No. 1031 M., DATED 8TH JUNE 1898.

[SUBJECT.—*Tuticorin water-supply scheme.*]

From the Sanitary Board, dated 21st November 1896, No. 263-S.

The history of the schemes for the water-supply of Tuticorin originally proposed by the Sanitary Engineer, is given in the note for orders stitched with G.O., No. 75 M., dated 16th January 1896. In that order the pumping scheme approved by the Sanitary Board was declared to be impracticable on financial grounds and the Board was requested to consider the two gravitation schemes estimated to cost Rs. 1,00,000 and Rs. 1,61,850 respectively, proposed by the Chairman of the Municipal Council and the Local Fund Engineer. On this, however, the Sanitary Board in its resolution No. 538, dated 24th February 1896, came to the conclusion that it was impossible to arrange for a satisfactory supply of water to Tuticorin without pumping and recommended that the original pumping scheme of the Sanitary Engineer might be revised by reducing the supply per head from 15 to 10 gallons. This recommendation of the Sanitary Board was approved by Government and in their order No. 435 M., dated 16th March 1896, the Sanitary Engineer was requested to submit revised estimates. The Municipal Council in its resolution thereon expressed the opinion that even on sanitary grounds 10 gallons per head would be quite insufficient and that fully 15 gallons would be required for each person in the town and as it still thought that pumping might with advantage be dispensed with, the Government were requested to reconsider their decision in the matter. But this letter was recorded in G.O., No. 1277 M, dated 31st July 1896, pending receipt of the revised estimate called for from the Sanitary Engineer.

2. With reference however to the Government Order of March 1896 quoted above, the Sanitary Engineer in the first instance submitted for the approval of the Sanitary Board, two schemes, one for Rs. 2,73,140 retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply and the other for Rs. 3,30,000 providing in addition to the modifications of the original scheme referred to above for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended, and

(2) chambers for Gill's arrangements for filters.

The Sanitary Board, however, considered these two schemes as impracticable for financial reasons and asked the Sanitary Engineer to state if a cheaper scheme could not be devised. On this, the Sanitary Engineer proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoirs. As this amount was also considered by the Board to be large, the Sanitary Engineer submitted a gravitation scheme, which though more expensive in the first instance than the pumping scheme costing Rs. 2,68,334, involved a cheaper annual cost. In this scheme the service reservoir, the filters, the pumping house and engines are all omitted.

3. The following statement given by the Sanitary Board shows the cost and working charges of the several schemes above referred to:—

Items.	Scheme.	Capital cost.	Annual working charges.	Remarks.
		RS.	RS.	
	Pumping scheme for 15 gallons per head with four months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office-note No. 2076-S., dated 18th November 1895.
B.	Pumping scheme for 10 gallons per head with four months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in statement are based on Jones' calculations in the case of schemes D and E.
C.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank.	3,30,000	18,310	
D.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	*Note.*—The capital cost in each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896 referred to by Mr. Jones in his comparative statement.
E.	Gravitation scheme for 10 gallons per head with nine months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	....
F.	Municipal Chairman's scheme	1,00,000	Not known.	....
G.	District Board Engineer's	1,61,850	Do.	....

4. After a careful consideration of all the schemes the Sanitary Board agrees with the Sanitary Engineer in recommending scheme D, if Government considers scheme C too expensive.

5. If scheme D, being the cheaper of the two schemes approved by the Sanitary Board, is undertaken and if the Government makes a grant to the Council of half the cost as already promised and lends the balance at $4\frac{1}{4}$ per cent. interest, the amount required to liquidate the loan in 30 years would be Rs. 7,996, which together with the working charges of Rs. 14,970 represents an annual expenditure of Rs. 22,966. This would however be reduced by Rs. 596, if a sum of Rs. 10,000 out of the current balance reserved for the water-supply scheme is deducted from the loan now required.

6. In the existing state of affairs this sum is beyond the means of the Municipality; but if the proposal to raise the rates of the taxes on houses and lands and the water-tax from $7\frac{1}{2}$ to $8\frac{1}{2}$ and 4 to 8 per cent. respectively is passed into law and if the tax on arts is extended to all the classes of the schedule, then the additional income which may be expected would be—

	RS.
Water-tax	15,799
House and land tax	4,443
Arts tax	585
Total ..	20,827

Thus the total amount available from all the sources will be Rs. 20,827 or Rs. 1,543 less than the amount required by the Municipal Council. Leaving altogether out of account the annual income expected from the South Indian Railway Company, the above deficit can easily be met by thoroughly revising the taxes on buildings and lands—*vide* the notes stitched with G.O., No. 180 M., dated 6th February 1895.

7. In these circumstances it is submitted that the Sanitary Board's recommendation to undertake scheme D may be approved.

V. RAGHAVA CHARLU—16-1-97.

Scheme C should, if possible, be approved. I have always been of opinion that Tuticorin is very much under-assessed all round: but I do not believe we shall have the assessment properly imposed unless (as I suggested when I was Collector of Tinnevelly) a special officer is deputed to do the work.

2. Would it not also be reasonable to ask Port funds to make a contribution?

G. S. FORBES—18-1-97.

I don't find any report of the Sanitary Engineer's forwarding scheme E and explaining the estimated cost of maintenance, under that scheme, of Rs. 11,100. I should like further information, for I don't understand why that scheme should be so summarily rejected. Nor, I may say, do I comprehend the intrinsic superiority of a pumping to a gravitation scheme, which seems to be assumed as a fact.

2. Why have schemes F and G not been examined?

3. Please send up some sort of plans by means of which I may be able to understand the various schemes.

4. Also please state whether, in view of the fact that, as I understand, the Korampallam tank has just breached, it is worth while to go on with any of these schemes. My impression is that the Korampallam tank or the channel supplying it breaches every two or three years. If so, why shouldn't Mr. Jones' proposed nine months' supply tank breach also and all the proposed expenditure be wasted? Mr. Hughes probably knows more about all these matters than any one else. Please consult him personally and let me know what he thinks.

5. It is all very well to say that the assessments at Tuticorin might be brought to a much higher standard if a special officer were put on. I daresay they might be. But it would not, I think, be safe to sanction a scheme for the supply of Tuticorin on the chance.

H. W. B[LISS]—19-1-97.

Draft demi-official to Mr. Hughes.

G. S. FORBES.

Please see draft demi-official put up.

V. RAGHAVA CHARLU—22-1-97.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated the 25th February 1897.

I received the plans of the Tuticorin water-supply scheme two days ago, but have not been able to examine them until to-day. I do not wish to offer any opinion on the proposed distribution works and confine my remarks to the works which concern me as an Irrigation officer, viz., the reserve tank and conduit.

2. At first Government charged for all the water issued from Korampallam tank but afterwards, for reasons into which I need not enter, it was conceded that only the water reaching the service reservoir should be charged for. I cannot say whether water is now paid for on measurement or otherwise. The quantity issued from the tank is about six times what reaches the town, and irrigation under the tank is carried on with much difficulty and greatly restricted owing to the large supply drawn off for Tuticorin and the system of giving the town the preference as long as the supply lasts. In this way I think Government loses Rs. 2,000 to Rs. 3,000 per annum. The construction of a water-tight conduit should have been insisted on long ago. The proposal now is to make a reserve tank, to be filled from the Korampallam tank and keep the water for use when the Korampallam supply gives out. The reserve tank is undoubtedly required if the town is to be supplied throughout the year and I have already expressed my opinion that it should be made large enough to contain nine months' supply. It will not however be filled every year but receive partial fillings during freshes and be filled at some time each year to the highest level reached in the Korampallam tank. Regarding the site of the reservoir I A notice that it does not appear to have been taken into account that there is a bye-wash near the left flank of the Korampallam tank which is intended to

discharge when there is a higher flood than the Oopar oday dam can dispose of or when there is danger to the bund. The water from this goes past Korampallam village and crosses the fresh water channel in the low ground not very far from the sluice. There should be a space of a few hundred feet left between the road and the reservoir bank. The next point is that the site is for the most part wet land for which no compensation is provided in the estimate. I do not know whether it is intended to make the bund of earth dug close by. The rate apparently provides for bringing earth from a good distance. In my letter of 4th May, which is in the file, I gave reasons for thinking that the waste by leakage and evaporation from the Korampallam tank is probably $1\frac{1}{2}$ feet a month. Mr. Jones has taken no notice of this but apparently adheres to his estimate of 5 inches a month loss from the new tank, evidently expecting to stop all leakage by the puddle wall extending to 4 feet below the tank bed. Perhaps he has had excavations made and found a clay bed at that level. If he has not done so, I think a thorough examination of the place should be made, or a leaky tank would be useless, and if the matter cannot be placed beyond doubt in any other way a small tank might be made as an experiment and filled by baling from the fresh water channel.

B | **C** | **D**

There is notoriously great leakage.
G. S. FORBES.

3. Regarding the conduit which it is proposed to build in the bed of the fresh water channel, I think it might be found impossible to build the whole four miles in one season while the Korampallam tank is dry and in time to allow it to set before the supply begins. It will take 2,500 tons of bricks which have to be carted about 20 miles or railed 30 and carted 3, but of course they could be prepared in advance.

E | Why not have 15″ or 18″ cement or glazed earthenware pipe which could be laid in a very short time and would be stronger than and as water-tight as the culvert, while costing very much less.

I return the papers and plans.

Demi-official from G. S. Forbes, Esq., I.C.S., Secretary to Government, Local and Municipal Department, to the Sanitary Engineer to Government, dated the 26th February 1897, No. 22.

Please see Hughes' letter.

2. The Honourable Member asked me to consult him. Can you throw light on his difficulties—see specially points marked **A, B, C, D, E.**

Demi-official from J. A. Jones, Esq., Sanitary Engineer to Government, to the Secretary to Government, Local and Municipal Department, dated 1st March 1897, No. 406.

Herewith notes on Mr. Hughes' remarks as to Tuticorin water-supply scheme, which I think fully reply to his criticisms.

Tuticorin Water-supply.

1. **A**—Bye-wash near the left flank of the Korampallam tank.—There is a space of not less than 150 feet below the road and reservoir bund. The bund of the new tank is farther from the road than the channel so that there has been no interference with any course through which water may be discharged from the bye-wash. The crossing is evidently by the channel crossing the fresh water channel, and this has not been interfered with.

2. **B**—The site is for the most part wet land and for which no compensation is allowed in the estimate.—Compensation for land taken up for the reserve tank *is* provided in the estimate—*vide* Sanitary Engineer's estimate, page 12, dated 27th July 1896. Again look at paragraph 8 of report, dated 27th July 1896, where *an increased* allotment for land is referred to.

3. **C**—Whether it is intended to make the bund of earth dug close by.—In paragraph 19 of the Sanitary Engineer's letter No. 1538, dated 27th July 1893, embodied in G.O., Mis. No. 159 M., dated 14th February 1894, he says "The tank is proposed to be formed of simple banks without pitching, the slopes are $2\frac{1}{2}$ to 1 both inside and out with a puddle wall in the centre. The soil is very sandy and there is no economy to be obtained by making the banks with steeper slopes as sand hills and other excavations in the bed of the tank give the quantity of earth sufficient to make the banks of the section proposed. The banks will be *turfed* and the top of the tank will be 4 feet above the maximum water level of the tank.

The data for the rate of Rs. 6-8-0 per 1,000 cubic feet are—

	RS.	A.	P.
One thousand cubic feet earthwork	2	12	0
One hundred and eighty yards lead at As. 6 for 20 yards	3	6	0
Two yards lift at As. 3	0	6	0
Total ..	6	8	0

4. **D**—Perhaps he (Sanitary Engineer) has had excavations made and found a clay bed at that level.—In estimating the area of the proposed tank, the Sanitary Engineer in his report, dated 27th July 1896, says: "*Evaporation has not been allowed for, as scheme is for* 34,000 *people whereas there are only* 25,000 *to be provided for* at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable."

5. There is no evidence of any clay bed below the sandy soil, and it would be inexpedient to arrange for tank taking into account a high evaporation and leakage for 34,000 when only 25,000 will use water at first and will probably not use even 10 gallons, and when it may be the case that by the time 34,000 people have to be provided for, the Korampallam tank may be filled to its proper level. The area of the tank altered is based on only a level of 16·00 and not 19·40 which is the proper full tank level.

6. **E**—Why not have 15″ or 18″ cement or glazed earthenware pipe which could be laid in a very short time and would be stronger than, and as water-tight as, the culvert while costing very much less.—Mr. Hughes suggests a 15″ or 18″ pipe. A 12″ pipe or less might be similarly suggested, but what is required is a 21″ pipe or else the full quantity of water for 34,000 people will not be obtainable. And this is a portion of the work which must be made full size at once. But even if an 18″ pipe was allowable, the cost would be more than what is proposed—*vide* the following:—

The cost of 21″ masonry culvert for a length of 22,100 feet as estimated is Rs. 44,472 or, say, Rs. 2 a foot.

The cost per foot of cement and stoneware pipes is as below:—

	RS.	A.	P.
21″ cement pipes (laid)	3	0	0
21″ stoneware pipes, Burn & Co.'s at Calcutta (exclusive of conveying charges and laying)	4	0	0
18″ stoneware pipes, Burn & Co.'s (delivery at Calcutta exclusive of conveying charges and laying)	2	8	0
18″ Doulton's stoneware pipes (delivered at Bombay)	3	8	0
15″ do. do.	2	8	0

7. The above rates clearly show that cement or stoneware pipes cannot be substituted for a masonry conduit, so that even if the fall were increased and much expenditure incurred in excavation and extra cost for filter, for service reservoir, for engine and for pumping and pipes so small as 15″ used, there would be no economy but the reverse.

8. Bricks quite good enough for the conduit are obtainable 10 miles from Korampallam. The culvert would be built in lengths, the channel being replaced by iron pipes during the building of the lower portion so that the building might occupy any length of time and the supply still go on.

Demi-official from H. A. Sim, Esq., I.C.S., Private Secretary to His Excellency the Governor, to the Secretary to Government, Local and Municipal Department, dated 2nd March 1897, No. 39.

With reference to the enclosed, which please return, I shall be glad if you will send up the papers regarding the Tuticorin water-supply scheme for His Excellency's information.

ENCLOSURES.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Private Secretary to His Excellency the Governor, dated 16th February 1897, No. 97.

I beg to submit a copy of my motion and the resolution of the Municipal Council, dated 12th instant, and request you will be so good as to let me know whether His Excellency will be pleased to grant an interview to the members of the deputation.

2. The members intend starting to Madras as early as possible before the end of this month.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Municipal Councillors, Tuticorin.

It is now so many years since a water-supply scheme to our town has been proposed, discussed, and submitted and over and over we represented to the Government the miseries and hardships of the people especially in times of droughts which are so frequent but up to date nothing definite has been done.

2. There has been some consolation to us when we heard from Government a few months ago that the Sanitary Engineer has been asked to prepare estimates to a less expensive water scheme on gravitation principle. There it lies and God knows when it is going to come.

3. It is a wonder that epidemics of most serious nature did not break out in this town; because, exclusive of the impurity of the water which the people have to drink, in times of water-supply failures, even the water we get from Korampallam tank by open channel is impure and subject to various pollutions. It will be unsafe no doubt to expect such special protections of Providence any more, unless the scheme is taken up at once. I am afraid most serious consequences are in store for this unfortunate town. Many towns which are very much less in importance receive the attention of Government, and water schemes are sanctioned and carried out without delay; whereas this town which is only next in importance of trade to the metropolis is ignored altogether. I am sure His Excellency the Governor will be only pleased to sanction the water scheme if he is only properly informed of the sufferings and miseries of the people for want of water-supply.

4. I therefore beg to propose that three members of the Council be selected and requested to wait on a deputation on His Excellency the Governor and lay before him the real state of affairs in this town for want of a water scheme.

Extract from the Proceedings of the Municipal Council, Tuticorin, dated 12th February 1897.

* * * * *

Read motion from the Chairman regarding water-supply scheme to this town.

Resolution No. 7.—Resolved that Captain Baker, the Chairman, and Rev. Mr. Gnanakan be requested to wait on His Excellency the Governor on deputation regarding the water scheme.

* * * * *

Herewith the file about Tuticorin.

G. S. FORBES.

To the Private Secretary.

Seen and returned with thanks.

A. E. H[AVELOCK]—6-3-97.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated 10th March 1897, No. 46.

I return the Tuticorin water-supply papers. Jones has been to see me and I understand him to agree that the storage reservoir should have its bed puddled $1\frac{1}{2}$ feet deep. With regard to the distance between the reservoir and the road, the men, who is carrying out the work, can see that enough space is left. I think there should be 300 feet.

2. It seems that it is considered inadvisable to lower the bed of the filter beds. It is not for me to say. Assuming them 7·40 I suppose a conduit $1\frac{3}{4}$ feet diameter is required. This is for Campbell to decide. All I am concerned about is that the reservoir and conduit or at least the latter should be built soon. I am afraid anybody who expects the Public Works Department to build the conduit in one dry season will be disappointed.

To the Local and Municipal Department.

LOCAL AND MUNICIPAL DEPARTMENT.

As the adoption of any particular scheme must depend largely on the amount of contribution or aid, Government can afford to give to the Municipality, this file must, until the financial position is clearer, lie over.

G. S. FORBES—28-5-97.

Yes, he should.
A. E. H[AVELOCK]—25-5-98.

I don't think the draft is enough. The Sanitary Engineer should be asked what he has been doing since the issue of G.O., No. 1571 M., dated 16th September 1896.

H. W. B[LISS]—20-5-98.

I concur.

2. The Tuticorin water-supply is, as far as my information guides me, the most pressing and important of those before us. In the linked file, the Tuticorin water-supply scheme and all others are ordered to lie over until our financial position is clearer. Our revenue is coming in well. Perhaps Sir H. Bliss would consider whether a further step towards getting this Tuticorin scheme set on foot might now be taken.

A. E. H[AVELOCK]—20-5-98.

Circulated to the Honourable Member again.

H. TREMENHEERE—21-5-98.

I am afraid there is very little chance at present of our having funds to forward any water and drainage schemes other than those entered in the budget (Tirupati, Rs. 77,400, Vizagapatam, Rs. 20,500 and Cocanada, Rs. 52,100). It is true that our revenue is coming in well, but (1) if we get an extra and unanticipated 20 lakhs this year, we could not use it, for we are limited as to expenditure to the provision made on the expenditure side of the budget, and (2) the first charge on any increase of revenue we may get will be provision for restoring our balance to the stipulated minimum of 20 lakhs. As the budget for 1898-99 stands, we shall close the year with a balance of 6·08 only. We have therefore a sum of Rs. 13·92 to make good from our annual surpluses of revenue over expenditure before we shall be restored to a state of solvency.

2. Another reason why we cannot at present help forward Municipal water and drainage schemes is that no allotment has been made us at present wherefrom we can grant loans to Municipalities. The Municipal Councils will therefore have to raise money in the open market, instead of borrowing from Government at 4 or $4\frac{1}{4}$ per cent. with the bank rate at 12 per cent., it is unnecessary to labour the point that they cannot hope to raise loans in the open market on any terms which they can afford.

No. 1031 M., 8TH JUNE 1898.

3 Our position will not improbably be raised during the year by the fact that we shall not need to spend on famine relief the whole sum of Rs. 8·50 which has been provided. But on the other hand, we only provided half a lakh, I think, for plague expenditure, which won't be anything like enough. We shall probably spend 2 or 2½ lakhs on plague preventive measures, even if plague does not actually break out: if it does, no one can say how much, perhaps 10 to 15 lakhs. Moreover, if we have any savings out of the budget provision for famine, they are already appropriated to the scheme for the better payment of the taluk establishments, if sanctioned by the Secretary of State, as I have little doubt they will be.

·50 under 24. Medical—Provincial.
C. M. SCHMIDT.

Also additional Munsif's Courts.
C.M.S.

4. I have written the above partly from memory and partly from reference to the original (preliminary) issue* of the civil estimates, so the Financial Department had better see before this goes to His Excellency and correct any errors I may have made.

*Dated 14th January 1898.

H. W. B[LISS]—21-5-98.

To the Financial Department with reference to the Honourable Member's note.

H. TREMENHEERE—23-5-98.

FINANCIAL DEPARTMENT.

Honourable Member's figures have been corrected with reference to the figures in the Financial statement.

C. M. SCHMIDT—23-5-98.

I accept, with regret, the draft Government Order. But, I should be glad if this matter be brought to notice after the lapse of four months, when perhaps our financial position may have become more assured.

A. T. A[RUNDEL]—23-5-98.

A. E. H[AVELOCK]—25-5-98.

To the Local and Municipal Department.

LOCAL AND MUNICIPAL DEPARTMENT.

Issue the draft.

G. S. FORBES—6-6-98.

[G.O., No. 1031 M., dated 8th June 1898.]

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd } 1898. *Enclosures*

Regd. } *Spare copies*

G.O., No. 1031 M., 8th June 1898.

Tuticorin water-supply scheme.

Stating, with remarks, that Government can do nothing with regard to the — until its financial position is clearer and requesting the Sanitary Engineer to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers :—

I

Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

Read—the following papers :—

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. JONES, Esq., MEM INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. HUGHES, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
No.—1412.

I have the honour to acknowledge and thank you for your No. 505 T N of 4th May 1896.

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

Letter—from J. A. JONES, Esq., MEM., INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 19th June 1896.
No.—1913.

I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
No.—801-T. W.

With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

Year.	July.	August.	September.	October.	November.	December.
1886	12·94	12·71	15·54	15·42	15·35	14·67
1887	..	..	..	15·43	14·97	16·38
1888	13·23	11·83	..	15·95	16·00	16·86
1889	12·50	12·62	15·06	16·78	16·20	14·96
1890	..	..	..	14·65	14·30	16·82
1891	13·98	12·93	12·10	15·56	17·25	15·34
1892	12·30	..	..	..	..	..
1893	12·72	..	..	14·50	16·50	18·00
1894	..	..	..	11·55	14·85	14·30
1895	12·14	..	..	16·49	17·79	18·29

Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained:—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1895.
B	Pumping scheme for 10 gallons per head with 4 months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones' calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,370	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	
F	Municipal Chairman's scheme ..	Not known.	Not known	
G	District Board Engineer's scheme ..			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows:—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

(True Extract).

R. Parsons,
Secretary.

To the Secretary to Government, Local and Municipal Department,
with papers.

II

Letter—from G. Zellweger, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.
Dated—the 10th May 1898.
No.—227.

I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

4. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town, and would point out in conclusion that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

No. 1031 M., 8TH JUNE 1898.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
(through the Collector of Tinnevelly).
,, Sanitary Board.
,, ,, Engineer.

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd / *Regd.* } 1898. *Enclosures* / *Spare copies*

G.O., No. 1031 M., 8th June 1898.

Tuticorin water-supply scheme.

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GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

Read—the following papers :—

I

Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

Read—the following papers :—

Letter—from J. A. Jones, Esq., mem. inst. c.e., f.r.s.e., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. Jones, Esq., mem inst. c.e., f.r.s.e., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. Hughes, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level. I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. Jones, Esq., mem. inst. c.e., f.r.s.e., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
No.—1412.

I have the honour to acknowledge and thank you for your No. 505 T N of 4th May 1896.

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

Letter—from J. A. Jones, Esq., mem., inst. c.e., f.r.s.e., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 19th June 1896.
No.—1913.

I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
No.—801-T. W.

With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

Year.	July.	August.	September.	October.	November.	December.
1886	12·94	12·71	15·54	15·42	15·35	14·67
1887	..	..	..	15·43	14·97	16·38
1888	13·23	11·83	..	15·95	16·00	16·86
1889	12·50	12·62	15·06	16·78	16·20	14·96
1890	..	..	..	14·65	14·30	16·83
1891	13·98	12·93	12·10	15·56	17·25	18·34
1892	12·30	..	..	..	..	..
1893	12·72	..	..	14·50	16·50	18·00
1894	..	..	..	11·55	14·85	14·30
1895	12·14	..	..	16·49	17·79	18·29

Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

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impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

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3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

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Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896, referred to by Mr. Jones in his comparative statement.

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Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
(through the Collector of Tinnevelly).
,, Sanitary Board.
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Government of Madras.

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Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. JONES, Esq., MEM INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. HUGHES, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
No.—1412.

I have the honour to acknowledge and thank you for your No. 505 T.N of 4th May 1896.

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

Letter—from J. A. JONES, Esq., MEM., INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 19th June 1896.
No.—1913.

I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
No.—801-T. W.

With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

Year.	July.	August.	September.	October.	November.	December.
1886	12·94	12·71	15·54	15·42	15·35	14·67
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1889	12·50	12·62	15·06	16·78	16·20	14·96
1890	..	..	..	14·65	14·30	16·83
1891	13·98	12·93	12·10	15·56	17·25	15·34
1892	12·30	..	..	..	..	..
1893	12·72	..	..	14·50	16·50	18·00
1894	..	..	..	11·55	14·85	14·30
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Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained:—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1893.
B	Pumping scheme for 10 gallons per head with 4 months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones' calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	3,75,000	11,100	
F	Municipal Chairman's scheme	Not known.	Not known.	
G	District Board Engineer's scheme			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This amount appears to be authorized by G.O., No. 847 M., dated 10th May 1896, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows:—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

(True Extract).

R. Parsons,
Secretary.

To the Secretary to Government, Local and Municipa Department, with papers.

II

Letter—from G. Zellweger, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.
Dated—the 10th May 1898.
No.—227.

I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

4. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town, and would point out in conclusion that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
(through the Collector of Tinnevelly).
,, Sanitary Board.
,, ,, Engineer.

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd } 1898. *Enclosures*
Regd. } *Spare copies*

G.O., No. 1031 M., 8th June 1898.

Tuticorin water-supply scheme.

Stating, with remarks, that Government can do nothing with regard to the — until its financial position is clearer and requesting the Sanitary Engineer to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers :—

I

Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

Read—the following papers :—

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To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
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I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

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5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained :—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1895.
B	Pumping scheme for 10 gallons per head with 4 months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones, calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	
F	Municipal Chairman's scheme ..	Not known.	Not known.	
G	District Board Engineer's scheme ..			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1895, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows :—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

(True Extract).

R. Parsons,
Secretary.

To the Secretary to Government, Local and Municipa Department,
with papers.

II

Letter—from G. Zellweger, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.
Dated—the 10th May 1898.
No.—227.

I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

4. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town, and would point out in conclusion that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

No. 1031 M., 8TH JUNE 1898.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
(through the Collector of Tinnevelly).
,, Sanitary Board.
,, ,, Engineer.

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd / *Regd.* } 1898. — *Enclosures* / *Spare copies*

G.O., No. 1031 M., 8th June 1898.

Tuticorin water-supply scheme.

Stating, with remarks, that Government can do nothing with regard to the — until its financial position is clearer and requesting the Sanitary Engineer to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers :—

I

Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

Read—the following papers :—

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. JONES, Esq., MEM INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. HUGHES, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level. I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
No.—1412.

I have the honour to acknowledge and thank you for your No. 505 T.N of 4th May 1896.

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

Letter—from J. A. JONES, Esq., MEM., INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 19th June 1896.
No.—1913.

I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
No.—801-T. W.

With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

Year.	July.	August.	September.	October.	November.	December.
1886	..	..	..	..	..	..
1887	12·94	12·71	15·54	15·42	15·35	14·67
1888	..	..	..	15·43	14·97	16·38
1889	13·23	11·83	..	15·95	16·00	16·86
1890	12·50	12·62	15·06	16·78	16·20	14·96
1891	..	..	..	14·65	14·30	16·83
1892	13·98	12·93	12·10	15·56	17·25	18·34
1893	12·30	..	..	..	..	..
1894	12·72	..	..	14·50	16·50	18·00
1895	..	..	..	11·55	14·85	14·30
	12·14	..	..	16·49	17·79	18·29

Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

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impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

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Dated—the 10th May 1898.
No.—227.

I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

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Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

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The Sanitary Commissioner notes as follows:—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

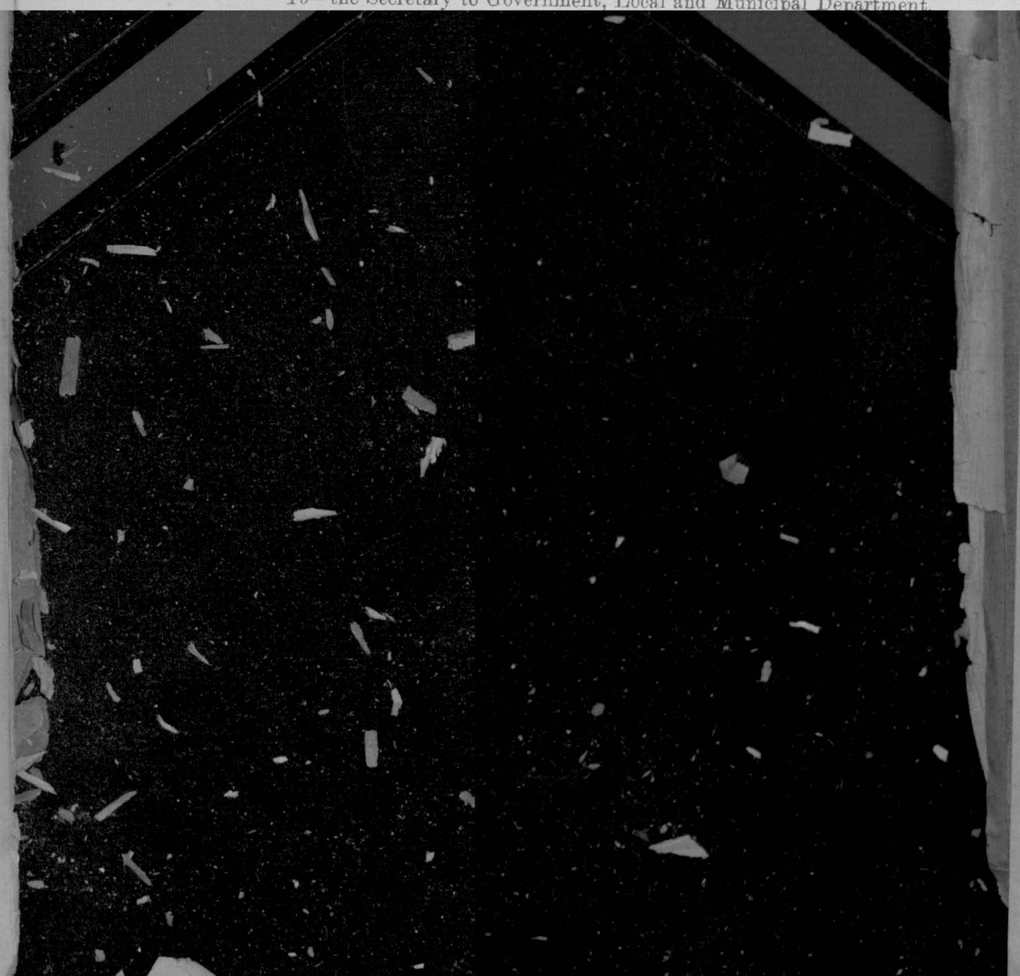
(True Extract).

R. PARSONS,
Secretary.

To the Secretary to Government, Local and Municipa Department,
with papers.

II

Letter—from G. ZELLWEGER, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.



No. 1031 M., 8TH JUNE 1898.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
" Sanitary Board. (through the Collector of Tinnevelly).
" " Engineer.

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd } 1898. *Enclosures*
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3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. JONES, Esq., MEM INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. HUGHES, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. JONES, Esq., MEM INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
No.—1412.

I have the honour to acknowledge and thank you for your No. 505 T.N of 4th May 1896.

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

Letter—from J. A. JONES, Esq., MEM., INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 19th June 1896.
No.—1913.

I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
No.—801-T. W.

With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

Year.	July.	August.	September.	October.	November.	December.
1886	12·94	12·71	15·54	15·42	15·35	14·67
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1888	13·23	11·83	..	15·95	16·00	16·86
1889	12·50	12·62	15·06	16·78	16·20	14·96
1890	..	..	..	14·65	14·30	16·83
1891	13·98	12·93	12·10	15·56	17·25	18·34
1892	12·80	..	..	..	..	..
1893	12·72	..	..	14·50	16·50	18·00
1894	..	..	..	11·55	14·85	14·30
1895	12·14	..	..	16·49	17·79	18·29

Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained:—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1895.
B	Pumping scheme for 10 gallons per head with 4 months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones, calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,370	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	
F	Municipal Chairman's scheme ..	Not known.	Not known	
G	District Board Engineer's scheme ..			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows:—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

(True Extract).

R. Parsons,
Secretary.

To the Secretary to Government, Local and Municipa Department,
with papers.

II

Letter—from G. Zellweger, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.
Dated—the 10th May 1898.
No.—227.

I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

4. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town, and would point out in conclusion that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
(through the Collector of Tinnevelly).
" Sanitary Board.
" " Engineer.

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd } 1898. *Enclosures*
Regd. } *Spare copies*

G.O., No. 1031 M., 8th June 1898.

Tuticorin water-supply scheme.

Stating, with remarks, that Government can do nothing with regard to the — until its financial position is clearer and requesting the Sanitary Engineer to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

Read—the following papers :—

I

Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

Read—the following papers :—

Letter—from J. A. Jones, Esq., mem. inst. c.e., f.r.s.e., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

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To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. Hughes, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was 4½ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about 1½ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

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3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

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6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

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J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained :—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1895.
B	Pumping scheme for 10 gallons per head with 4 months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones, calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,370	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	
F	Municipal Chairman's scheme ..	Not known.	Not known	
G	District Board Engineer's scheme ..			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows :—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

(True Extract).

R. Parsons,
Secretary.

To the Secretary to Government, Local and Municipa Department,
with papers.

II

Letter—from G. Zellweger, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.
Dated—the 10th May 1898.
No.—227.

I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

4. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town, and would point out in conclusion that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

No. 1031 M., 8TH JUNE 1898.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
(through the Collector of Tinnevelly).
,, Sanitary Board.
,, ,, Engineer.

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd } 1898. *Enclosures*
Regd. } *Spare copies*

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Tuticorin water-supply scheme.

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GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

Read—the following papers :—

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Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

Read—the following papers :—

Letter—from J. A. Jones, Esq., mem. inst. c.e., f.r.s.e., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. Jones, Esq., mem inst. c.e., f.r.s.e., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. Hughes, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. Jones, Esq., mem. inst. c.e., f.r.s.e., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
No.—1412.

I have the honour to acknowledge and thank you for your No. 505 T N of 4th May 1896

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

Letter—from J. A. Jones, Esq., mem., inst. c.e., f.r.s.e., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 19th June 1896.
No.—1913.

I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
No.—801-T. W.

With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

Year.	July.	August.	September.	October.	November.	December.
1886	12·94	12·71	15·54	15·42	15·35	14·67
1887	..	..	..	15·43	14·97	16·38
1888	13·23	11·83	..	15·95	16·00	16·86
1889	12·50	12·62	15·06	16·78	16·20	14·96
1890	..	..	..	14·65	14·30	16·83
1891	13·98	12·93	12·10	15·56	17·25	15·34
1892	12·80	..	..	..	..	..
1893	12·72	..	..	14·50	16·50	18·00
1894	..	..	..	11·55	14·85	14·30
1895	12·14	..	..	16·49	17·79	18·29

Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

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(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

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3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

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(True Extract).

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2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
No.—1412.

I have the honour to acknowledge and thank you for your No. 505 T N of 4th May 1896.

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

Letter—from J. A. JONES, Esq., MEM., INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 19th June 1896.
No.—1913.

I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
No.—801-T. W.

With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

Year.	July.	August.	September.	October.	November.	December.
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1891	13·98	12·93	12·10	15·56	17·25	15·34
1892	12·30	..	..	..	..	..
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1894	..	..	..	17·55	14·85	14·30
1895	12·14	..	..	16·49	17·79	18·29

Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained:—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1895.
B	Pumping scheme for 10 gallons per head with 4 months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones, calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	
F	Municipal Chairman's scheme ..	Not known.	Not known	
G	District Board Engineer's scheme ..			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1895, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows:—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

(True Extract).

R. Parsons,
Secretary.

To the Secretary to Government, Local and Municipa Department,
with papers.

II

Letter—from G. Zellweger, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.
Dated—the 10th May 1898.
No.—227.

I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

4. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town, and would point out in conclusion that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

No. 1031 M., 8TH JUNE 1898.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
(through the Collector of Tinnevelly).
" Sanitary Board.
" " Engineer.

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd } 1898. *Enclosures*
Regd. } *Spare copies*

G.O., No. 1031 M., 8th June 1898.

Tuticorin water-supply scheme.

Stating, with remarks, that Government can do nothing with regard to the — until its financial position is clearer and requesting the Sanitary Engineer to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers :—

I

Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

Read—the following papers :—

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. JONES, Esq., MEM INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. HUGHES, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

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J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained:—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1895.
B	Pumping scheme for 10 gallons per head with 4(months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones' calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	
F	Municipal Chairman's scheme ..	Not known.	Not known	
G	District Board Engineer's scheme ..			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows:—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

(True Extract).

R. Parsons,
Secretary.

To the Secretary to Government, Local and Municipal Department, with papers.

II

Letter—from G. Zellweger, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.
Dated—the 10th May 1898.
No.—227.

I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

4. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town, and would point out in conclusion that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
(through the Collector of Tinnevelly).
,, Sanitary Board.
,, ,, Engineer.

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd } 1898. *Enclosures*
Regd. } *Spare copies*

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Tuticorin water-supply scheme.

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GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers :—

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Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

Read—the following papers :—

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. JONES, Esq., MEM INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. HUGHES, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. JONES, Esq., MEM INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
No.—1412.

I have the honour to acknowledge and thank you for your No. 505 T N of 4th May 1896.

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

Letter—from J. A. JONES, Esq., MEM., INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 19th June 1896.
No.—1913.

I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
No.—801-T. W.

With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

Year.	July.	August.	September.	October.	November.	December.
1886	..	..	..	..	..	..
1887	12·94	12·71	15·54	15·42	15·35	14·67
1888	..	..	..	15·43	14·97	16·38
1889	13·23	11·83	..	15·95	16·00	16·86
1890	12·50	12·62	15·06	16·78	16·20	14·96
1891	..	..	..	14·65	14·30	16·83
1892	13·98	12·93	12·10	15·56	17·25	18·34
1893	12·30	..	..	..	..	..
1894	12·72	..	..	14·50	16·50	18·00
1895	..	..	..	11·55	14·85	14·30
	12·14	..	..	16·49	17·79	18·29

Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

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(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

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3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

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4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
No.—1412.

I have the honour to acknowledge and thank you for your No. 505 T.N of 4th May 1896

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

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Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
No.—801-T. W.

With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

Year.	July.	August.	September.	October.	November.	December.
1886	..	..	..	..	..	..
1887	12·94	12·71	15·54	15·42	15·35	14·67
1888	..	..	..	15·43	14·97	16·38
1889	13·23	11·83	..	15·95	16·00	16·86
1890	12·50	12·62	15·06	16·78	16·20	14·96
1891	..	..	..	14·65	14·30	16·83
1892	13·98	12·93	12·10	15·56	17·25	18·34
1893	12·30	..	..	..	..	..
1894	12·72	..	..	14·50	16·50	18·00
1895	..	..	..	11·55	14·85	14·30
	12·14	..	..	16·49	17·79	18·29

Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained:—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1895.
B	Pumping scheme for 10 gallons per head with 4[months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones, calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	
F	Municipal Chairman's scheme ..	Not known.	Not known	
G	District Board Engineer's scheme ..			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1895, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows:—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

(True Extract).

R. PARSONS,
Secretary.

To the Secretary to Government, Local and Municipa Department, with papers.

II

Letter—from G. ZELLWEGER, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.
Dated—the 10th May 1898.
No.—227.

I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

4. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town, and would point out in conclusion that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

No. 1031 M., 8TH JUNE 1898.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
" Sanitary Board. (through the Collector of Tinnevelly).
" " Engineer.

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd } 1898. *Enclosures*
Regd. } *Spare copies*

G.O., No. 1031 M., 8th June 1898.

Tuticorin water-supply scheme.

Stating, with remarks, that Government can do nothing with regard to the — until its financial position is clearer and requesting the Sanitary Engineer to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

GOVERNMENT OF MADRAS.

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READ—the following papers :—

I.

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Read—the following papers :—

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To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

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2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

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With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

Year.	July.	August.	September.	October.	November.	December.
1886	12·94	12·71	15·54	15·42	15·35	14·67
1887	..	..	..	15·43	14·97	16·38
1888	13·23	11·83	..	15·95	16·00	16·86
1889	12·50	12·62	15·06	16·78	16·20	14·96
1890	..	..	..	14·65	14·30	16·83
1891	13·98	12·93	12·10	15·56	17·25	18·34
1892	12·30	..	..	..	..	..
1893	12·72	..	..	14·50	16·50	18·00
1894	..	..	..	11·55	14·85	14·30
1895	12·14	..	..	16·49	17·79	18·29

Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained:—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1895.
B	Pumping scheme for 10 gallons per head with 4 months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones' calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,73,000	11,100	
F	Municipal Chairman's scheme ..	Not known.	Not known	
G	District Board Engineer's scheme ..			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows:—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

(True Extract).

R. PARSONS,
Secretary.

To the Secretary to Government, Local and Municipa Department,
with papers.

II

Letter—from G. ZELLWEGER, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.
Dated—the 10th May 1898.
No.—227.

I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

4. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town, and would point out in conclusion that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

No. 1031 M., 8TH JUNE 1898.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
,, Sanitary Board. (through the Collector of Tinnevelly).
,, ,, Engineer.

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd } 1898. *Enclosures*
Regd. } *Spare copies*

G.O., No. 1031 M., 8th June 1898.

Tuticorin water-supply scheme.

Stating, with remarks, that Government can do nothing with regard to the — until its financial position is clearer and requesting the Sanitary Engineer to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers :—

I

Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

Read—the following papers :—

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. JONES, Esq., MEM INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. HUGHES, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. JONES, Esq., MEM INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
No.—1412.

I have the honour to acknowledge and thank you for your No. 505 T.N of 4th May 1896

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

Letter—from J. A. JONES, Esq., MEM., INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 19th June 1896.
No.—1913.

I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kiudly send the information as far as available as soon as possible.

No. 1031 M., 8TH JUNE 1898.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
No.—801-T. W.

With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

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Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

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3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

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impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained :—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1895.
B	Pumping scheme for 10 gallons per head with 4 months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones' calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,370	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	
F	Municipal Chairman's scheme ..	Not known.	Not known.	
G	District Board Engineer's scheme ..			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 347 M., dated 10th May 1895, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows :—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

(True Extract).

R. Parsons,
Secretary.

To the Secretary to Government, Local and Municipa Department, with papers.

II

Letter—from G. Zellweger, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.
Dated—the 10th May 1898.
No.—227.

I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

4. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town, and would point out in conclusion that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

No. 1031 M., 8TH JUNE 1898.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
(through the Collector of Tinnevelly).
,, Sanitary Board.
,, ,, Engineer.

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd } 1898. *Enclosures*
Regd. } *Spare copies*

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Tuticorin water-supply scheme.

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GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers :—

I

Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

Read—the following papers :—

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. JONES, Esq., MEM INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. HUGHES, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
No.—1412.

I have the honour to acknowledge and thank you for your No. 505 T.N of 4th May 1896.

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

Letter—from J. A. JONES, Esq., MEM., INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 19th June 1896.
No.—1913.

I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
No.—801-T. W.

With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

Year.	July.	August.	September.	October.	November.	December.
1886	..	..	15·54	15·42	15·35	14·67
1887	12·94	12·71	..	15·43	14·97	16·38
1888	..	..	15·06	15·95	16·00	16·86
1889	13·23	11·83	..	16·78	16·20	14·96
1890	12·50	12·62	12·10	14·65	14·30	16·83
1891	..	..	..	15·56	17·25	18·34
1892	13·98	12·93	..	..	..	..
1893	12·30	..	..	14·50	16·50	18·00
1894	12·72	..	..	11·55	14·85	14·30
1895	..	..	..	16·49	17·79	18·29
	12·14	..	..			

Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained:—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1895.
B	Pumping scheme for 10 gallons per head with 4 months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones' calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	
F	Municipal Chairman's scheme ..	Not known.	Not known.	
G	District Board Engineer's scheme ..			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows:—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

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(True Extract).

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Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
" Sanitary Board. (through the Collector of Tinnevelly).
" " Engineer.

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

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ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

Year.	July.	August.	September.	October.	November.	December.
1886	12·94	12·71	15·54	15·42	15·35	14·67
1887	..	..	..	15·43	14·97	16·38
1888	13·23	11·83	..	15·95	16·00	16·86
1889	12·50	12·62	15·06	16·78	16·20	14·96
1890	..	..	..	14·65	14·30	16·83
1891	13·98	12·93	12·10	15·56	17·25	18·34
1892	12·30	..	..	..	..	..
1893	12·72	..	..	14·50	16·50	18·00
1894	..	..	..	11·55	14·85	14·30
1895	12·14	..	..	16·49	17·79	18·29

Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained :—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1895.
B	Pumping scheme for 10 gallons per head with 4 months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones' calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	
F	Municipal Chairman's scheme ..	Not known.	Not known.	
G	District Board Engineer's scheme ..			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows :—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

(True Extract).

R. PARSONS,
Secretary.

To the Secretary to Government, Local and Municipa Department, with papers.

II

Letter—from G. ZELLWEGER, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.
Dated—the 10th May 1898.
No.—227.

I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

4. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town, and would point out in conclusion that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

No. 1031 M., 8TH JUNE 1898.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
(through the Collector of Tinnevelly).
" Sanitary Board.
" " Engineer.

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd } 1898. *Enclosures*
Regd. } *Spare copies*

G.O., No. 1031 M., 8th June 1898.

Tuticorin water-supply scheme.

Stating, with remarks, that Government can do nothing with regard to the — until its financial position is clearer and requesting the Sanitary Engineer to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers :—

I

Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

Read—the following papers :—

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. JONES, Esq., MEM INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. HUGHES, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level. I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
No.—1412.

I have the honour to acknowledge and thank you for your No. 505 T.N of 4th May 1896.

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

Letter—from J. A. JONES, Esq., MEM., INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 19th June 1896.
No.—1913.

I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
No.—801-T. W.

With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

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4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

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Sanitary Engineer to Government.

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impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

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3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

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5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained :—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
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C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
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Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1895, referred to by Mr. Jones in his comparative statement.

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To the Secretary to Government, Local and Municipa Department, with papers.

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I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

4. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town, and would point out in conclusion that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
(through the Collector of Tinnevelly).
,, Sanitary Board.
,, ,, Engineer.

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd	1898.	*Enclosures*
Regd.		*Spare copies*

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Tuticorin water-supply scheme.

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GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

Read—the following papers :—

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Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

Read—the following papers :—

Letter—from J. A. Jones, Esq., mem. inst. c.e., f.r.s.e., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. Jones, Esq., mem inst. c.e., f.r.s.e., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. Hughes, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level. I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. Jones, Esq., mem. inst. c.e., f.r.s.e., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
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I have the honour to acknowledge and thank you for your No. 505 T.N of 4th May 1896.

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

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Dated—Fort St. George, the 19th June 1896.
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I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
No.—801-T. W.

With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

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STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

Year.	July.	August.	September.	October.	November.	December.
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1891	13·98	12·93	12·10	15·56	17·25	18·34
1892	12·30	..	..	..	..	..
1893	12·72	..	..	14·50	16·50	18·00
1894	..	..	..	11·55	14·85	14·30
1895	12·14	..	..	16·49	17·79	18·29

Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained :—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1895.
B	Pumping scheme for 10 gallons per head with 4 months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones' calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	
F	Municipal Chairman's scheme ..	Not known.	Not known.	
G	District Board Engineer's scheme ..			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows:—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

(True Extract).

R. Parsons,
Secretary.

To the Secretary to Government, Local and Municipa Department, with papers.

II

Letter—from G. Zellweger, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.
Dated—the 10th May 1898.
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Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained:—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1895.
B	Pumping scheme for 10 gallons per head with 4 months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones' calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	
F	Municipal Chairman's scheme ..	Not known.	Not known.	
G	District Board Engineer's scheme ..			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 347 M., dated 10th May 1896, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows:—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

(True Extract).

R. Parsons,
Secretary.

To the Secretary to Government, Local and Municipa Department,
with papers.

II

Letter—from G. Zellweger, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.
Dated—the 10th May 1898.
No.—227.

I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

4. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town, and would point out in conclusion that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

No. 1031 M., 8TH JUNE 1898.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
(through the Collector of Tinnevelly).
" Sanitary Board.
" " Engineer.

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd } 1898. *Enclosures*
Regd. } *Spare copies*

G.O., No. 1031 M., 8th June 1898.

Tuticorin water-supply scheme.

Stating, with remarks, that Government can do nothing with regard to the — until its financial position is clearer and requesting the Sanitary Engineer to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers :—

I

Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

Read—the following papers :—

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. JONES, Esq., MEM INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. HUGHES, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level. I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
No.—1412.

I have the honour to acknowledge and thank you for your No. 505 T.N of 4th May 1896.

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

Letter—from J. A. JONES, Esq., MEM., INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 19th June 1896.
No.—1913.

I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
No.—801-T. W.

With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

Year.	July.	August.	September.	October.	November.	December.
1886	..	..	..	..	..	..
1887	12·94	12·71	15·54	15·42	15·35	14·67
1888	..	..	..	15·43	14·97	16·38
1889	13·23	11·83	..	15·95	16·00	16·86
1890	12·50	12·62	15·06	16·78	16·20	14·96
1891	..	..	..	14·65	14·30	16·83
1892	13·98	12·93	12·10	15·56	17·25	15·34
1893	12·30	..	..	..	..	..
1894	12·72	..	..	14·50	16·50	18·00
1895	..	..	..	11·55	14·85	14·30
	12·14	..	..	16·49	17·79	18·29

Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

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5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

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2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

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3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

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Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
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Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896, referred to by Mr. Jones in his comparative statement.

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(True Extract).

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To the Secretary to Government, Local and Municipa Department, with papers.

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No. 1031 M., 8TH JUNE 1898.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
(through the Collector of Tinnevelly).
,, Sanitary Board.
,, ,, Engineer.

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd	1898.	*Enclosures*
Regd.		*Spare copies*

G.O., No. 1031 M., 8th June 1898.

Tuticorin water-supply scheme.

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GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers :—

I

Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

Read—the following papers :—

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. JONES, Esq., MEM INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. HUGHES, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level. I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
No.—1412.

I have the honour to acknowledge and thank you for your No. 505 T.N of 4th May 1896.

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

Letter—from J. A. JONES, Esq., MEM., INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 19th June 1896.
No.—1913.

I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
No.—801-T. W.

With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

Year.	July.	August.	September.	October.	November.	December.
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1891	..	..	..	14·65	14·30	16·83
1892	13·98	12·93	12·10	15·56	17·25	18·34
1893	12·80	..	..	..	..	..
1894	12·72	..	..	14·50	16·50	18·00
1895	..	..	..	11·55	14·85	14·30
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Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801 T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained :—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1895.
B	Pumping scheme for 10 gallons per head with 4(months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones' calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,370	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	
F	Municipal Chairman's scheme ..	Not known.	Not known.	
G	District Board Engineer's scheme ..			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows :—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

(True Extract).

R. PARSONS,
Secretary.

To the Secretary to Government, Local and Municipa Department,
with papers.

II

Letter—from G. ZELLWEGER, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.
Dated—the 10th May 1898.
No.—227.

I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

4. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town, and would point out in conclusion that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

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2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

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(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
" Sanitary Board. (through the Collector of Tinnevelly).
" " Engineer.

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

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Read } 1898. *Enclosures*

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3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained :—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1895.
B	Pumping scheme for 10 gallons per head with 4 months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones' calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,270	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	
F	Municipal Chairman's scheme ..	Not known.	Not known.	
G	District Board Engineer's scheme ..			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows :—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

(True Extract).

R. Parsons,
Secretary.

To the Secretary to Government, Local and Municipa Department, with papers.

II

Letter—from G. Zellweger, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.
Dated—the 10th May 1898.
No.—227.

I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

4. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town, and would point out in conclusion that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
(through the Collector of Tinnevelly).
,, Sanitary Board.
,, ,, Engineer.

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd } 1898. *Enclosures*
Regd. } *Spare copies*

G.O., No. 1031 M., 8th June 1898.

Tuticorin water-supply scheme.

Stating, with remarks, that Government can do nothing with regard to the — until its financial position is clearer and requesting the Sanitary Engineer to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers :—

I

Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

Read—the following papers :—

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. JONES, Esq., MEM INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. HUGHES, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
No.—1412.

I have the honour to acknowledge and thank you for your No. 505 T.N of 4th May 1896

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

Letter—from J. A. JONES, Esq., MEM., INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 19th June 1896.
No.—1913.

I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
No.—801-T. W.

With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

Year.	July.	August.	September.	October.	November.	December.
1886	..	..	..	..	..	..
1887	12·94	12·71	15·54	15·42	15·35	14·67
1888	..	..	..	15·43	14·97	16·38
1889	13·23	11·83	..	15·95	16·00	16·86
1890	12·50	12·62	15·06	16·78	16·20	14·96
1891	..	..	..	14·65	14·30	16·83
1892	13·98	12·93	12·10	15·56	17·25	15·34
1893	12·30	..	..	..	..	..
1894	12·72	..	..	14·50	16·50	18·00
1895	..	..	..	11·55	14·85	14·30
	12·14	..	..	16·49	17·79	18·29

Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

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4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

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8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

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Sanitary Engineer to Government.

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2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

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3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

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Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 347 M., dated 10th May 1896, referred to by Mr. Jones in his comparative statement.

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Secretary.

To the Secretary to Government, Local and Municipa Department, with papers.

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G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
(through the Collector of Tinnevelly).
,, Sanitary Board.
,, ,, Engineer.

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd } 1898. *Enclosures*
Regd. } *Spare copies*

G.O., No. 1031 M., 8th June 1898.

Tuticorin water-supply scheme.

Stating, with remarks, that Government can do nothing with regard to the — until its financial position is clearer and requesting the Sanitary Engineer to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers :—

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Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

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Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

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To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. HUGHES, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level. I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never been ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
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I have the honour to acknowledge and thank you for your No. 505 T.N of 4th May 1896.

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

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I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

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Dated—Fort St. George, the 7th July 1896.
No.—2095.

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Dated—Trichinopoly, the 8th July 1896.
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With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

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ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

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Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained :—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1895.
B	Pumping scheme for 10 gallons per head with 4 months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones' calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	
F	Municipal Chairman's scheme ..	Not known.	Not known.	
G	District Board Engineer's scheme ..			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows :—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

(True Extract).

R. Parsons,
Secretary.

To the Secretary to Government, Local and Municipa Department, with papers.

II

Letter—from G. Zellweger, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.
Dated—the 10th May 1898.
No.—227.

I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

4. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town, and would point out in conclusion that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
(through the Collector of Tinnevelly).
" Sanitary Board.
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6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained :—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1895.
B	Pumping scheme for 10 gallons per head with 4 months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones' calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	
F	Municipal Chairman's scheme ..	Not known.	Not known.	
G	District Board Engineer's scheme ..			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows :—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

(True Extract).

R. PARSONS,
Secretary.

To the Secretary to Government, Local and Municipa Department,
with papers.

II

Letter—from G. ZELLWEGER, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.
Dated—the 10th May 1898.
No.—227.

I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

4. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town, and would point out in conclusion that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

No. 1031 M., 8TH JUNE 1898.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
" Sanitary Board. (through the Collector of Tinnevelly).
" " Engineer.

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd } 1898. *Enclosures*
Regd. } *Spare copies*

G.O., No. 1031 M., 8th June 1898.

Tuticorin water-supply scheme.

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GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers :—

I

Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

Read—the following papers :—

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. JONES, Esq., MEM INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. HUGHES, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
No.—1412.

I have the honour to acknowledge and thank you for your No. 505 T.N of 4th May 1896.

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

Letter—from J. A. JONES, Esq., MEM., INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 19th June 1896.
No.—1913.

I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
No.—801-T. W.

With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

Year.	July.	August.	September.	October.	November.	December.
1886	12·94	12·71	15·54	15·42	15·35	14·67
1887	..	..	..	15·43	14·97	16·38
1888	13·23	11·83	..	15·95	16·00	16·86
1889	12·50	12·62	15·06	16·78	16·20	14·96
1890	..	..	..	14·65	14·30	16·83
1891	13·98	12·93	12·10	15·56	17·25	18·34
1892	12·80	..	..	..	..	..
1893	12·72	..	..	14·50	16·50	18·00
1894	..	..	..	11·55	14·85	14·30
1895	12·14	..	..	16·49	17·79	18·29

Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

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J. A. JONES,
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impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

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3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

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5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained :—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
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Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896, referred to by Mr. Jones in his comparative statement.

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(True Extract).

R. PARSONS,
Secretary.

To the Secretary to Government, Local and Municipa Department,
with papers.

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I have the honour to bring the following points to your kind attention.

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(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
(through the Collector of Tinnevelly).
" Sanitary Board.
" " Engineer.

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

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I

Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

Read—the following papers :—

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. JONES, Esq., MEM INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. HUGHES, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
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I have the honour to acknowledge and thank you for your No. 505 T.N of 4th May 1896.

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

Letter—from J. A. JONES, Esq., MEM., INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 19th June 1896.
No.—1913.

I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

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Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
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With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

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STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

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1891	13·98	12·93	12·10	15·56	17·25	18·34
1892	12·80	..	..	..	..	..
1893	12·72	..	..	14·50	16·50	18·00
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Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained:—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1895.
B	Pumping scheme for 10 gallons per head with 4 months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones, calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	
F	Municipal Chairman's scheme ..	Not known.	Not known.	
G	District Board Engineer's scheme ..			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1898, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows:—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

(True Extract).

R. Parsons,
Secretary.

To the Secretary to Government, Local and Municipa Department,
with papers.

II

Letter—from G. Zellweger, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.
Dated—the 10th May 1898.
No.—227.

I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

4. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town, and would point out in conclusion that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
(through the Collector of Tinnevelly).
,, Sanitary Board.
,, ,, Engineer.

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd. / *Regd.* } 1898. *Enclosures* / *Spare copies*

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Tuticorin water-supply scheme.

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7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained :—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1895.
B	Pumping scheme for 10 gallons per head with 4 months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones' calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	
F	Municipal Chairman's scheme ..	Not known.	Not known.	
G	District Board Engineer's scheme ..			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows :—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

(True Extract).

R. PARSONS,
Secretary.

To the Secretary to Government, Local and Municipal Department, with papers.

II

Letter—from G. ZELLWEGER, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.
Dated—the 10th May 1898.
No.—227.

I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

4. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town, and would point out in conclusion that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
(through the Collector of Tinnevelly).
,, Sanitary Board.
,, ,, Engineer.

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd / *Regd.* } 1898. *Enclosures* / *Spare copies*

G.O., No. 1031 M., 8th June 1898.

Tuticorin water-supply scheme.

Stating, with remarks, that Government can do nothing with regard to the — until its financial position is clearer and requesting the Sanitary Engineer to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers :—

I

Proceedings of the Sanitary Board, No. 263 S., dated 21st November 1896.

Read—the following papers :—

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. JONES, Esq., MEM INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. HUGHES, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
No.—1412.

I have the honour to acknowledge and thank you for your No. 505 T.N of 4th May 1896.

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

Letter—from J. A. JONES, Esq., MEM., INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 19th June 1896.
No.—1913.

I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
No.—801-T. W.

With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

Year.	July.	August.	September.	October.	November.	December.
1886	12·94	12·71	15·54	15·42	15·35	14·67
1887	..	..	..	15·43	14·97	16·38
1888	13·23	11·83	..	15·95	16·00	16·86
1889	12·50	12·62	15·06	16·78	16·20	14·96
1890	..	..	..	14·65	14·30	16·83
1891	13·98	12·93	12·10	15·56	17·25	18·34
1892	12·80	..	..	..	..	..
1893	12·72	..	..	14·50	16·50	18·00
1894	..	..	..	11·55	14·85	14·30
1895	12·14	..	..	16·49	17·79	18·29

Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

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Resolution—No. 263-S., dated 21st November 1896.

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impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

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3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

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Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896, referred to by Mr. Jones in his comparative statement.

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(True Extract).

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Secretary.

To the Secretary to Government, Local and Municipa Department, with papers.

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I have the honour to bring the following points to your kind attention.

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No. 1031 M., 8TH JUNE 1898.

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(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
" Sanitary Board. (through the Collector of Tinnevelly).
" " Engineer.

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

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Read } 1898. *Enclosures*
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To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 17th April 1896.
No.—1183.

I have the honour to forward herewith a copy of a statement received from Major Baddelley in 1893 in reference to the Korampallam tank near Tuticorin.

2. In view to some modifications desirable in the scheme for the water-supply of Tuticorin, I have the honour to inquire whether circumstances are improved at the tank so that water is now held up for a longer period during each year since 1893. I understood that by certain arrangements then under contemplation the tank would hold water for a longer period and at a higher level.

3. It is proposed to have a storage tank outside the Korampallam tank which will be filled when the Korampallam tank is full and be indented on only when water is no longer obtainable from the main tank. What we therefore wish to determine is, how many months' supply for the population of Tuticorin must this subsidiary storage tank hold ?

4. An early reply will much oblige.

Letter—from J. A. JONES, Esq., MEM INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 29th April 1896.
No.—1312.

I have the honour to invite your attention to my No. 1183, dated 17th April 1896, and request that you will be good enough to favour me with a reply thereto.

Letter—from W. HUGHES, Esq., Superintending Engineer, VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 4th May 1896.
No.—505—T. N.

I wished to have the statement received with your letter No. 1183, dated 17th April 1896, carried down to date, but as it appears from your reminder that you wish for a reply at once I give you what information I can.

2. The full tank level has not been altered nor has it been proposed to alter it. I do not know what improvements Major Baddelley had in view unless it was something connected with the more efficient working of the surplus sluice. The rules regarding the level to which water may be retained are (1) that is to be limited to 6 feet on the sill to 15th December, (2) to 7 feet from 15th December to 1st January, after which the tank may be filled to 8 feet or full supply level. I am not now prepared to propose any alterations in these rules, as I find the discharging capacity of the escape has never beeen ascertained and observations of high floods have also been rendered of little use through the breaching of the tank.

3. The experience of 1890 and 1892 goes to show that you cannot depend on getting a supply when the south-west monsoon, fails. There must always be some supply in the north-east monsoon, but I should be inclined to say that as long as water is freely issued for irrigation it would be difficult to guarantee even four months' supply to Tuticorin.

4. Although the tank has now been 26 years in existence, the loss from natural causes is excessive. On my inspection in August last I made the following notes :—

"The supply to the town ceased this year in the middle of March, but the registers show that it may cease much earlier in the year. It was resumed towards the end of April and again ceased in the beginning of July, although no water had been issued for irrigation except a trifling quantity for seed beds. The water was $4\frac{1}{2}$ feet on sluice floor in middle of May. The level fell pretty regularly ·10 foot per day, and as the issues will probably not account for more than half of this the loss by evaporation and leakage seems to be about $1\frac{1}{2}$ feet per month. An exact calculation could be made if we had a contoured survey of the north end of the tank."

The high tank bed between the north part of the tank and the escape is 5 or 6 feet above the Tuticorin sluice floor, so that from the time water falls to this level an exact account could be made out of the quantity used and lost. If you find it necessary for your purposes to make such a survey, I shall afterwards give you what assistance I can by having the sluice registers kept with especial care and if necessary shall have measuring weirs built. The tank, however, is made on and with two quite different kinds of soil and observations of it may be an uncertain guide. I fear you will find the soil everywhere in the neighbourhood more or less permeable and that the degree to which it is so can only be ascertained by making an experimental tank.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th May 1896.
No.—1412.

I have the honour to acknowledge and thank you for your No. 505 T.N of 4th May 1896.

2. I presume I am correct in premising that your views briefly are that if a reserve tank be formed to maintain a supply for Tuticorin, that tank must contain at least eight months' supply. I will be obliged if you can supplement the information given by informing me of the average levels of the surface of the Korampallam tank during the months the tank usually receives or supplies, so that I may determine the area of the reserve tank in reference to average depth of water which it is probable will be obtained annually in such tank.

3. If the Korampallam tank surpluses each year, will it be advisable to assume that the full tank level can be depended up long enough to supply through an ordinary sluice an additional tank if a capacity of say 20,000,000 cubic feet or should some level less than the full tank level be adopted.

Letter—from J. A. JONES, Esq., MEM., INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 19th June 1896.
No.—1913.

I have the honour to inform you that I regret to have to request an early reply to my No. 1412, dated 7th May 1896, but Government have again requested an early submission of the Tuticorin project. I shall therefore be much obliged if you will kindly send the information as far as available as soon as possible.

Letter—from J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Superintending Engineer, VI Circle.
Dated—Fort St. George, the 7th July 1896.
No.—2095.

I have the honour to invite your attention again to my No. 1412, dated 7th May 1896, and request the favour of your furnishing the information as early as possible.

Letter—from W. HUGHES, Esq., Superintending Engineer VI Circle.
To—the Sanitary Engineer to Government.
Dated—Trichinopoly, the 8th July 1896.
No.—801-T. W.

With reference to your letter No. 1412, dated 7th May 1896, I have the honour to enclose a statement of average monthly levels of Korampallam tank between July and December for the last ten years from which it would appear that a reserve tank for the supply of the town should contain at least nine months' supply. The water level falls rapidly after December except at the northern end there is very little water in the tank when the level falls below about M.S.L. + 16·00. It will be noticed that in one year there was no supply after July.

2. It cannot be assumed that the present rules under which the tank is allowed to be filled only very late in the north-east monsoon will be always in force. I hope in course of time to make the tank so safe that it can be filled without danger whenever there is water.

ENCLOSURE.

STATEMENT of the average mean sea levels of water in the Korampallam tank from 1886 to 1895.

Year.	July.	August.	September.	October.	November.	December.
1886	12·94	12·71	15·54	15·42	15·35	14·67
1887	..	..	..	15·43	14·97	16·38
1888	13·23	11·83	..	15·95	16·00	16·86
1889	12·50	12·62	15·06	16·78	16·20	14·96
1890	..	..	..	14·65	14·30	16·83
1891	13·98	12·93	12·10	15·56	17·25	18·34
1892	12·30	..	..	..	..	..
1893	12·72	..	..	14·50	16·50	18·00
1894	..	..	..	11·55	14·85	14·30
1895	12·14	..	..	16·49	17·79	18·29

Remarks.— Sill level of fresh water channel head sluice 11·40. Full tank level 19·40 M.S.L.

Report by the Sanitary Engineer to Government, dated 27th July 1896 regarding Tuticorin water-supply.

The Sanitary Board by resolution No. 538 of 24th February advised Government that in order to reduce the cost of the proposed water-supply for Tuticorin the supply to be given might be reduced to 10 gallons per head and the plans revised accordingly. Government in G.O., Mis. No. 435 M., dated 16th March 1896, requested the Sanitary Engineer to submit revised estimate and these are herewith sent for remarks to the Sanitary Board previous to submission to Government.

2. Attention is requested to the comparative statement attached to this report.

3. If the scheme is simply revised at it stood, that is keeping the design the same (with minor alterations) but adapting dimension of filter reservoir and pipes to the 10 gallon supply, the reduction will be (including Rs. 28,661 for establishment now required) a total of Rs. 46,450 (less a slight increase of Rs. 160). It will be seen that if establishment had still to be paid for the reduction would have been only some Rs. 18,000 which is hardly worth making.

4. No reduction, it will be observed, has been made in the size or cost of the reserve tank nor of the conduit, as to the former my remarks later on explain why this is so; as to the latter its size is incapable of reduction as it could not be constructed of smaller size at any less cost.

5. If the estimate however is revised in view of present information and keeping in view the requirements of the Sanitary Board in regard to Gill's apparatus, the estimate will have to be increased to a sum of Rs. 3,30,000 or Rs. 10,570 more than the original estimate.

6. The main reason for this is that, as the accompanying correspondence with the Superintending Engineer shows, the reserve tank under the existing conditions of the Korampallam tank is too small under existing restriction in regard to that tank which cannot meantime be altered. (*Vide* Superintending Engineer's No. 505 T.W. of 4th May 1896). In the original design it was calculated that a reserve supply for 3 or 4 months would be sufficient and that the reserve tank could be filled up each year to a level of 19·40 because it was hoped that arrangements would be made in connection with the Korampallam tank which would allow it to be filled to full tank level at the very earliest possible date during the monsoon.

7. The Superintending Engineer (*vide* his No. 801-T.W. of 8th July 1896) now states that though the restriction affecting the filling of the tank may not always be permanent, he advises that a supply for 9 months should be maintained in the reserve tank (the supply in other 3 months being obtained from the main tank); though the full tank level is 19·40, for calculation of storage the level cannot be assumed higher than 16·00 (in certain years it did not rise to this)—*vide* statement attached to letter above quoted. This would of course make the tank much larger even allowing for 4 months' reserve only. The size required for 9 months' consumption is shown on drawings. The tank is divided in three portions, each in connection with the conduit, so that 1 or 2 portions may be first constructed until experience shows exactly what is necessary in reference to the condition under which the Korampallam tank may be worked at the time the scheme is under construction.

8. The increased size of tank increases the estimate by Rs. 29,672 (bunds) + Rs. 7,240 (sluices) + Rs. 8,136 (land, etc).

9. The only other increase of importance in estimate is Rs. 11,360 for Gill's filter arrangement which is shown on plan but which under the circumstances might be omitted.

J. A. JONES,
Sanitary Engineer to Government.

P.S.—Evaporation has not been allowed for as scheme is for 34,000 people whereas there are only 25,000 to be provided for at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable.

J. A. JONES.

Resolution—No. 263-S., dated 21st November 1896.

In July 1893, the Sanitary Engineer submitted to Government a pumping scheme providing for a supply of 15 gallons per head and estimated to cost Rs. 3,19,430. This scheme appears to have been referred for report to the Collector of Tinnevelly who laid before Government in August 1895 two gravitation schemes—one proposed by the Chairman, Municipal Council, Tuticorin, and the other by the District Board Engineer, Tinnevelly. Both these schemes were referred to the old Sanitary Board for remarks. The Board holding the pumping scheme to be decidedly preferable to the gravitation schemes, proposed to Government that before the gravitation schemes were examined in detail, it should be ascertained whether the Municipality could or could not undertake the pumping scheme. The Government, however, pronounced the pumping scheme as one beyond the means of the Municipality and consequently impracticable. The Sanitary Board, thereupon, took into consideration all the schemes propounded, including the pumping scheme, and arrived at the conclusion that "it is

impossible to arrange a satisfactory supply to Tuticorin without pumping." The Board accordingly recommended to Government that the original scheme of the Sanitary Engineer, viz., the pumping scheme, might be revised by reducing the supply per head from 15 to 10 gallons. This proposal met with the approval of Government, and the Sanitary Engineer was called upon to submit revised estimates accordingly.

2. In pursuance of this order, the Sanitary Engineer submitted for the approval of the Sanitary Board in the first instance two schemes—one for Rs. 2,73,140, retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply; and the other for Rs. 3,30,000 providing, in addition to the modifications of the original scheme referred to above, for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended; and

(2) chambers for Gill's arrangements for filters.

3. The President of the Sanitary Board concurred with the Sanitary Commissioner in thinking that it was quite useless to submit to Government an estimate for Rs. 3,30,000, the Government having already decided that the original estimate for Rs. 3,19,430 was impracticable for financial reasons. He, therefore, suggested that if a cheaper scheme could not be devised, the Sanitary Engineer should report accordingly. The Sanitary Engineer then proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoir. Even this amount was considered excessive by the President, Sanitary Board, who, therefore, desired the Sanitary Engineer to say definitely whether it was impossible to prepare a cheaper gravitation scheme.

4. The Sanitary Engineer now submits a scheme of this kind, which, though more expensive in first cost than the pumping scheme which was estimated at Rs. 2,68,334, is cheaper in annual cost; the maintenance and working expenses being less. In this scheme, the service reservoir, the filters, the pumping house and engines are all omitted.

In all the schemes put forward by the Sanitary Engineer except the first for Rs. 3,19,430 (for 15 gallons) the supply per head is 10 gallons. The inadequacy of such supply for the population of Tuticorin has been pointed out by the Municipality.

5. The following statement shows the cost, both capital and working, of each scheme proposed, so far as can be ascertained :—

Items.	Scheme.	Capital cost.	Annual working cost.	Remarks.
		Rs.	Rs.	
A	Pumping scheme for 15 gallons per head with 4 months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office note No. 2070-S., dated 18th November 1895.
B	Pumping scheme for 10 gallons per head with 4 months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in the statement are based on Mr. Jones' calculations in the case of schemes D and E.
C	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank.	3,30,000	18,310	
D	Pumping scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,370	
E	Gravitation scheme for 10 gallons per head with 9 months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	
F	Municipal Chairman's scheme ..	Not known.	Not known.	
G	District Board Engineer's scheme ..			

Note.—The capital cost of each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896, referred to by Mr. Jones in his comparative statement.

6. The Sanitary Engineer, who has been consulted by the Sanitary Board, states that, though he prepared scheme E, he does not recommend it. Neither does he recommend schemes A or B, because Tuticorin (under existing conditions) would be without water a part of the year. He is of opinion that if scheme C cannot be afforded, scheme D should be adopted, as this scheme can have a filter and service reservoir added at any time.

The Sanitary Commissioner notes as follows :—"As there can be no possible difference of opinion as to the sanitary merits of the schemes (so far as yet presented for consideration) there can be no object of undersigned making any remarks on the subject."

7. After careful consideration of all the schemes presented the present Sanitary Board agree with Mr. Jones in recommending scheme D, if Government consider scheme C too expensive. These two schemes are in the opinion of the Board superior to any of the others.

Gravitation scheme E, however, possesses financial advantages which entitle it to some consideration. It is very little more expensive than scheme D in first cost, and it stands first as to economy of working. But there are disadvantages which must also be taken into account. The service reservoir, the filters, pumping house and engines are all omitted. For each fountain is substituted a pump so that the inhabitants must themselves pump all the water they require, and no hydrant can be used.

(True Extract).

R. Parsons,
Secretary.

To the Secretary to Government, Local and Municipa Department, with papers.

II

Letter—from G. Zellweger, Esq., Chairman Delegate, Municipal Council, Tuticorin.
To—the Secretary to Government, Local and Municipal Department.
Dated—the 10th May 1898.
No.—227.

I have the honour to bring the following points to your kind attention.

1. That His Excellency Sir Arthur Havelock and several of his predecessors have given promise to expedite the water-supply scheme of this town and that Government was graciously pleased to promise to contribute a moiety of the outlay.

2. That, in G.O., Mis. No. 1571 M., dated 16th September 1896, this Municipality was given to understand that a cheap gravitation scheme would be prepared by the Sanitary Engineer and submitted to Government.

3. That nothing more has been heard since and that the population which has since grown to about 40,000 are left without a single drop of water during this present hot weather.

4. I would, therefore, urge upon Government the necessity of fixing, without further delay, upon some particular scheme suitable to the financial and sanitary position of this town, and would point out in conclusion that it is only after some particular scheme has been devised that the question of financing same can be taken on hand.

Order—No. 1031 M., dated 8th June 1898.

As the adoption of any particular scheme of water-supply for the town must depend mainly on the amount of contribution or aid which Government can afford to give to the Municipal Council, the Government regrets that nothing can be done until its financial position is clearer. Meanwhile, the Municipal Council should do its best to improve the existing tanks and wells in the town.

No. 1031 M., 8TH JUNE 1898.

2. The Sanitary Engineer is requested to state what progress has been made in the preparation of the cheap gravitation scheme referred to in his letter No. 2741, dated 4th September 1896.

3. The Chairman's letter should have been submitted through the Collector as required in G.O., No. 1162 M., dated 4th September 1893.

(True Extract.)

G. S. FORBES,
Secretary to Government.

To the Chairman, Municipal Council, Tuticorin
" Sanitary Board. (through the Collector of Tinnevelly).
" " Engineer.

LOCAL AND MUNICIPAL DEPARTMENT.

NOTES CONNECTED WITH G.O., No. 1031 M., DATED 8TH JUNE 1898.

[SUBJECT.—*Tuticorin water-supply scheme.*]

From the Sanitary Board, dated 21st November 1896, No. 263-S.

The history of the schemes for the water-supply of Tuticorin originally proposed by the Sanitary Engineer, is given in the note for orders stitched with G.O., No. 75 M., dated 16th January 1896. In that order the pumping scheme approved by the Sanitary Board was declared to be impracticable on financial grounds and the Board was requested to consider the two gravitation schemes estimated to cost Rs. 1,00,000 and Rs. 1,61,850 respectively, proposed by the Chairman of the Municipal Council and the Local Fund Engineer. On this, however, the Sanitary Board in its resolution No. 538, dated 24th February 1896, came to the conclusion that it was impossible to arrange for a satisfactory supply of water to Tuticorin without pumping and recommended that the original pumping scheme of the Sanitary Engineer might be revised by reducing the supply per head from 15 to 10 gallons. This recommendation of the Sanitary Board was approved by Government and in their order No. 435 M., dated 16th March 1896, the Sanitary Engineer was requested to submit revised estimates. The Municipal Council in its resolution thereon expressed the opinion that even on sanitary grounds 10 gallons per head would be quite insufficient and that fully 15 gallons would be required for each person in the town and as it still thought that pumping might with advantage be dispensed with, the Government were requested to reconsider their decision in the matter. But this letter was recorded in G.O., No. 1277 M, dated 31st July 1896, pending receipt of the revised estimate called for from the Sanitary Engineer.

2. With reference however to the Government Order of March 1896 quoted above, the Sanitary Engineer in the first instance submitted for the approval of the Sanitary Board, two schemes, one for Rs. 2,73,140 retaining the design of the original scheme with minor alterations but adopting dimensions of filter, reservoir and pipes to the 10-gallon supply and the other for Rs. 3,30,000 providing in addition to the modifications of the original scheme referred to above for—

(1) such an increase in the size of the reserve tank as would render it capable of holding nine months' supply of water, instead of only four months' supply as originally intended, and

(2) chambers for Gill's arrangements for filters.

The Sanitary Board, however, considered these two schemes as impracticable for financial reasons and asked the Sanitary Engineer to state if a cheaper scheme could not be devised. On this, the Sanitary Engineer proposed to reduce the cost of his scheme to Rs. 2,68,334 by omitting filter beds and service reservoirs. As this amount was also considered by the Board to be large, the Sanitary Engineer submitted a gravitation scheme, which though more expensive in the first instance than the pumping scheme costing Rs. 2,68,334, involved a cheaper annual cost. In this scheme the service reservoir, the filters, the pumping house and engines are all omitted.

3. The following statement given by the Sanitary Board shows the cost and working charges of the several schemes above referred to:—

Items.	Scheme.	Capital cost.	Annual working charges.	Remarks.
		Rs.	Rs.	
A.	Pumping scheme for 15 gallons per head with four months' supply in the reserve tank.	3,19,430	18,000	That the working cost is Rs. 18,000 per annum appears from the Sanitary Commissioner's office-note No. 2070-S., dated 18th November 1895.
B.	Pumping scheme for 10 gallons per head with four months' supply in the reserve tank.	2,73,140	16,720	The working cost has not been given by the Sanitary Engineer. The figures in statement are based on Jones' calculations in the case of schemes D and E.
C.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank.	3,30,000	18,310	
D.	Pumping scheme for 10 gallons per head with nine months' supply in the reserve tank (filters and service reservoir omitted).	2,68,334	14,970	*Note.*—The capital cost in each of the schemes B to E does not include provision for "establishment." This omission appears to be authorized by G.O., No. 847 M., dated 10th May 1896 referred to by Mr. Jones in his comparative statement.
E.	Gravitation scheme for 10 gallons per head with nine months' supply in the reserve tank (filters, service reservoir and pumps omitted).	2,78,000	11,100	....
F.	Municipal Chairman's scheme	1,00,000	Not known.	....
G.	District Board Engineer's	1,61,850	Do.	....

4. After a careful consideration of all the schemes the Sanitary Board agrees with the Sanitary Engineer in recommending scheme D, if Government considers scheme C too expensive.

5. If scheme D, being the cheaper of the two schemes approved by the Sanitary Board, is undertaken and if the Government makes a grant to the Council of half the cost as already promised and lends the balance at $4\frac{1}{4}$ per cent. interest, the amount required to liquidate the loan in 30 years would be Rs. 7,996, which together with the working charges of Rs. 14,970 represents an annual expenditure of Rs. 22,966. This would however be reduced by Rs. 596, if a sum of Rs. 10,000 out of the current balance reserved for the water-supply scheme is deducted from the loan now required.

6. In the existing state of affairs this sum is beyond the means of the Municipality; but if the proposal to raise the rates of the taxes on houses and lands and the water-tax from $7\frac{1}{2}$ to $8\frac{1}{2}$ and 4 to 8 per cent. respectively is passed into law and if the tax on arts is extended to all the classes of the schedule, then the additional income which may be expected would be—

	Rs.
Water-tax	15,799
House and land tax	4,443
Arts tax	585
Total ..	20,827

Thus the total amount available from all the sources will be Rs. 20,827 or Rs. 1,543 less than the amount required by the Municipal Council. Leaving altogether out of account the annual income expected from the South Indian Railway Company, the above deficit can easily be met by thoroughly revising the taxes on buildings and lands—*vide* the notes stitched with G.O., No. 180 M., dated 6th February 1895.

7. In these circumstances it is submitted that the Sanitary Board's recommendation to undertake scheme D may be approved.

V. RAGHAVA CHARLU—16-1-97.

Scheme C should, if possible, be approved. I have always been of opinion that Tuticorin is very much under-assessed all round: but I do not believe we shall have the assessment properly imposed unless (as I suggested when I was Collector of Tinnevelly) a special officer is deputed to do the work.

2. Would it not also be reasonable to ask Port funds to make a contribution?

G. S. FORBES—18-1-97.

I don't find any report of the Sanitary Engineer's forwarding scheme E and explaining the estimated cost of maintenance, under that scheme, of Rs. 11,100. I should like further information, for I don't understand why that scheme should be so summarily rejected. Nor, I may say, do I comprehend the intrinsic superiority of a pumping to a gravitation scheme, which seems to be assumed as a fact.

2. Why have schemes F and G not been examined?

3. Please send up some sort of plans by means of which I may be able to understand the various schemes.

4. Also please state whether, in view of the fact that, as I understand, the Korampallam tank has just breached, it is worth while to go on with any of these schemes. My impression is that the Korampallam tank or the channel supplying it breaches every two or three years. If so, why shouldn't Mr. Jones' proposed nine months' supply tank breach also and all the proposed expenditure be wasted? Mr. Hughes probably knows more about all these matters than any one else. Please consult him personally and let me know what he thinks.

5. It is all very well to say that the assessments at Tuticorin might be brought to a much higher standard if a special officer were put on. I daresay they might be. But it would not, I think, be safe to sanction a scheme for the supply of Tuticorin on the chance.

H. W. B[LISS]—19-1-97.

Draft demi-official to Mr. Hughes.

G. S. FORBES.

Please see draft demi-official put up.

V. RAGHAVA CHARLU—22-1-97.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated the 25th February 1897.

I received the plans of the Tuticorin water-supply scheme two days ago, but have not been able to examine them until to-day. I do not wish to offer any opinion on the proposed distribution works and confine my remarks to the works which concern me as an Irrigation officer, viz., the reserve tank and conduit.

2. At first Government charged for all the water issued from Korampallam tank but afterwards, for reasons into which I need not enter, it was conceded that only the water reaching the service reservoir should be charged for. I cannot say whether water is now paid for on measurement or otherwise. The quantity issued from the tank is about six times what reaches the town, and irrigation under the tank is carried on with much difficulty and greatly restricted owing to the large supply drawn off for Tuticorin and the system of giving the town the preference as long as the supply lasts. In this way I think Government loses Rs. 2,000 to Rs. 3,000 per annum. The construction of a water-tight conduit should have been insisted on long ago. The proposal now is to make a reserve tank, to be filled from the Korampallam tank and keep the water for use when the Korampallam supply gives out. The reserve tank is undoubtedly required if the town is to be supplied throughout the year and I have already expressed my opinion that it should be made large enough to contain nine months' supply. It will not however be filled every year but receive partial fillings during freshes and be filled at some time each year to the highest level reached in the Korampallam tank. Regarding the site of the reservoir I A notice that it does not appear to have been taken into account that there is a bye-wash near the left flank of the Korampallam tank which is intended to

discharge when there is a higher flood than the Oopar oday dam can dispose of or when there is danger to the bund. The water from this goes past Korampallam village and crosses the fresh water channel in the low ground not very far from the sluice. There should be a space of a few hundred feet left between the road and the reservoir bank. The next point is that the site is for the most part wet land for which no compensation is provided in the estimate. I do not know whether it is intended to make the bund of earth dug close by. The rate apparently provides for bringing earth from a good distance. In my letter of 4th May, which is in the file, I gave reasons for thinking that the waste by leakage and evaporation from the Korampallam tank is probably 1½ feet a month. Mr. Jones has taken no notice of this but apparently adheres to his estimate of 5 inches a month loss from the new tank, evidently expecting to stop all leakage by the puddle wall extending to 4 feet below the tank bed. Perhaps he has had excavations made and found a clay bed at that level. If he has not done so, I think a thorough examination of the place should be made, or a leaky tank would be useless, and if the matter cannot be placed beyond doubt in any other way a small tank might be made as an experiment and filled by baling from the fresh water channel.

B **C** **D**

There is notoriously great leakage.
G. S. Forbes.

3. Regarding the conduit which it is proposed to build in the bed of the fresh water channel, I think it might be found impossible to build the whole four miles in one season while the Korampallam tank is dry and in time to allow it to set before the supply begins. It will take 2,500 tons of bricks which have to be carted about 20 miles or railed 30 and carted 3, but of course they could be prepared in advance. Why not have 15″ or 18″ cement or glazed earthenware pipe which could be laid in a very short time and would be stronger than and as water-tight as the culvert, while costing very much less.

E

I return the papers and plans.

Demi-official from G. S. Forbes, Esq., I.C.S., Secretary to Government, Local and Municipal Department, to the Sanitary Engineer to Government, dated the 26th February 1897, *No.* 22.

Please see Hughes' letter.

2. The Honourable Member asked me to consult him. Can you throw light on his difficulties—see specially points marked **A, B, C, D, E.**

Demi-official from J. A. Jones, Esq., Sanitary Engineer to Government, to the Secretary to Government, Local and Municipal Department, dated 1st March 1897, *No.* 406.

Herewith notes on Mr. Hughes' remarks as to Tuticorin water-supply scheme, which I think fully reply to his criticisms.

Tuticorin Water-supply.

1. **A**—Bye-wash near the left flank of the Korampallam tank.—There is a space of not less than 150 feet below the road and reservoir bund. The bund of the new tank is farther from the road than the channel so that there has been no interference with any course through which water may be discharged from the bye-wash. The crossing is evidently by the channel crossing the fresh water channel, and this has not been interfered with.

2. **B**—The site is for the most part wet land and for which no compensation is allowed in the estimate.—Compensation for land taken up for the reserve tank *is* provided in the estimate—*vide* Sanitary Engineer's estimate, page 12, dated 27th July 1896. Again look at paragraph 8 of report, dated 27th July 1896, where *an increased* allotment for land is referred to.

3. **C**—Whether it is intended to make the bund of earth dug close by.—In paragraph 19 of the Sanitary Engineer's letter No. 1538, dated 27th July 1893, embodied in G.O., Mis. No. 159 M., dated 14th February 1894, he says "The tank is proposed to be formed of simple banks without pitching, the slopes are 2½ to 1 both inside and out with a puddle wall in the centre. The soil is very sandy and there is no economy to be obtained by making the banks with steeper slopes as sand hills and other excavations in the bed of the tank give the quantity of earth sufficient to make the banks of the section proposed. The banks will be *turfed* and the top of the tank will be 4 feet above the maximum water level of the tank.

The data for the rate of Rs. 6-8-0 per 1,000 cubic feet are—

	Rs.	A.	P.
One thousand cubic feet earthwork	2	12	0
One hundred and eighty yards lead at As. 6 for 20 yards	3	6	0
Two yards lift at As. 3	0	6	0
Total ..	6	8	0

4. **D**—Perhaps he (Sanitary Engineer) has had excavations made and found a clay bed at that level.—In estimating the area of the proposed tank, the Sanitary Engineer in his report, dated 27th July 1896, says: "*Evaporation has not been allowed for, as scheme is for* 34,000 *people whereas there are only* 25,000 *to be provided for* at present and by the time the population increases to 34,000, the condition of the Korampallam tank may be altered and the proper full tank level obtainable."

5. There is no evidence of any clay bed below the sandy soil, and it would be inexpedient to arrange for tank taking into account a high evaporation and leakage for 34,000 when only 25,000 will use water at first and will probably not use even 10 gallons, and when it may be the case that by the time 34,000 people have to be provided for, the Korampallam tank may be filled to its proper level. The area of the tank altered is based on only a level of 16·00 and not 19·40 which is the proper full tank level.

6. **E**—Why not have 15″ or 18″ cement or glazed earthenware pipe which could be laid in a very short time and would be stronger than, and as water-tight as, the culvert while costing very much less.—Mr. Hughes suggests a 15″ or 18″ pipe. A 12″ pipe or less might be similarly suggested, but what is required is a 21″ pipe or else the full quantity of water for 34,000 people will not be obtainable. And this is a portion of the work which must be made full size at once. But even if an 18″ pipe was allowable, the cost would be more than what is proposed—*vide* the following:—

The cost of 21″ masonry culvert for a length of 22,100 feet as estimated is Rs. 44,472 or, say, Rs. 2 a foot.

The cost per foot of cement and stoneware pipes is as below:—

	Rs.	A.	P.
21″ cement pipes (laid)	3	0	0
21″ stoneware pipes, Burn & Co.'s at Calcutta (exclusive of conveying charges and laying)	4	0	0
18″ stoneware pipes, Burn & Co.'s (delivery at Calcutta exclusive of conveying charges and laying)	2	8	0
18″ Doulton's stoneware pipes (delivered at Bombay)	3	8	0
15″ do. do.	2	8	0

7. The above rates clearly show that cement or stoneware pipes cannot be substituted for a masonry conduit, so that even if the fall were increased and much expenditure incurred in excavation and extra cost for filter, for service reservoir, for engine and for pumping and pipes so small as 15″ used, there would be no economy but the reverse.

8. Bricks quite good enough for the conduit are obtainable 10 miles from Korampallam. The culvert would be built in lengths, the channel being replaced by iron pipes during the building of the lower portion so that the building might occupy any length of time and the supply still go on.

Demi-official from H. A. Sim, Esq., I.C.S., Private Secretary to His Excellency the Governor, to the Secretary to Government, Local and Municipal Department, dated 2nd March 1897, No. 39.

With reference to the enclosed, which please return, I shall be glad if you will send up the papers regarding the Tuticorin water-supply scheme for His Excellency's information.

ENCLOSURES.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Private Secretary to His Excellency the Governor, dated 16th February 1897, No. 97.

I beg to submit a copy of my motion and the resolution of the Municipal Council, dated 12th instant, and request you will be so good as to let me know whether His Excellency will be pleased to grant an interview to the members of the deputation.

2. The members intend starting to Madras as early as possible before the end of this month.

Letter from M.R.Ry. J. M. B. Roche Victoria Avargal, Chairman, Municipal Council, Tuticorin, to the Municipal Councillors, Tuticorin.

It is now so many years since a water-supply scheme to our town has been proposed, discussed, and submitted and over and over we represented to the Government the miseries and hardships of the people especially in times of droughts which are so frequent but up to date nothing definite has been done.

2. There has been some consolation to us when we heard from Government a few months ago that the Sanitary Engineer has been asked to prepare estimates to a less expensive water scheme on gravitation principle. There it lies and God knows when it is going to come.

3. It is a wonder that epidemics of most serious nature did not break out in this town; because, exclusive of the impurity of the water which the people have to drink, in times of water-supply failures, even the water we get from Korampallam tank by open channel is impure and subject to various pollutions. It will be unsafe no doubt to expect such special protections of Providence any more, unless the scheme is taken up at once. I am afraid most serious consequences are in store for this unfortunate town. Many towns which are very much less in importance receive the attention of Government, and water schemes are sanctioned and carried out without delay; whereas this town which is only next in importance of trade to the metropolis is ignored altogether. I am sure His Excellency the Governor will be only pleased to sanction the water scheme if he is only properly informed of the sufferings and miseries of the people for want of water-supply.

4. I therefore beg to propose that three members of the Council be selected and requested to wait on a deputation on His Excellency the Governor and lay before him the real state of affairs in this town for want of a water scheme.

Extract from the Proceedings of the Municipal Council, Tuticorin, dated 12th February 1897.

* * * * *

Read motion from the Chairman regarding water-supply scheme to this town.

Resolution No. 7.—Resolved that Captain Baker, the Chairman, and Rev. Mr. Gnanakan be requested to wait on His Excellency the Governor on deputation regarding the water scheme.

* * * * *

Herewith the file about Tuticorin.

To the Private Secretary. G. S. FORBES.

Seen and returned with thanks.

A. E. H[AVELOCK]—6-3-97.

Demi-official from W. Hughes, Esq., Chief Engineer for Irrigation, to the Secretary to Government, Local and Municipal Department, dated 10th March 1897, No. 46.

I return the Tuticorin water-supply papers. Jones has been to see me and I understand him to agree that the storage reservoir should have its bed puddled $1\frac{1}{2}$ feet deep. With regard to the distance between the reservoir and the road, the men, who is carrying out the work, can see that enough space is left. I think there should be 300 feet.

2. It seems that it is considered inadvisable to lower the bed of the filter beds. It is not for me to say. Assuming them 7·40 I suppose a conduit $1\frac{3}{4}$ feet diameter is required. This is for Campbell to decide. All I am concerned about is that the reservoir and conduit or at least the latter should be built soon. I am afraid anybody who expects the Public Works Department to build the conduit in one dry season will be disappointed.

To the Local and Municipal Department.

LOCAL AND MUNICIPAL DEPARTMENT.

As the adoption of any particular scheme must depend largely on the amount of contribution or aid, Government can afford to give to the Municipality, this file must, until the financial position is clearer, lie over.

G. S. FORBES—28-5-97.

Yes, he should.

A. E. H[AVELOCK]—25-5-98.

I don't think the draft is enough. The Sanitary Engineer should be asked what he has been doing since the issue of G.O., No. 1571 M., dated 16th September 1896.

H. W. B[LISS]—20-5-98.

I concur.

2. The Tuticorin water-supply is, as far as my information guides me, the most pressing and important of those before us. In the linked file, the Tuticorin water-supply scheme and all others are ordered to lie over until our financial position is clearer. Our revenue is coming in well. Perhaps Sir H. Bliss would consider whether a further step towards getting this Tuticorin scheme set on foot might now be taken.

A. E. H[AVELOCK]—20-5-98.

Circulated to the Honourable Member again.

H. TREMENHEERE—21-5-98.

I am afraid there is very little chance at present of our having funds to forward any water and drainage schemes other than those entered in the budget (Tirupati, Rs. 77,400, Vizagapatam, Rs. 20,500 and Cocanada, Rs. 52,100). It is true that our revenue is coming in well, but (1) if we get an extra and unanticipated 20 lakhs this year, we could not use it, for we are limited as to expenditure to the provision made on the expenditure side of the budget, and (2) the first charge on any increase of revenue we may get will be provision for restoring our balance to the stipulated minimum of 20 lakhs. As the budget for 1898-99 stands, we shall close the year with a balance of 6·08 only. We have therefore a sum of Rs. 13·92 to make good from our annual surpluses of revenue over expenditure before we shall be restored to a state of solvency.

2. Another reason why we cannot at present help forward Municipal water and drainage schemes is that no allotment has been made us at present wherefrom we can grant loans to Municipalities. The Municipal Councils will therefore have to raise money in the open market, instead of borrowing from Government at 4 or $4\frac{1}{4}$ per cent. with the bank rate at 12 per cent., it is unnecessary to labour the point that they cannot hope to raise loans in the open market on any terms which they can afford.

3 Our position will not improbably be raised during the year by the fact that we shall not need to spend on famine relief the whole sum of Rs. 8·50 which has been provided. But on the other hand, we only provided half a lakh, I think, for plague expenditure, which won't be anything like enough. We shall probably spend 2 or 2½ lakhs on plague preventive measures, even if plague does not actually break out: if it does, no one can say how much, perhaps 10 to 15 lakhs. Moreover, if we have any savings out of the budget provision for famine, they are already appropriated to the scheme for the better payment of the taluk establishments, if sanctioned by the Secretary of State, as I have little doubt they will be.

·50 under 24. Medical—Provincial.
C. M. Schmidt.

Also additional Munsif's Courts.
C.M.S.

4. I have written the above partly from memory and partly from reference to the original (preliminary) issue* of the civil estimates, so the Financial Department had better see before this goes to His Excellency and correct any errors I may have made.

* Dated 14th January 1898.

H. W. B[liss]—21-5-98.

To the Financial Department with reference to the Honourable Member's note.

H. Tremenheere—23-5-98.

Financial Department.

Honourable Member's figures have been corrected with reference to the figures in the Financial statement.

C. M. Schmidt—23-5-98.

A. T. A[rundel]—23-5-98.

I accept, with regret, the draft Government Order. But, I should be glad if this matter be brought to notice after the lapse of four months, when perhaps our financial position may have become more assured.

A. E. H[avelock]—25-5-98.

To the Local and Municipal Department.

Local and Municipal Department.

Issue the draft.

G. S. Forbes—6-6-98.

[G.O., No. 1031 M., dated 8th June 1898.]