

**DESIGN OF WATER DISTRIBUTION NETWORK BY USING EPANET SOFTWARE**

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**ABSTRACT**

*The study represents the usage of EPANET software in water distribution network design. EPANET is user friendly software which helps to design the water distribution network for any required area like for any domestic house hold usages or any commercial exercises. EPANET is a computer program that performs extended period simulation of hydraulic and water quality behavior with in pressurized pipe networks. A network consists of pipes, pumps, valves, nodes (pipe junctions) and storage tanks or reservoirs. It can be used for many different kinds of applications in distribution system analysis. In this paper it was used to carry out the Design of water distribution network in the study area. The study examined the water demand analysis of Public Water Supply in rural area using EPANET 2.0 software with the aim of providing effective planning, development and operation of water supply and distribution networks which is one of the most essential components of any water distribution networks. Water serving came in to existence from past several decades to every house hold. Hardy-cross method is one major method of designing flow networks from 1936, and it was used very enormously all over the world for decades. It gives the input and output details of pipe but can't give the operation of flow working inside the pipe. But EPANET can give the detailed flow of network even inside the pipe systems. Like this, EPANET can be used to design the water distribution network. Not only for domestic purposes but also for the agricultural purposes like sprinklers and for drainage sewerage system EPANET software can be utilized.*

**Keywords:** Analysis, EPANET 2.0, other modes of usages, Water distribution network

**INTRODUCTION**

Water is the major resource for every human being and also for living organisms. Not only for the domestic purposes, but also for industrial and irrigation purposes the water distribution can be utilized. Water served human beings and living organisms in past centuries by rivers valleys and small streams. Water supply had taken an initiative role to give the convenience for every domestic user by giving water to respective house hold nodes through water distribution network from past few decades. Mainly, the city or any place of village growth development will depend on many constraints. Water distribution is also one of the major aspects in it. Many cities which are in the development stage depend on the population growth. The water distribution network should meet the demand of increased growth of population. To increase

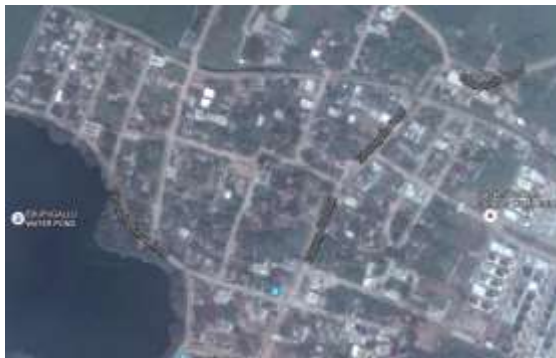
the living standards water distribution water distribution is required in a major role. Water supply deficiency is the major drawback in urban area since the water distribution system is intermittent system. Under this scheme water is distributed to the residents intermittently for few hours in a week. Due to the intermittent water supply most of the time the pipelines in the distribution network are either empty or partially filled. These conditions make the water in pipelines vulnerable to cross contamination via sewage and contaminated groundwater. In order to that we are providing continuous water distribution system to give 24hours, day and night and 365days to every house hold who are in end of the network also without falling into any negative pressure. Intermittent system will not supply water continuously through network pipes, by this

contamination of pipes due to empty space and also bacteria formation takes place. That contaminations and bacteria formation results harmful effects in the consumer health. To avoid this continuous water system has been designed in this study to avoid negative pressures and full length supply for every node in all the time.

## STUDY AREA



Eedupugallu is a village near to Vijayawada which is Andhra Pradesh capital.



## Materials

For this study, various other tools have been used to create the geometry of water distribution network for study area eedupugallu, such as Google earth, arc gis shape files, M S excel tools. Parameters include water demand, study area population, and also distribution network

parameters such as; elevations, pipe diameter, pipe length, base demand.

## Methodology

Initially the geometry of network was created by using Google earth and KML file had converted into shape file by using ARC GIS software and it is further converted to INP EPANET file.

Elevation, pipe diameter and length had given to each node and pipe for hydraulic analysis by using scale tool from Google earth application.

Total area was divided into several grids and demand path is estimated by depending on the number of houses living in the area taken in grid.

## DEMAND CALCULATION

The number of houses is counted by using topography map in every grid. 5 members are estimated per house and consumption per person is taken as 135+15 lpcd (15 for unaccounted flow).

Number of houses in each grid	Total population	Total demand in lpcd
32	160	24600
33	165	24750
17	85	12750
20	100	15000
42	210	31500
44	220	33000
18	90	13500
18	90	13500
9	45	6750
8	40	6000
10	50	7500

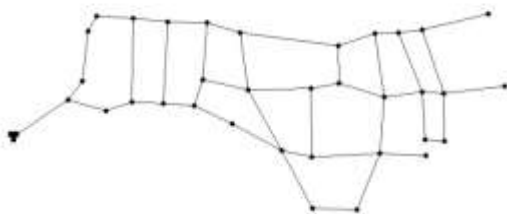
Total Number of houses = 251

Number of people = 1255

Total lpcd = 1,88,250

## EPANET

EPANET is a computer program that performs extended period simulation of hydraulic and water quality behavior within pressurized pipe networks. 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. A network consists of pipes, nodes (pipe junctions), pumps, valves and storage tanks or reservoirs. In addition to chemical species, water age and source tracing can also be simulated. The EPANET uses the following equations to calculate head loss:



This is the distribution network by using nodes, pipes, tank in geometric view of edupugallu village.



Pressure at each node from starting node to ending node is denoted in above figure by indicating them with distinguished colors. Flow in each pipe also indicating from starting node to ending node with another set of colors.

## HAZEN WILLIAMS FORMULA

Resistance coefficient	$4.727c^{-1.852}d^{-4.871}L$
flow exponent	1.852

C= hazen-williams roughness coefficient  
d = diameter of pipe  
L = pipe length.

## Analysis results

Network Table - Nodes at 9:00 Hrs	Demand	Head	Pressure
Node ID	LPS	m	m
Junc 1	0.04	149.93	18.93
Junc 2	0.04	149.93	19.93
Junc 3	0.04	149.92	20.92
Junc 4	0.04	149.92	20.92
Junc 5	0.11	149.92	20.92
Junc 6	0.96	149.92	21.92
Junc 7	0.05	149.92	22.92
Junc 8	0.08	149.92	22.92
Junc 9	0.2	149.91	23.91
Junc 10	0.21	149.91	24.91
Junc 11	0.21	149.91	25.91
Junc 12	0.03	149.91	25.91
Junc 13	0.03	149.91	27.91
Junc 14	0.21	149.91	25.91
Junc 15	0.03	149.91	25.91
Junc 16	0.21	149.91	24.91
Junc 17	0.02	149.92	27.92
Junc 18	0.02	149.92	27.92
Junc 19	0.03	149.91	26.91
Junc 20	0.04	149.93	21.93
Junc 21	0.11	149.92	22.42
Junc 22	0.1	149.92	22.92
Junc 23	0.05	149.92	22.92
Junc 24	0.12	149.92	23.92
Junc 25	0.12	149.92	24.92
Junc 26	0.12	149.92	25.92
Junc 27	0.12	149.92	25.92

Junc 29	0.22	149.92	25.92
Junc 31	0.05	149.92	22.92
Junc 32	0.08	149.92	22.92
Junc 33	0.08	149.92	23.92
Junc 34	0.17	149.91	26.91
Junc 35	0.17	149.91	25.91
Junc 37	0.12	149.91	24.91
Tank 28	-4.26	149.93	9.93

## CONCLUSION

In this study area it has been observed that some of the critical areas have been identified and variation in parameter is observed. Hydraulic parameters such as velocity, head, and flow unit head loss for each node and link

The entire network has uniform flow and velocity and every node receives enough pressure and there is no deficiency in demand. However, some of the area has to be improved to achieve desired pressure levels.

## RECOMMENDATIONS

EPANET is new generation software which can give the water distribution networks design efficiently and economically.

Conventional methods like Hardy-Cross methods are not recommendable in present days if the network is in high scale because that high network designing by conventional method will not give the efficient and economical design as comparative to EPANET software.

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