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DESIGN OF CONTINUOUS WATER SUPPLY SYSTEM BY USING WATERGEMS

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ABSTRACT

Continuous water supply systems has generated significant interest in India due to its many advantages. Also it is useful for conserving water and its quality. Now-a-days demand for drinking water is increasing day by day with corresponding increase in population. This continuously increasing demand can be fulfilled by designing efficient water distribution networks based on advance computing systems which includes modern hydraulic modeling and designing software. In order to deliver adequate service, these systems must be carefully planned, designed, operated and maintained. Design of distribution network for continuous water supply can be easily achieved with the help of software WaterGEMS, which is used for water distribution modeling and management.WaterGEMS is a very useful hydraulic modeling software package with the advancements in the interoperability, optimization of networks in addition to, model building supported with geospatial tools and asset management tools. In this paper, the design methodology adopted to design an distribution network for continuous water supply on software waterGEMS is discussed.

Keywords—Continuous Water-supply, WaterGEMS, EPS, Darwin Designer, Optimization.

I.INTRODUCTION

Water is an, very important requirement in our day to day life. Providing continuous water supply i.e. 24x7 water supply to every consumer throughout the year, is one of the important emerging trend in water supply management. The provision of continuous water supply is made by the accurate design of the water distribution network with optimum design of pipes, pumps and tanks, etc. to minimize the overall cost of the project.

The definition of 24x7 water supply is- "The supply of potable water to end users through system of pipes – comprising interlinked bulk transmission and/or distribution systems – which are continuously full and under positive pressure throughout their whole length, such that the end user may draw off water at any time of the day or night, 24 hours a day, every day of the year.[1]

Design of water distribution network is a critical part of water supply system which contributes for the major share of overall expenditure incurred in it, hence systematic and proper design as well as modeling of distribution network becomes crucial one.With the advancement in the field of water supply, many field experts, scientists, research scholars, developers and programmers developed number of software's for design and modeling of water distribution systems.

WaterGEMS is a versatile hydraulic modeling application for water distribution systems with advanced interoperability, optimization and asset management tools. From fire flow and constituent concentration analysis, to energy consumption and capital cost management, waterGEMS provides an easy-to-use

environment for engineers to analyze, design and optimize water distribution systems.[2]WaterGEMS software algorithm is based on gradient method, and gives optimal solution for the design of new as well as expansion of existing water supply network.In this paper, the design methodology adopted to design an distribution network for continuous water supply on software waterGEMS is discussed.

II.WATERGEMS

WaterGEMS can perform following functions effectively:

1. Building a network and performing a steady state analysis.
2. Extended Period Simulation (EPS).
3. Scenario management.
4. Reporting results.
5. Automated fire flow analysis.
6. Water quality analysis.
7. Darwin Designer to optimize the setup of the pipe network.
8. Darwin Designer to optimize the pipe network.
9. Scenario energy costs.
10. Pressure dependant demands.
11. Criticality and segmentation.
12. Flushing.
13. Importing SCADA data.
14. SCADA connect simulator.

III.DESIGNSTEPS TO DESIGN CONTINUOUS WATER SUPPLY SYSTEM ON WATERGEMS

3.1.Drawing of Distribution Network:

To initiate the modeling of distribution network, the basic network consisting of pipes, junctions, valves, tank or ESR (elevated storage reservoir), etc. have to be drawn in waterGEMS. The required network can be drawn on the blank window with the provision of specified scale to it. Also we can import image, CAD and GIS files for background as a reference for drawing of desired distribution network with consideration of road network and elevation of ground terrain.We can also assign an, user defined length for every pipe, if required i.e. if drawing is not drawn to the desired scale. Also we have to fill the basic properties of every component in the drawing of water distribution network such as, junctions, valves, pipes, tanks, reservoir, pumps, etc.

As water distribution systems are generally so designed, that the energy consumption in pumping and other works should be minimum and hence distribution system should supply continuous water in majority of the area through gravity (i.e. without using pumps). The elevations should be given to every component, as it has more importance as water is continuously supplied by distribution network.In distribution network for continuous

water supply, usually there is no requirement of any flow control valve to control the flow regularly, however these are provided for repairing work in case of leakage or damage to components.

1.Drawing of Distribution Network

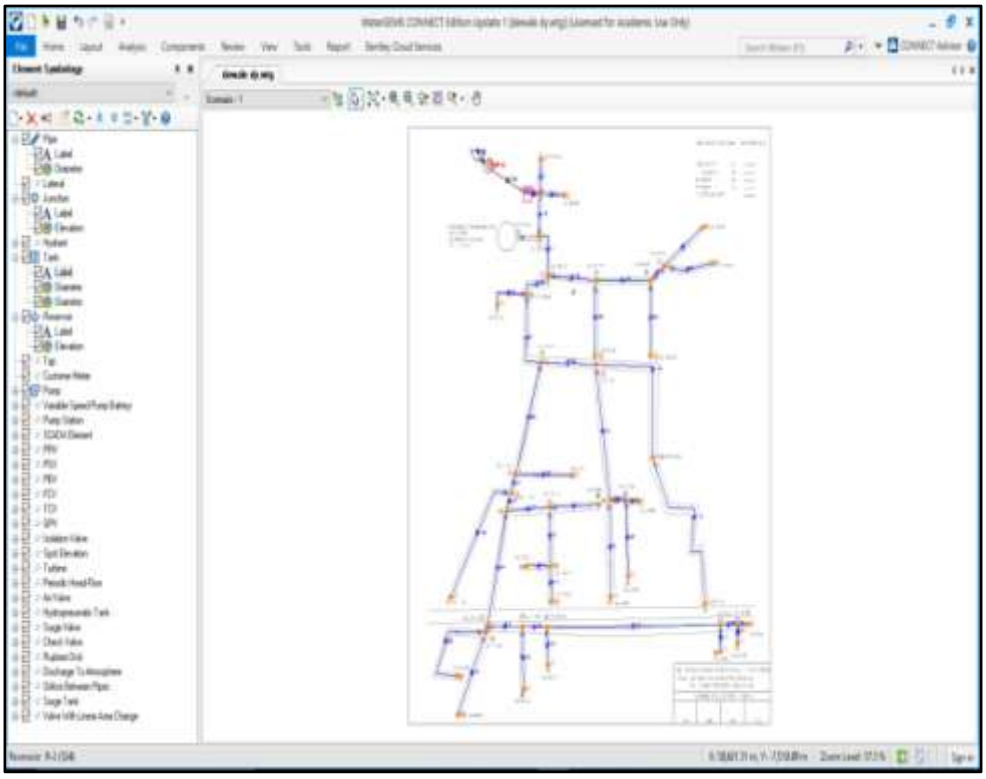

Fig.1 Distribution Network

3.2. Computing Demands:

For design of continuous water supply system, the population density of each zone should be accurately determined and designed for considered life span of project. For particular distribution network, the population for each branch of pipe should be known to give the sufficient design demand for end junction or node of every branch. Design demand for each branch = design population at that branch x rate of water supply (lpcd)

Each branch of network is considered separately for calculation of daily water demand, which would have to be given at the end node or end junction of that branch.There are various methods of population forecasting such as arithmetical increase method, geometrical increase method, geographical increase method, etc. and based on this population forecasting water requirement is calculated. In addition to it, some losses are taken into account to find out gross water demand. Generally, the probable life span of water supply system is taken as 20 to 30 years.

3.3. Defining Demand pattern:

The modeling of distribution network for continuous water supply in waterGEMS should be done with 'EPS (Extended Period Simulation)' instead of 'steady state' of time analysis type.

For EPS analysis it is required to give specific pattern for given demands with respect to hourly, daily or monthly variation in water demands. As the distribution network is designed for continuous water supply

system, the hourly varying demand pattern plays an important role in it. WaterGEMS estimates the network with respect to peak factor (maximum factor from hourly varying demand pattern).Also we can give patterns to pumps, valve settings and power usage also.

2.Demand Pattern

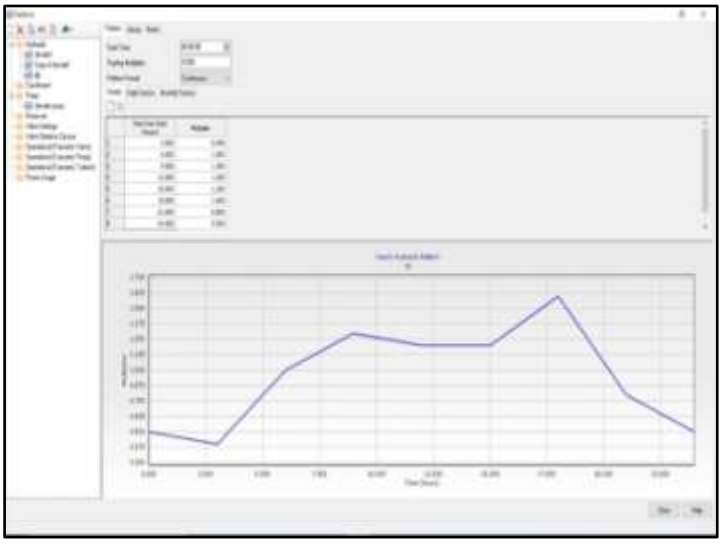

Fig.2 Water Demand Pattern

3.4. Computation of ESR:

Capacity of ESR is mainly depends upon population and rate of water supply for a day. In continuous water supply, tank capacity is designed for maximum multiplier given in hourly varying demand pattern i.e. peak factor.

Daily Demand =Population x rate of water supply (lpcd) x Peak factor

In addition to this there is losses in pumping and rising main also taken in consideration for total daily demand. Capacity of ESR is depends upon daily demand and pumping system provided.

3.5. Analysis of Network:

For continuous water supply, distribution network is analyzed for EPS. The pumps are provided to fill the ESR with consideration of ESR emptying time and the time at which ESR runs full. By analyzing network, the software gives results which includes velocity of water in pipe, pressure at each junction, headloss gradient of pipes, hydraulic grade of junctions, flow, etc. and much more. The results, reports and graphs can be exported to MS Exel, MS Word, or CAD format effectively.

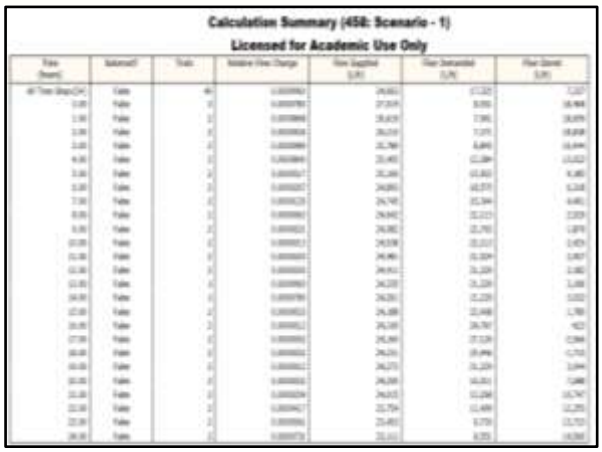

Fig.3 Analysis of Network on WaterGEMS

3.6. Optimization:

The software waterGEMS has an extraordinary feature named as 'Darwin Designer', which gives optimum results to maximize benefit or to minimize capital cost of the project.

Darwin designer is a generic algorithm. It provides multi criteria optimization. The criteria being performance and cost. The solutions provided by the software are ranked. This allows the user to choose the best solution which suits to his requirements of pressure and availability of money.[3] It optimizes the network, on the basis of pressure and velocity constraints given.Darwin designer gives the optimum solution for network which may consist variety of diameter pipes. Hence, from practical point of view, these diameters maybe efficiently arranged.

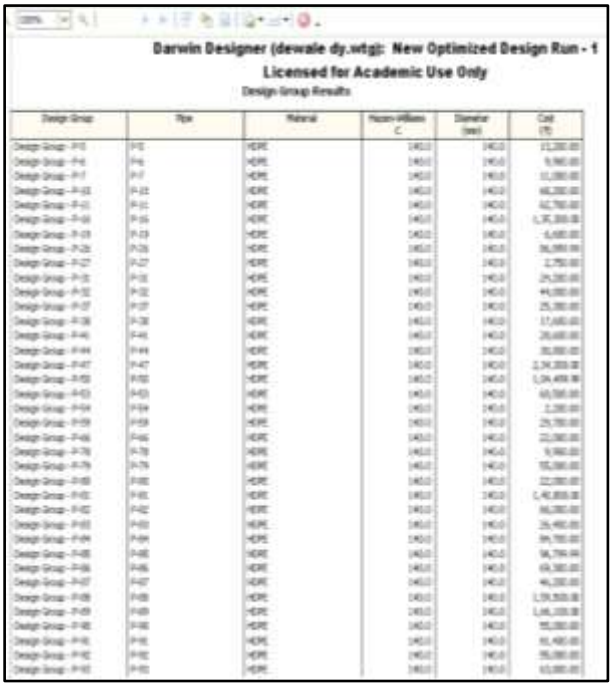

Fig.4 Darwin Designer Result

Also there is 'Darwin Scheduler' included in waterGEMS which schedules the specific patterns for pumps, on the basis of pressure & velocity constraints and tank size, either to minimize energy cost or to minimize energy use.

IV.CONCLUSION

Now a days, the concept of continues water supply has generated significant interest in India due to its number of advantages over intermittent system of water supply.Presently there are number of continuous water supply systems designed and developed byusing waterGEMS software effectively. In Maharashtra state Malkapur continuous water supply scheme effectivelyimplementedwhich is designed in waterGEMS.Design of continuous water supply system by using waterGEMSbecomes much more advantageous than manual process, as it minimizes the required time and gives accurate results within short period. Also it optimizes the distribution network on the basis of performance and cost.

Based on the above discussion and considering various extraordinary features of waterGEMS, we can say that, the effective design of continuous water supply system is possible by using waterGEMS software.

REFERENCES

[1] Ministry of Urban Development, Government of India. Guidance notes for continuous water supply (24-7 supply).

[2] www.bentely.com/waterGEMS-Spec.

[3] MalkapurNagarpanchayat and MaharastraJeevanPradhikaran, Malkapur 24x7 Water Supply Scheme.

[4] The Government Of India-Central Public Health & Environmental Engineering Organization, Manual On Water Supply And Treatment.

[5] Department of Civil Engineering, STJIT Engg. Colleg, Renebennur, Karnataka, India, Design of 24x7 Water Supply System for RenebennurTown..

[6] N.P.Sonaje&M.G.Joshi, A review of modeling and application of water distribution networks(WDN) softwares, *International Journal of Technical Research & Applications-Vol.6, Issue 5- 2015.*

[7] S.S.Pathan&Dr.U.J.Kahalekar, Design of Optimal Water Supply Networks& its Water Quality Analysis By Using WaterGEMS, *Inetrnational Journal of Science And Research (IJSR)-2015*

[8] A.G.Choudhari, A.K.Joshi, Review study: Experimental Investigation By WaterGEMS Software For Redesign of Water Distribution System of Bhavani Mata ESR *–ICCSM-17.*