# WATER SUPPLY NETWORK USING EPANET

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*Abstract*— This improved demand impose extra load on the existing normal water distribution process, As a way to fulfil the water demand on the continually raising population, it's crucial to offer the uniform and sufficient volume of water from the created system of water lines, This attempt exhibits the use of EPANET software package within the style and design on the water distribution system. EPANET is a programming program that performs time simulation that is extended of hydraulic as well as water quality behaviour in only pressurized pipe networks. A system features links (pipes), nodes (pipe junctions), the majority of most pumps, regulators in addition to storage space tanks or perhaps reservoirs. EPANET imprint the flow of water within every pipe, the pressure in each and every node, the amount of water for each and every tank, therefore the absorption of a substance sort throughout the system, EPANET is designed to be an exploration program for increasing the type of ours of the movement in addition to long lasting potential future of consuming drinking water constituents in only division phone. It might be used for a large amount of a variety of type of uses to come down with serious distribution network analysis.

*Keywords*—  Water Demand, Distribution Networks, water supply, EPANET

## Introduction

Water distribution networks tend to be the fundamental component of the towns to complete the water source requirements of individuals all the time. Water is a valuable healthy resource as well as probably the most crucial demands of just about all living your life beings. The perception of water accessibility and the quality of its is often talked about, analyzed as well as examined by the hydraulic scientists with history ten years. It's believed to become moderate owing to different hydraulic, green controllable and unrestrained factors. Lots of problems are therefore apprehended pertaining into the ability, reliability and capacity of the water distribution networks. You will discover numerous places, small and large, with good public development rates which in turn aren't able to get access to drinking water equally in terminology of amount (average need per hydraulic head and capita) (water Head on the consumer 's end). The perfect pattern, maintenance and operation of WDN is very important within current occasions to avoid overexploitation of water resources.

## I . AIM & OBJECTIVES

The present study of urban residential water distribution network under the control of Pune  involves the appraisal, analysis for its capacity and reliability estimation to fulfil the water demands at various nodes by applying the EPANET hydraulic simulation software. The main objectives are:

Simulation on the water distribution network for different hydraulic parameters.

1.      Verifying the output values with regular values of some pressure, unit head loss. and velocity

2.      To determine reliability of WDN for head at nodes and quantity of water reaching the consumer

3.      Design of pipe network considering nodal demand for the future demand.

4.      To learn the current water supply network

## II . LITERATURE REVIEW

1- Athulya.T et.al (2020) (1) this particular evaluation supplies the use of EPANET program inside the layout on the water division product only for your 3 wards of Anjarakandy Grama Panchayath, Kannur district. The primary goal of providing a great distribution system is delivering sufficient pressure at each issue with fewer losses. A water distribution network functions pipes, regulators, tanks etc. EPANET is a computer system that screens the flow of water for each and every pipe, the strain for every single node and height of water within each and every tank. Hardy-Cross strategy is a mechanical technique making corrections to initial assumed value by using formulas. In just a few the documents it'd been used to deal with the layout and hydraulic analysis of water division process by utilizing Hardy-Cross procedure as well as epanet a software program.

2- Madhusudhan M S et.al (2020) (2),  assessment an attempt is carried out to develop the new community of water supply division process keeping the goal during upcoming advancement of public. The design of water supply task for the accessibility of water by utilizing EPANET software application demonstrates to continually be useful to meeting the daily necessity about the selected location confirming collectively together with the standards. The results within the EPANET be made up of various hydraulic specifics for instance head, great pressure for every single node, head loss in water lines and in addition at nodes. The Model is validated by analysing the results on the merchandise combined with the by hands estimated mind injury by utilizing Hazen Williams situation that allows within analysing the stability as well as suitability of all the product

3- Saeid Khalifeh et.al (2020) (3) Within this info put on the Harris Hawks Optimization Algorithm for optimization on the water distribution system over the Homashahr positioned in Iran The technique offered to this short article works well for superiors of water and also wastewater makers, water supply expertise in addition to h2o division device handling director for optimum local community layout to take down costs, Hawks Optimization Algorithm (HHO) was developed for the optimisation on the water distribution system. The analysis evidenced that the best fixes attained by the Harris Hawks Optimization Algorithm (HHO) are already 35,508 1dolar1. The final result subjected the HHO algorithm was properly inside the best possible type of water source networks problem.

4- Richard Weber et.al (2020) (4) This paper explores the behaviour as well as topology of sections, especially the criticality of theirs from the perspective of the whole phone system. A novel, goal, dimensionless, sector based quantity is recommended analysing the vulnerability of equally areas along with the whole WDN coming from a person, incidental pipe rest, computed as the product on the chance of disappointment within the segment and the amount of unnerved consumption. twenty seven substantial real world WDNs are examined by methods of newest metric or even in with all the help of complex community idea, exploiting the idea on the amount division and also topology dependent structural qualities (e.g. community diameter, clustering coefficient).
It has been really found that metrics largely dependent purely on topology case different community behaviour as vulnerability analysis which includes the hydraulics. The searching of global community vulnerabilities has shown many significantly discovered programs, along with furthermore, the spot distributions unveiled new characteristics of WDNs inside the situation linked to an arbitrary pipe break. This specific papers explores the behaviour as well as topology of areas, especially the criticality of theirs from the perspective of the whole system. A novel, goal, dimensionless, sector based amount is recommended analysing the vulnerability of equally food portions along with the whole WDN coming from a person, incidental pipe rest, computed as the product on the chance of disappointment within the segment and the amount of unserved consumption. 27 considerable real-life WDNs are examined by methods of newest metric or even in with all the help of complex community concept, exploiting the thought on the amount division and also topology dependent structural attributes (e.g. local community diameter, clustering coefficient). It has been really found that metrics dependent purely on topology case different community behaviour as vulnerability analysis which comes with the hydraulics. The searching of worldwide community vulnerabilities has shown numerous considerably discovered programs, along with furthermore, the spot distributions unveiled brand new characteristics of WDNs inside the situation linked to an arbitrary pipe rest..

5- A.Naga Ajay et.al (2020) (5) In this specific task. The EPANET software program uses Newton Raphson method of the analysis on the flow of water within the pipe networks. The requirements due to this particular analysis includes: chart of GUDIVADA Town, Population in addition to in addition, the elevation of numerous nodes. The GUDIVADA Town chart was from Google earth Pro. The node elevations may additionally be

absorbed of Google earth pro software package. The water need was approximated based on the density of public. The water division system in the GUDIVADA Town includes 10 Elevated Service Reservoirs, every one particular helping a certain field. The pipe substance just for the whole society unit originates from cast metallic and contains a roughness coefficient of 100.

## III . METHODOLOGY

 LOCATION

A metropolitan non-commercial WDN of Pune is taken for review. The system is situated around Kothrud pune region that is near Mumbai highway and also flood plains of river Mutha, Western portion of Pune as displayed within the fig 3.1. And then fig 3.2  The residential place is called as Sai enclave. The size of this area is twenty four hectares. For providing water for this area, water is initially obtained within a subterranean reservoir (UGR) coming from water remedy plant that is around 7.0 kms far from the non-commercial region. The UGR is attached to water remedy plant by a pipeline of 700mm diameter. The topography of general area is dull with slope between 1 % to 2 % the spot Sai Enclave is situated at longitude 77°12 '22.9"E as well as latitude 28°46 '08.4" N. Fig 3.1.3 shows satellite perspective of Sai Enclave
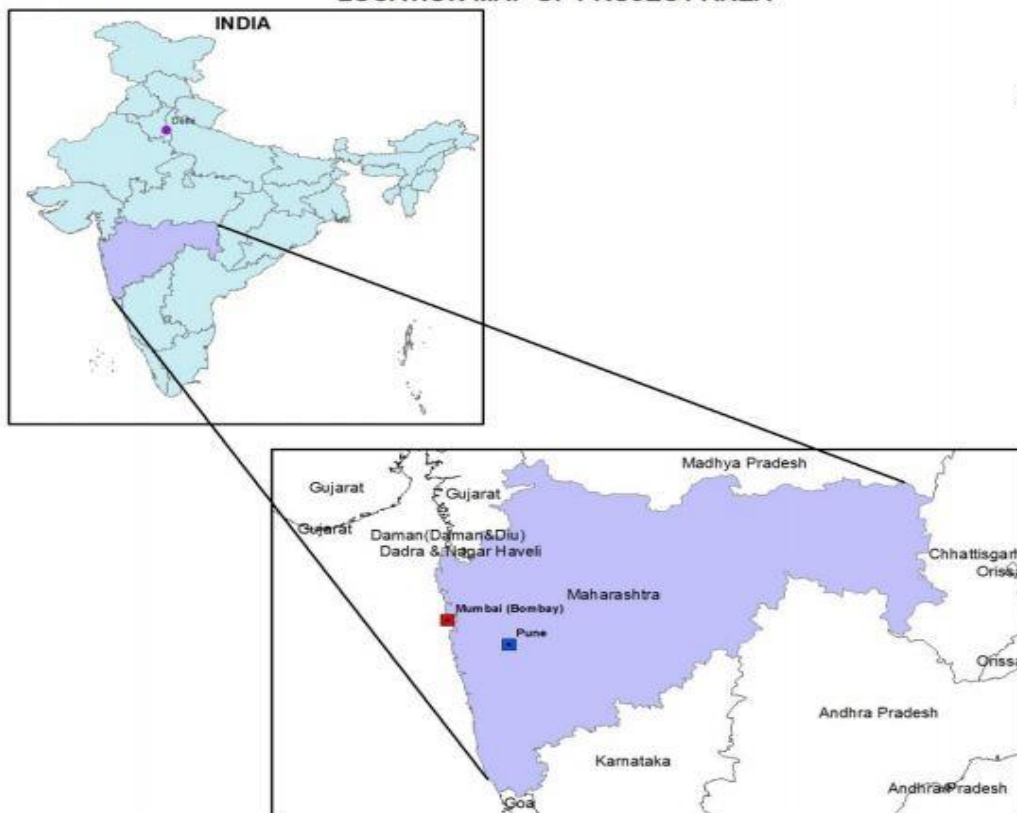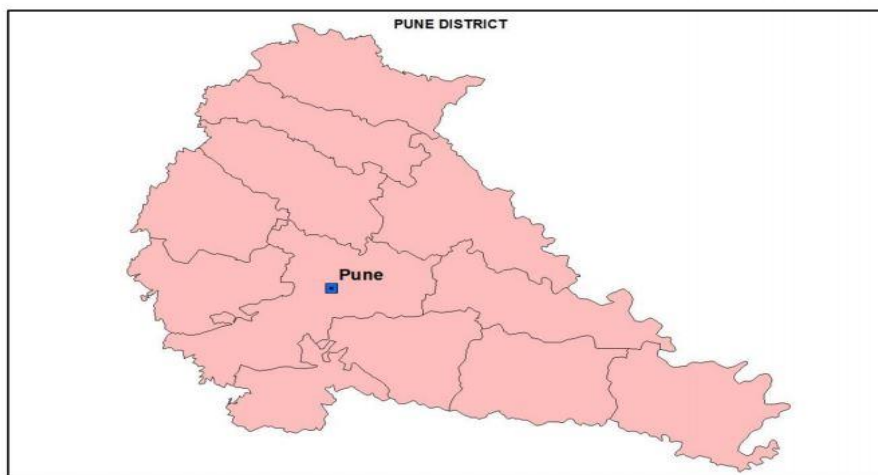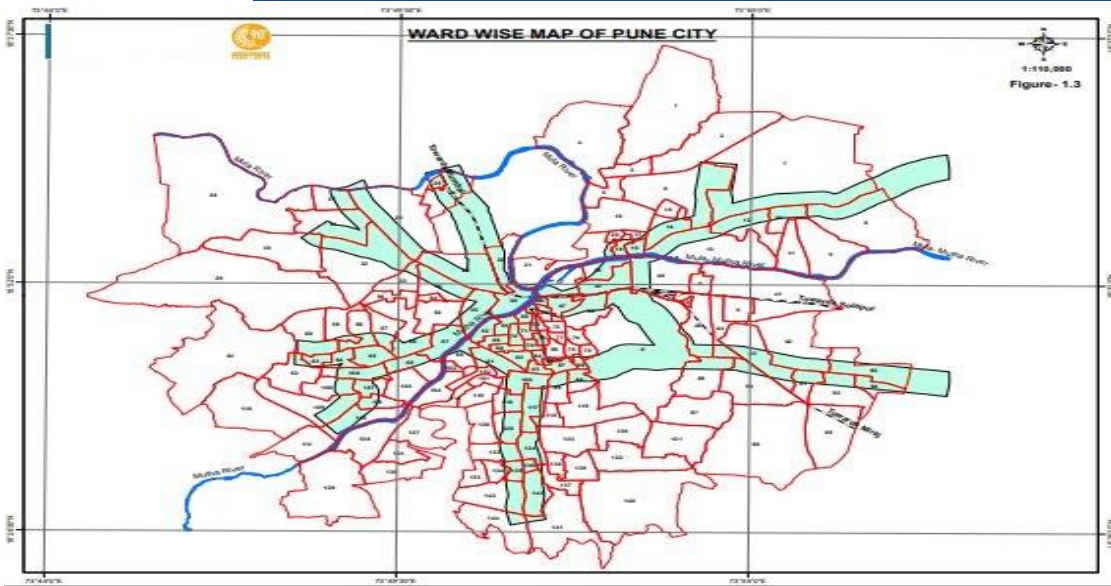


Fig. 1



Fig.2

**Figure 3 Ward Wise Map of Pune City**

The climate on the area is humid subtropical. The spot experiences excessive humidity throughout the wet season with weighty rainfall. There's excessive variation between winter and summer temperatures. The typical optimum as well as total precipitation and minimum temperature of non-commercial place is displayed the fig.4.
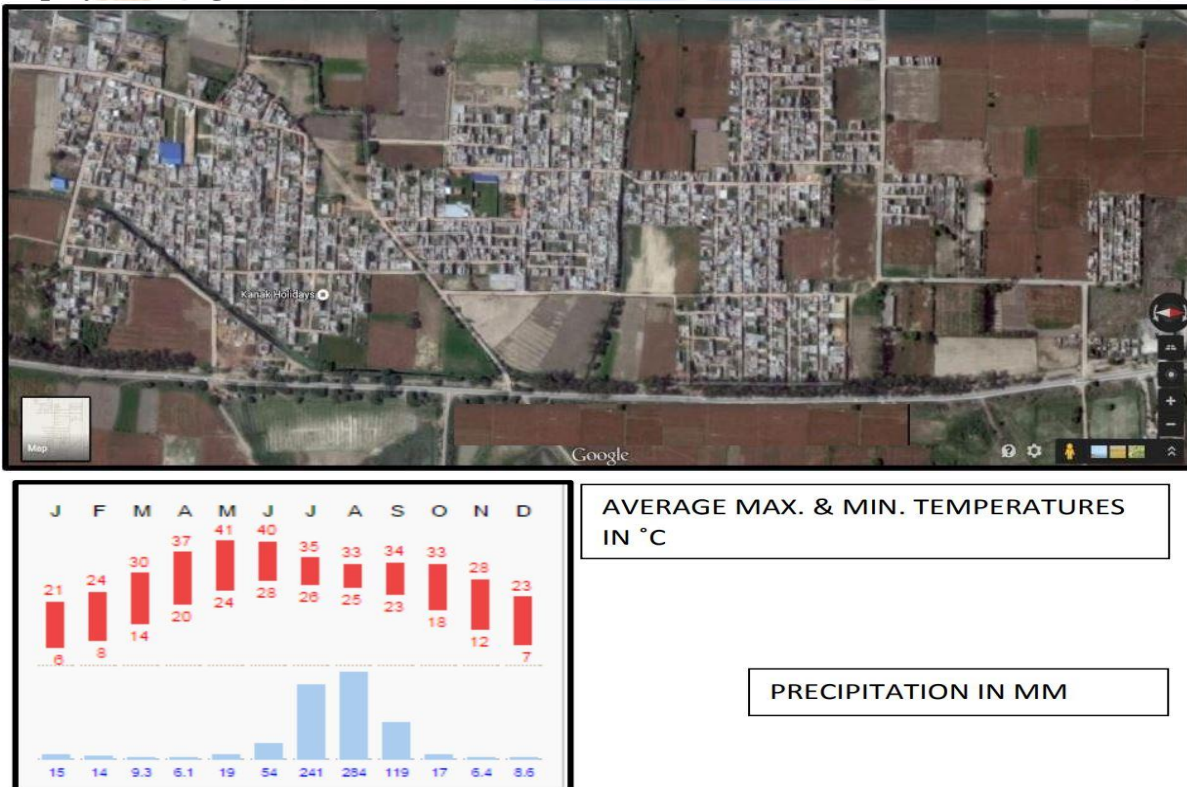




Fig.5

SALIENT DATA : The WDN under study is a dead end system. The salient data of the network are:-

| ITEM | VALUE |
|---|---|
| AREA | 24 Hectares |
| NO. OF PUMPS | 3 |
| DISCHARGE AND HEAD OF PUMP | 2 MGD and 28 m |
| HORSE POWER OF PUMP | 100-150 HP |
| NO. OF OVER HEAD TANK | Nil |
| NO. OF UNDER GROUND RESERVOIR (UGR) | 1 |
| SIZE/VOLUME OF UGR | 10 Million Liters |
| NO. OF CURRENT CONSUMERS | 15480 approx. |
| NO. OF PIPES | 233 |
| MATERIAL OF PIPE | Ductile Iron (DI) |
| DIAMETER OF THE PIPELINE | 100, 200 and 250 mm |
| AGE OF THE WATER SUPPLY NETWORK | Less than 5 years |
| DESIGN PERIOD OF THE NETWORK | 40 Years |
| NO. OF NODES | 215 |
| NO. OF PLOTS | 1935 |
| MAXIMUM HEIGHT ALLOWED TO BE CONSTRUCTED | 15 Meters |

Table.1

## IV. SCOPE OF PROJECT

This particular study was performed by developing different thematic maps as well as integrating a variety of field as well as administrative info of GIS environment. By using the GIS scientific studies as well as EPANET modification on the water distribution network continues to be recommended for much better managing of all of the area. To develop methods for more accurate estimation of demands at nodes In general this particular analysis is going to be useful for the Municipality to aware of the new demands as well as plan the network based on it.

# V.RESULT & DISCUSSION

A water distribution system consists of network of pipes, pumps, reservoirs, valves along with other hydraulic components. In order to analyze the inter-relationship along with numerous elements, a water distribution system is transformed right into a network representation known as water distribution network (WDN) Yang et al... 1996. The purpose of it is supplying sufficient quantity of water to customers inside ample pressure amounts under altering demand problems. The improvement as well as augmentation of water source for Pune is among the submission for urbanized infrastructure of urban areas concentrated under Jawaharlal Nehru National Renewal Mission (JNNURM), community advancement plan, department of metropolitan advancement, Govt. of Maharashtra; 2006 since inadequacy of water supply continues to be labeled as among the weak area.

EPANET - WATER DISTRIBUTION MODELING TOOL

The existing analysis employs EPANET hydraulic simulation software program, that is totally free software created by USEPA, for analysing the water division system. EPANET helps for altering system enter information, operating hydraulic and also liquid quality simulations, as well as looking at the end result within an assortment of platforms. EPANET has a completely furnished as well as extended period of hydraulic evaluation which works with huge methods. Additionally, it supports the simulation of temporarily altering water need, variable or constant speed most pumps, and also the small head losses for fittings and bends. The modelling offers info including passes in pipes, pressures at junctions, propagation of a contaminant, water age, chlorine concentration, as well as substitute situation evaluation. This will help to to calculate pumping cost and energy then unit different kinds of regulators, such as shutoffs, determine pressure regulating as well as flow management.

EPANET utilizes the "Gradient Method" to fix the system hydraulics. The end result from EPANET are accustomed to look into the overall performance on the network depending on the reliability of its. For analysis within this article Hazen William formulation is utilized. Ductile Iron pipes are utilized within the system, thus C = 140 are for the water lines.

# VI.CONCLUSION

The water division system of Sai Enclave, Kothrud Pune happens to be analyzed by using EPANET simulation software program just for the following:
(i) Capacity of WDN to provide water, the capability of its to fulfill the customers for the future water needs of theirs for four decades.
(ii) Effect of public boost along with the reliability of its.
The literature evaluation on the subject emphasized that the water division networks within the urban centres happen to be analyzed thoroughly by the scientists throughout history two years with the special simulation software program and possesses assisted to creating a lot more dependable and also cost-efficient water distribution networks of current occasions. In line with the study and also discussion with this report, below is concluded:-
1. The water need during just one node considered as 0.219 LPS by DJB seems to be insufficient thinking about the anticipated population boost even while per town planning in Pune.
2. The current water distribution system is being employed as intermittent water distribution system. It's in a position to provide water need of up to 156.25 LPCD with present public.
3. The current WDN may rarely gratify the water need of 0.68 LPS within the system for intermittent water source soon after a single ten years out of existing as a the speed of expansion of public.
4. The head reliability RH on the current water distribution network is a lot more compared to 90 % with the water need of up to 112.5 LPCD for existing public for 6 working hours of water supply.
5. The current water source system is suggested for constant water source program in order to cater the existing water need of up to 180 LPCD as well as shall therefore satisfy the water requirements as per the population development of up to three years.
6. The reliability on the current WDN when utilized as constant water source product shall be above 90 % of up to three many years and also shall stay above 70 % within quarter decade as per warm water need at nodes.
7. If the system is extended within the future, it won't have the ability to supply water with adequate head of zone 3 as well as 4.

## Acknowledgement

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