Network Analysis of Water Distribution System in Surat Using EPANET

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***Abstract*- In order to fulfill the water demand of the continuously growing population, it is essential to provide the sufficient and uniform quantity of water through the designed network of pipes. The general features of the area like information about the main water source, population of the area, demand of water, requirement of the pumps, distribution network and water tanks are essential for efficient design of water distribution system. According to the per capita consumption of water by an Individual person is 150 liters per day and design has been made accordingly. This work highlights the process carried out on design of water supply system for an area named PALAN PUR with the help of all this information the design of the water supply scheme for the area with the help of software "EPANET". This design of the water supply scheme for proper supply of water is efficient to meet the daily requirement of water in this area**

I.INTRODUCTION

Water is the most precious gift of nature. It is most crucial for sustaining life and is required in almost all the activities of mankind i.e., domestic use, industrial use, for irrigation; to meet the growing food and fiber needs, power generation, navigation, recreation etc., and also required for animal consumption. The common source of water mainly comprises of Rain water, Surface water, Ground water and Water obtained from reclamation. The development, conservation and use of water form one of the main elements in country's development planning. It is necessary to adopt a new approach to design urban water supply networks, water shortages are expected in the forthcoming decades and environmental regulations for water utilization and waste-water disposal are increasingly stringent.

In order to fulfill the water demand of the continuously growing population we need to provide the sufficient and uniform quantity of water through the designed network of pipes is known as water supply. Infrastructure for the collection, transmission, treatment, storage, distribution of water for homes, commercial establishments, industry, and irrigation, as well as for such public needs as firefighting and street flushing. Water supply systems must also meet requirements for public, commercial, and industrial activities. In all cases, the water must fulfill both quality and quantity requirements. A plan of water supply system for the PALAN PUR in Surat city has been prepared as per "CPHEEO Manual on Water and Water Treatment" and using EPANET software.

Aim:

To network analysis of water distribution system in using EPANET

Objectives-

To analysis the consisting water distribution system. And development the water distribution system using EPANET, To compare the existing and developed water distribution system .Enhance quality of surrounding environment. Maximize the use of natural resources .Minimize environment emission Optimize inhabitant health & productivity, Minimize operating cost, Improve comfort, Simplify use of technologies, Ensure security.

II. OVERVIEW OF EPANET SOFTWARE.

EPANET was developed by Water Supply and Water Resources Division (formerly the Drinking Water Research Division) of the U.S. Environmental Protection Agency's National Risk Management Research Laboratory. It is Public domain software that may be freely copied and distributed. EPANET is a computer program that performs extended period simulation of hydraulic and water quality behavior within pressurized pipe networks. A network consists of pipes, nodes (pipe junctions), pumps, valves and

storage tanks or reservoirs. EPANET tracks the flow of water in each pipe, the pressure at each node, the height of water in each tank, and the concentration of a chemical species throughout the network during a simulation period comprised of multiple time steps. In addition to chemical species, water age and source tracing can also be simulated

EPANET is designed to be a research tool for improving our understanding of the movement and fate of drinking water constituents within distribution systems. EPANET can help assess alternative management strategies for improving water quality throughout a system. These can include

- -Altering source utilization within multiple source systems
- -Altering pumping and tank filling/emptying schedules
- -Use of satellite treatment, such as re-chlorination at storage tanks
- -Targeted pipe cleaning and replacement.

Running under Windows, EPANET provides an integrated environment for editing network input data, running hydraulic and water quality simulations, and viewing the results in a variety of formats. These include color-coded network maps, data tables, time series graphs, and contour plots.

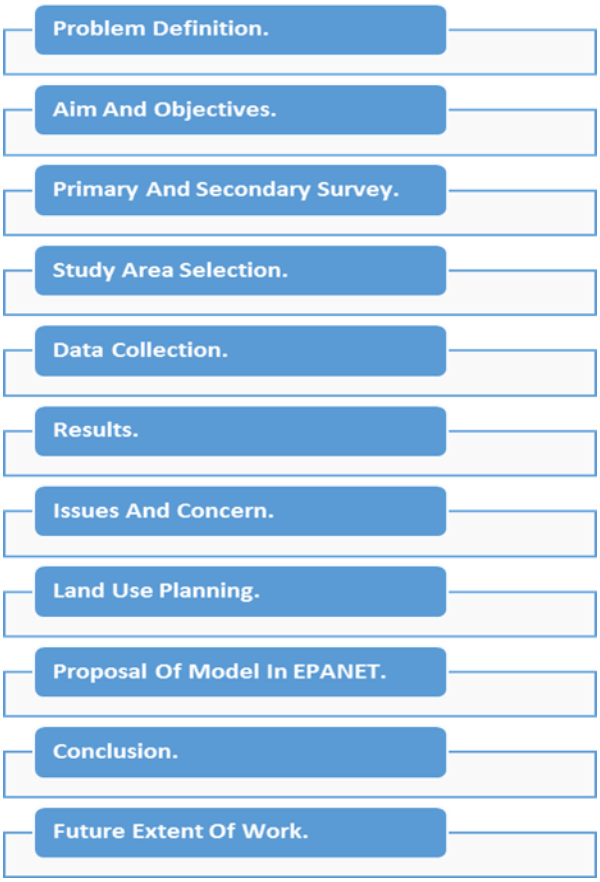
III. METHODOLOGY

1. Issue Identification.
- After conducting survey in rural area palan pur of Surat we examined that most of the people were using water from smc distribution for their basic needs.
- Limited amount of water was supplied which was not enough for their utility.
- Almost every house had boreholes for 24 hours water supply.
- Water supplied by SMC was only for 3 hours per day.

2. Study Area Selection
- After a lot of discussion we selected palan pur as our study area.

3. Data Collection
- The data collected in our project is from SMC (Surat Municipal Corporation).
- Usage of water and its distribution networks.
- Brief information about nodes and links.
- Epanet software for distribution and network of water supply.
- Internet and as well as old records. 4 Land Use Planning
- Based on data collected we started our work using Epanet software and designed a 24 hour water distribution network in palan pur in Surat.

4. Concluding Remarks
- The main task we had to overcome was to measure the water usage of each person at different interval of time during 24 hours based on that we prepared a water supply system which was capable of supplying water 24/7 in palan pur.



METHODS OF DISTRIBUTION:

Three methods or systems are outlined below: (i) Gravity system (ii) Pumping system (iii) Combined gravity and pumping system

LAYOUT OF DISTRIBUTION NETWORKS

There are four principal methods of layout for distribution systems: (i) Dead end or tree system (ii)

Gridiron system (iii) Circular or ring system (iv) Radial system

STEPS IN DESIGN WATER DISTRIBUTION NETWORK:

(i) Conducting topographic surveys and preparation of maps. (ii) Preparation of tentative layout. (iv) Computation of discharges in pipelines. (iv) Calculation of pipe diameters. (v) Computation of pressures in the pipelines. (vi) Determination and positioning of appurtenances

SURVEYS AND MAPS

The strip of land lying between the source of water supply and the distribution area is surveyed to obtain the levels for fixing up the alignment of the rising main. This main will carry treated water to the distribution reservoir(s) located in the distribution area. The distribution area is also surveyed and detailed maps of are prepared showing the positions of roads, streets, lanes, residential areas, commercial locality, industrial areas, gardens etc. A topographical map of the area is prepared to locate the high and low areas. The cross section of streets, roads, lanes, etc. is prepared, showing the position of existing underground service lines like electric and telephone lines, sewer lines, existing water supply lines (if any), etc.

TENTATIVE LAYOUT

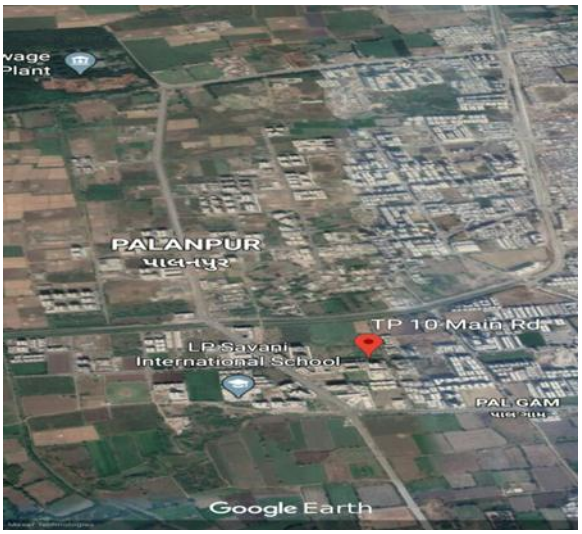
A tentative layout of the distribution line is then marked, showing the location of the treatment plant(s), distribution mains, distribution and balancing reservoirs, valves, hydrants, etc. The whole area is divided into various distribution districts. The density of population (average number of people per hectare area) is also marked. The length of pipelines should be kept as short as possible.

DISCHARGE IN PIPELINES

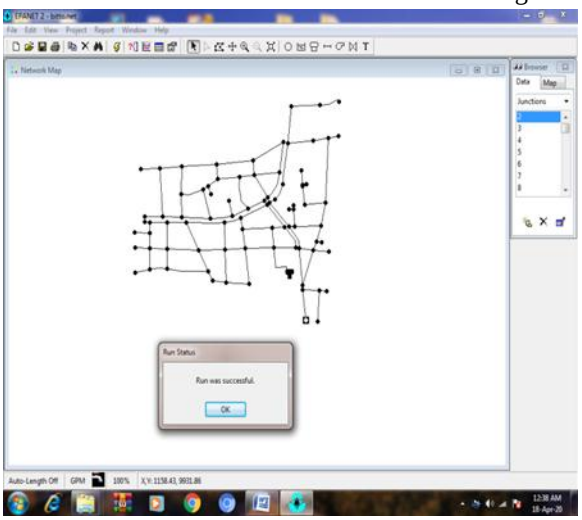
Based on the density of the population, type of distribution district (residential, commercial etc) and firefighting and other requirements, the discharge required from each pipeline is calculated. The fire hydrants are placed at 50 to 100m intervals on straight runs, and on street junctions. The size of the distribution pipes are fixed such that a minimum necessary pressure head is maintained at all points, carrying peak hourly flow through them. The pipes should be designed for a discharge ranging from 2.25 to 3 times the average rate of supply. For populations over 50,000, the distribution mains should have a capacity of 225% of average rate of supply, while for population below 5000; the distribution pipes should have a capacity of 300% for the average rate of supply. The flow required for firefighting should be added to this maximum flow, to get the total flow. The pipes should be able to carry this total flow without excessive pressure drops.

IV. DATA COLLECTION

1. Map of Sarsana Village including water distribution network



2. Water distribution nrtwork of Sarsana Village



Time pattern is mainly use in EPANET softwere to set the exect amount of water pressure passing throgh the junctions.

V. RESULTS

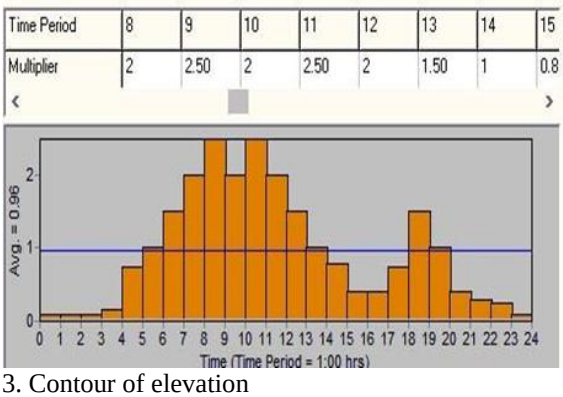
1.Pipe Report

Network Table - Links at 1:00 Hrs			
Link Id	Velocity (fps)	Unit head loss(ft)	Friction factor
P-1	0.83	0.23	0.78
P-2	0.56	0.29	1.39
P-4	0.72	0.18	1.59
P- 5	0.72	0.18	1.25
P-6	0.67	0.20	0.08
P-7	0.79	0.71	0.03
P-8	0.52	0.13	0.17
P-9	0.79	0.56	1.35
P-10	0.89	0.68	1.90
P-11	0.47	0.27	0.70
P-12	0.91	0.92	2.05
P-13	0.84	0.44	0.75

2. NETWORK TABLE JUNCTION

	Demand (GPM)	Head (ft)	Pressure
J-2	0.00	18.22	0.60
J-3	335.35	16.83	0.90
J-4	0.00	16.63	1.00
J-5	0.00	15.38	0.80
J-6	304.17	15.30	0.70
J-7	0.00	15.27	1.20
J-8	472.48	15.13	0.70
J-9	0.00	13.78	1.10
J-10	181.82	13.22	1.00
J-11	350.38	12.52	0.40
J-12	0.00	11.17	0.80
J-13	283.59	14.63	0.60
J-14	0.00	14.32	0.70

2. Time Patter



3. Contour of elevation

VI. CONCLUSION

In this work, the water distribution system has been design with the help of EPANET in which we use number of nodes, elevation, number of pipes and demands of pal palanpur area. First we surveyed the area and take information about the population and per capita demand of the people. And according to that we design the distribution system for the area. In this system centrifugal pumps are used having power of 10hp. In storage two overhead tanks are used having capacity of 21 lakhs. Here during the day time hours that is peak hours during morning time the demand of water is more as compared to the other time so the maximum supply is given for 24 hours a day. And also we concluded from the graphs that we obtained from EPANET shows that the demand is more during the peak hours.

The different nodes shows different variation of pressures and demand like the demand is more at nodes 19,24,32,29 as compared to others. The pressures at node 24, 25, 26 are more due to their elevation. Comparison of these results indicates that the simulated model seems to be reasonably close to actual network. Discharge should be increased to achieve the base demand. This study would help the water supply engineers

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BOOKS
1. Economics of Water Resources Planning
2. System Approach to Water Management
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