STUDY OF FLOW VARIATIONS IN GREATER COLOMBO WATER SUPPLY SCHEME

M.Sc in Environmental Management

Department of Civil Engineering
University of Moratuwa
Sri Lanka

Submitted By:

Eng. W. Jayasiri de Silva

Supervised by:

Prof. (Mrs) N. Ratnayake
Department of Civil Engineering

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STATEMENT :

"This thesis was submitted to the Department of Civil Engineering of the University of Moratuwa, Sri Lanka,as a partial fulfillment of the requirements of the degree of Master of Science in Environmental Management"

DECLARATION:

"This thesis has not been previously presented in whole or part to any University or Institute for a higher degree.

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W. Jayasiri de Silva

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ABSTRACT

While designing and operating a water supply system, it is very important to know how much water is needed (water demand) and when it is needed (variation in demand).

In Sri Lanka, basic statistical data such as population, growth rates, per capita consumption of water, leakage rates etc., are available to give a fairly accurate assessment of the water demand.

However, availability of statistical data and literature to assess the variation in demand is very limited or virtually non-existent. In recent NWSDB designs carried out by consultants, the factors such as hourly peak factor, minimum night flow factor, daily peak factor as well as the diurnal variation of the flow have been assumed without giving much justification.

The scope of this research project is to shed some light towards this uncertain area. Under the project, flow variations in some distribution systems in Greater Colombo Area have been studied in order to establish the variation in demand patterns under different circumstances. This study became possible due to the availability of instant rate of flow at regular intervals through the NWSDB telemetry system.

Under the project, the outflow data pertaining to Kaduwela, Pannipitiya, Kolonnawa, Church Hill and Dehiwala Service Reservoirs were studied.

Initially, the parameters for each day such as Daily Average Flow, Maximum Hourly Flow and it's time of occurrence , Minimum Hourly Flow and it's time of occurrence, Hourly Peak Factor (HPF) and Minimum Night Flow Factor (MNF) pertaining to each service area were derived. Daily Peak Factors (DPF) pertaining to each week were also derived. These parameters were tabulated under each service reservoir and presented in the report. Although these parameters provided vital information on the system, they were not sufficient to draw definite conclusions on the overall system behaviors.

Therefore, the data were subjected to a statistical analysis in order to generalize the results. The outcome of the statistical analysis clearly indicated the probable behavior of the system with 95% confidence limit. The parameters obtained through this analysis provided the best indication of the behavior of each system as the data contained the sample readings collected over a period of eighteen months.

From the research, it was found that the new schemes such as Kaduwela and Pannipitiya were operating at high DPF, high HPF and low MNF values as expected. This was due to the limited number of service connections and the spare capacities available in these systems. Such systems can continue to satisfy the consumer needs for many years to come.

The old and large systems such as Dehiwala was operating at very low HPF, low DPF and very high MNF values. They indicate the insufficient hydraulic capacity of the system which can meet only a restricted flow during the peak hours. The remaining quantity of water is delivered to the consumer by increasing the flow during the rest of the day, thus increasing the MNF. The high MNF was possible due to the presence of many domestic storage tanks in the distribution area.

It was evident that the large and old systems have low HPF, high MNF and low DPF values compared to the small and new systems. Kolonnawa is a small but old system and behaves differently due to the influence of the balancing reservoir.

The systems operating at very low HPF and DPF values generally indicated a reduction in the service levels. Such systems need augmentation to improve the supply.

It was also observed that the Hourly Peak Flow and the Daily Peak Flow did not occur in the same day thus questioning the practice of multiplying the two factors to obtain the overall peak factor used in the design.

The report also analyzed the behavior of the systems followed by long term shut downs and short term shut downs. The results also failed to show any appreciable seasonal variation.

The report recommends to continue this study to cover the other water supply schemes in Greater Colombo and outside areas. Parallel sociological studies should be done to assess the on-going service levels, so that the necessary augmentation work could be planned in time. The limiting values of DPF, HPF and MNF corresponding to the optimum customer satisfaction and optimum service levels should be conveyed to Design Engineers for developing appropriate design criteria for augmentation of existing systems as well as for designing of new water supply systems.

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LIST OF ABBREVIATIONS

BWL	– bottom water level
CMC	– Colombo Municipal Council
Cum/hr	– cubic meter per hour
DPF	– daily peak factor
EPZ	– export processing zone
HPF	– hourly peak factor
M3/day	– meter cubes per day
MGD	– million gallons per day
MNF	– hourly minimum night flow factor
NWSDB	– National Water Supply & Drainage Board
TWL	– top water level

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