DAR ES SALAAM WATER SUPPLY PROBLEMS AND POSSIBLE SOLUTIONS: Reflections

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ABSTRACT

Dar es Salaam is the largest and most rapidly growing city, (with a growth rate of about 7% per annum) in Tanzania with an estimated population of over 2.8 million people. Like all Regional Headquarters Water Supplies and Water Supply to Dar es Salaam City residents is inadequate. Since 1982 water demand has exceeded total water production capacity of the three plants namely Mtoni; Upper Ruvu and Lower Ruvu. In 1989 the estimated water demand was about 289,760 m³/day while total estimated water production was about 239,560 m³/day. giving a deficit of 50,000 m³/day. Estimated production from the three plants is Mtoni 4,520 m³/day, Upper Ruvu 54,340 m³/day and lower 180,800 m³/day (Ministry of Water, 1989). The location of the plants and the main pipeline network is as shown of Figure 1 below.

The problems of water supply can be those of quantity and invariably those of quality. There is not a doubt that the supplied quantity has been exceeded by the demand. In future this demand will be beyond what the present sources can ever supply. There is therefore a need to develop other augmentation systems through short term and long term plans. Under short term solutions shallow wells, boreholes and rain water harvesting should be considered. Long term solutions should include development of the Kizinga and Mzinga reservoirs which would release up to 1,000 m³/day. The development of the proposed Kidunda reservoir upstream of the present Ruvu intakes will enhance the supply up to 2.2 million m³/day which surpasses the year 2020 demand of about 1,000,000 m³/day.

The quality of water from deep boreholes is usually of acceptable levels in terms of physical, chemical and bacteriological parameters. In some cases the quality does not meet the Tanzania Standard, therefore calls for treatment. Saline water intrusion is another problem to be tackled especially for ground water exploitation along the coastal belt. Shallow wells which are invariably from shallow aquifers are prone to pollution. It is therefore to be expected that their waters will need treatment. Often shallow wells do not produce water which meets the international standards in terms of chloride, nitrate and pathogenic organisms quality.

This paper is an attempt to highlight the water problems facing the Dar es Salaam residents and propose possible solutions to the same. The paper points out the possible short and long term solutions.

Keywords: Unaccounted for Water, Water Resources Management, Kidunda Reservoir Development, Ground Water Development and Quality, Nitrate Problems in Groundwater Sources.

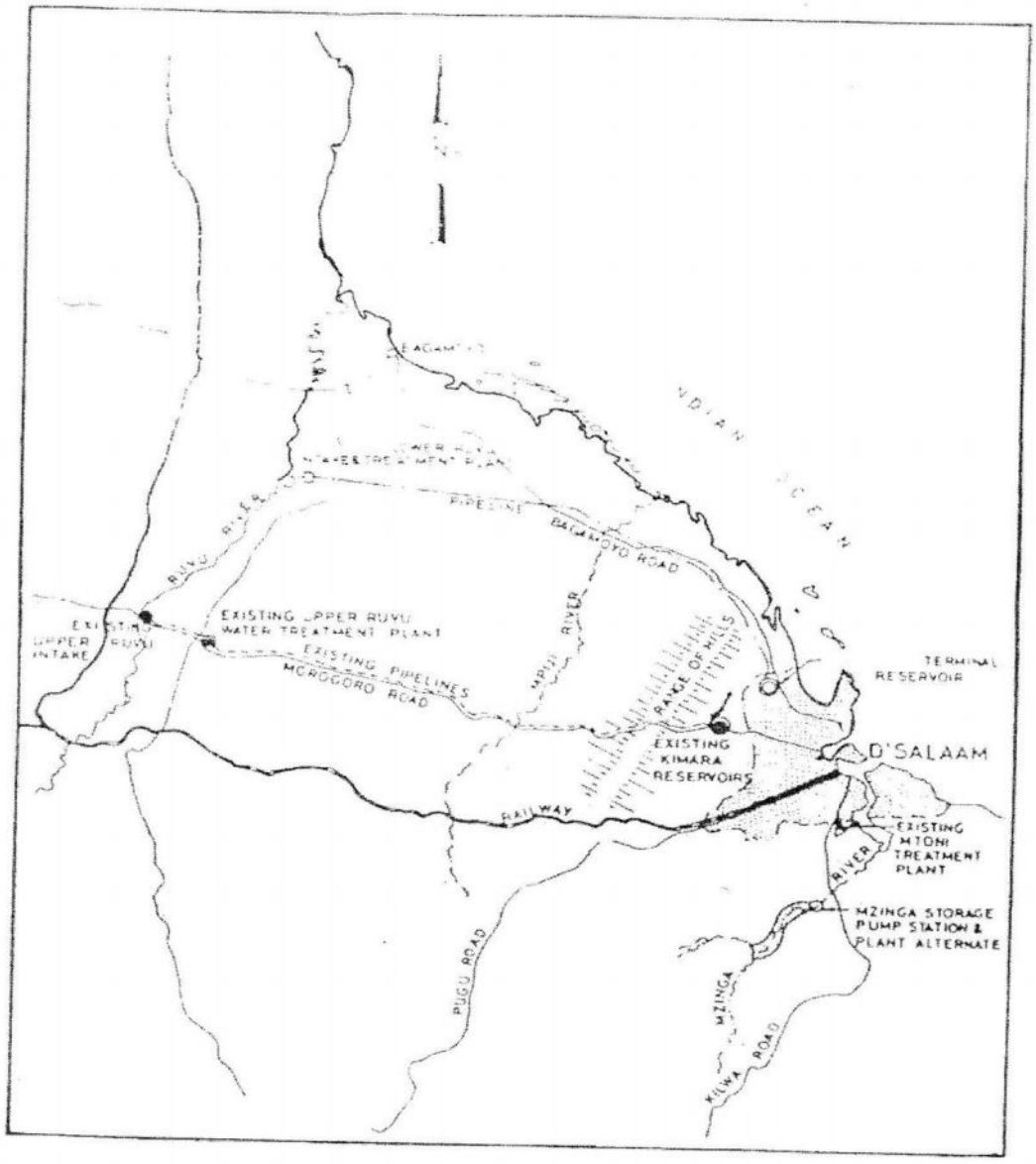

Figure 1: Existing water supply systems for Dar es Salaam (Strilchuck, 1976)

WATER QUALITY PROBLEMS

Groundwater sources

Generally the groundwater in Dar es Salaam contains quantities of mineral salts and is moderately hard. However, isolated cases colour and turbidity are excessive. In such cases treatment of the water is therefore required. The chemicals to be used are alum and chlorine compounds. Some shallow water sources may have faecal pollution thus necessitating disinfection. Based on organoleptic considerations the concentration of chloride should not exceed 250mg/L. some wells in Dar es Salaam have exhibited higher values, as situation confirmed by electrical conducitty measurements. Samples of five boreholes made in the recent Dar es Salaam boreholes programmes are used to exemplify the augment in Tables, 1 and 2.

High levels of nitrates have been recorded in some of the water samples tested. Prolonged nitrate intake is known to be the causative of methemoglobinemia disease in infants, popularly known as blue baby disease.

A borehole drilled in Ukonga has given a pH value of 5.3, which is not only acidic, but differs significantly with the results of other groundwater samples collected within Dar es Salaam city. The experience shows that pH of groundwater in Dar es Salaam vary from 6.6 to 8.3. This is attributed to high lime content in the soil and water; it is therefore highly unlikely to find groundwater with low pH.

Table 1 Groundwater water quality results for some boreholes around Dar es Salaam

No.	Parameter	Water Sources				
		B/H (A)	B/H (B)	B/H (C)	B/H (D)	B/H (E)
1	pH	7.5	8.29	7.33	6.64	5.3
2	Turbidity NTU	NIL	1051	1	5	4
3	E. Conductivity us/cm	1255	1050	796	1480	1626
4	Total dis. Solids mg/L	628	525	398	730	801
5	Colour ptCo	NIL	635	NIL	NIL	19
6	Suspended solids mg/L	NIL	105	NIL	8	3
7	Total hardness mg/L	275	70	160	205	160
8	Alkalinity (P) mg/L	NIL	NIL	NIL	NIL	NIL
9	Total alkalinity mg/L	270	140	28	37	45
10	Bicarbonate mg/L	270	140	28	37	45
11	Sulphate mg/L	75	53	61	120	150
12	Chloride mg/L	170	140	100	379	435
13	Floride mg/L	0.07	NIL	0.1	NIL	NIL
14	Nitrate mg/L	8.1	55.44	129.8	2.64	3.1
15	Nitrate mg/L	0.08	0.215	0.376	0.04	0.04
16	Silicate mg/L	5.0	5.8	3.15	ND	ND
17	Ortho phosphate mg/L	0.44	0.36	0.33	ND	0.1
18	Manganese mg/L	NIL	1.0	0.1	0.1	0.54
19	Iron mg/L	0.02	0.48	0.06	0.22	32
20	Calcium mg/L	91.2	16.0	56.0	42.8	23
21	Magnesium mg/L	13.6	8.7	5.8	42.9	ND
22	Sodium mg/L	142.6	198	99.5	ND	ND
23	Potassium, mg/L	9.78	20.3	14.47	ND	ND
24	Zinc mg/L	NIL	0.067	0.205	ND	ND
25	Lead mg/L	NIL	NIL	NIL	ND	ND
26	Copper mg/L	0.3	0.30	NIL	0.35	ND
27	Cadmium mg/L	ND	ND	0.039	ND	ND
28	Chemical oxygen demand mg/L	ND	288	64	ND	ND
29	Total coliform mg/L	NIL	NIL	NIL	19	206
30	Feacal coliform no./100 mg/L	NIL	NIL	NIL	11	291

ND - not determined

Table 2 : Nitrate results as recorded in some shallow wells around Dar es Salaam

Well No.	Nitrate mg/L
1	59.8
2	10.1
3	18.9
4	5.7
5	NIL
6	52.4
7	7.0
8	10.1
9	9.2
10	14.1
11	52.6
12	48.2
13	33.0
14	29.9

World Health Organization give 30 mg/L nitrate as an allowable limit while Tanzania Standards gives a tentative figure of 100 mg/L nitrate, (Rural Water Health Standard Committee, 1974). Out of the 14 samples analysed for nitrate only 5 did not meet the WHO allowable limit. If we consider rural situation all met the standard. But as this is an urban setting WHO guidelines apply i.e. 5 samples do not meet the standard.

Generally contamination is often random and intermittent, hence pollution may not be revealed by an occasional sample. A monitoring programme should be drawn by the concerned authorities whereby the water quality of the wells will be subjected to routine monitoring and whenever poor quality is observed, the consumers are to be informed accordingly.

SURFACE WATER SOURCES

On other hand the quality of the surface Water Sources of Rufiji, Ruvu and Wami Rivers in terms of concentration of colour, suspended solids and turbidity are excessive necessitating, treatment. The treatment may entail coagulation/flocculation followed by clarification and filtration. In most cases the water may require disinfection by an appropriate chemical such as calcium hypochlorite.

POSSIBLE SOLUTIONS

Short term

(i) Under short term solutions curbing all water losses due to pipe leakage and an unaccounted for water (UFW) is necessary. These losses account for more than 35% of the water supplied at present.

(ii) Development of groundwater source free of contamination, through shallow wells and boreholes to supplement the existing water supplies.

(iii) The development of reservoir storage for Kizinga and Mzinga River is considered a short or medium term solution. It is estimate that Kizinga and Mzinga sources, if they are developed can supply up to 1000m^3/day.

(iv) It is imperative that water has to be properly priced and consumption through the monitored provision of water meters or other methods thus curbing unnecessary water loses.

Long term

(i) Development of reservoir storage for Ruvu River, e.g. the proposed KIDUNDA reservoir upstream of the present Ruvu intakes to augment supply up to 2.2million m^3/day.

(ii) On long term solution inter-basin water transfer to argument the Ruvu river system is one of the options. The potential water sources are Rufiji and Wami rivers. Unfortunately when low flows occur in the Ruvu river it is worst in the Wami. Therefore inter basin transfer is not feasible (between the two basins).

CONCLUSIONS AND RECOMMENDATIONS

Based on what has been explained it can be concluded and recommended that besides that current ground water exploitation, studies already done under short term measures should be taken with the aim of improving the water supply systems of Dar es Salaam.

- Proper studies should be done to establish long term solutions to the Dar es Salaam water problems and the government should commit itself in following expert advices.
- It is strongly recommended that considerations should be given to the long term proposals including the development of Kidunda reservoir up-stream of Upper Ruvu intakes.
- Water quality aspects it is recommended that a long term monitoring programme be put in place so as to check water quality of groundwater sources especially the shallow well sources.
- The water should be properly price and charged so as to reduce unnecessary use of the scarce resources.
- There must be proper management of water supply to Dar es Salaam which would reduce the unaccounted for water to reasonable and internationally accept levels between 20% and 25%.

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