ANALYSIS OF EXISTING WATER DISTRIBUTION SYSTEM OF RAVET AREA AND OPTIMIZATION USING WATERGEMS SOFTWARE

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Abstract: Drinking water is an important element required for the substance of all biotic components. Demand for drinking water is increasing continuously with the corresponding increasing population. This ever-increasing demand can be fulfilled by designing an efficient water distribution network based on advanced computing systems including modern hydraulics and designing software.

In this study, a water distribution network of the Ravet region of Pimpri Chinchwad is analyzed which is located in the district Pune Maharashtra. The water distribution network system from the Ravet area is analyzed and designed with the help of WaterGEMS Software. The WaterGEMS Software analyses the pressure at each node, track the flow of water in each pipe and the height of the water in each tank during simulation. After simulation of the existing water distribution network, result was present and compared water distribution networks are very important for the development of the area as they serve many purpose in addition to the provision of water for human consumption, it directly influence to the nation's development.

IndexTerms: **Analyze, WaterGEMS, Simulation, Network**

I. INTRODUCTION

Water distribution network connects consumers to sources of water using hydraulic components. Water distribution networks consist of a set of pipes hydraulic devices and storage reservoirs. The purpose of a water distribution system is to deliver water from a source in sufficient quantity, quality, and at satisfactory pressure and flow to all individual consumers. A Water supply network may have either branched looped or a combination of the branched and looped type of configuration depending upon the layout of the existing area. The water supply in most Indian cities is only available for a few hours per day, pressure is irregular and the water is of questionable quality.

Bentley system, Incorporated is an American-based software development company that develops, manufactures, licenses sells, and supports computer software and services for the design, construction, and operation of infrastructure. The company's software serves the building, plant, civil and geospatial markets in the area of architecture, engineering, construction, and operations. Their software product is used to design engineer, build and operate large constructed assets such as roadway, railway, bridges, buildings, industrial plants, power plants, and utility networks. The company re-invests 20% of its revenues in research and development WaterGENS provides full geodatabase integration so you can create, display, edit, run, map, and analyze hydraulic models from geospatial environments.

Intermittent water supply, insufficient pressure, and unpredictable services impose both financial and health costs on Indian households. Hydraulic modeling simplifies the analysis of the water distribution system. With its help, the uncertainties in present and future demands can be predicted. Hence the reliability of the water distribution system can be computed and special measures to improve the system can be suggested.

1.1 NEED OF PROJECT:

The study area Ravet comes under the Pimpri Chinchwad city (PCMC). PCMC is one of the fastest developing metro cities. Industries and businesses are growing rapidly around Ravet this intern is resulting in population growth of the town. Drinking water is one of the most requirements for sustaining and decides many development outcomes such as health, livelihoods, and so on so. It is necessary to construct a water distribution network in the Ravet area of PCMC city.

1.2 OBJECTIVES:

- To deliver water to individual consumers with appropriate quantity, quality, and pressure.
- To supply water at a reasonable cost to the users.
- To supply water at convenient points and timings.
- Analyze the existing water distribution system of the Ravet area and to suggest some measures if a present network does not fulfill present and future demands.

1.3 STUDY AREA:

Ravet is located to the northwest of Pune city in Maharashtra, India. The coordinates of the area are 18°38'55.68" N and 73°45'7.92" E.

Pawana Dam is the main source of water, which is 35km away from the city. Presently water is pumped from the headwork at the Ravet from the Pavana river to the water treatment plant(WTP), then from the WTP, treated water is pumped to the ESRs and then distributed.
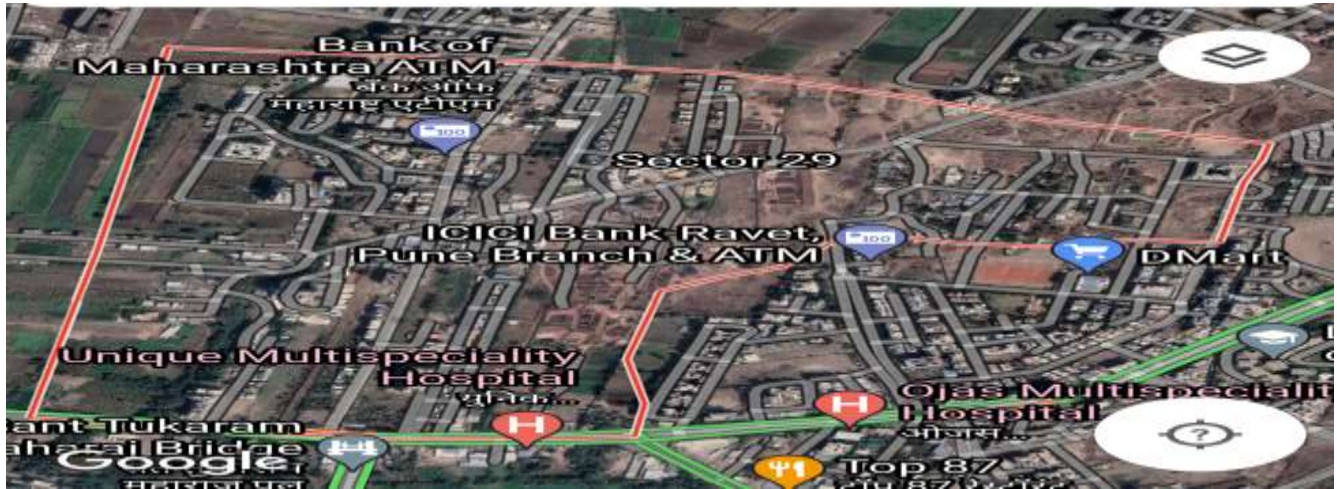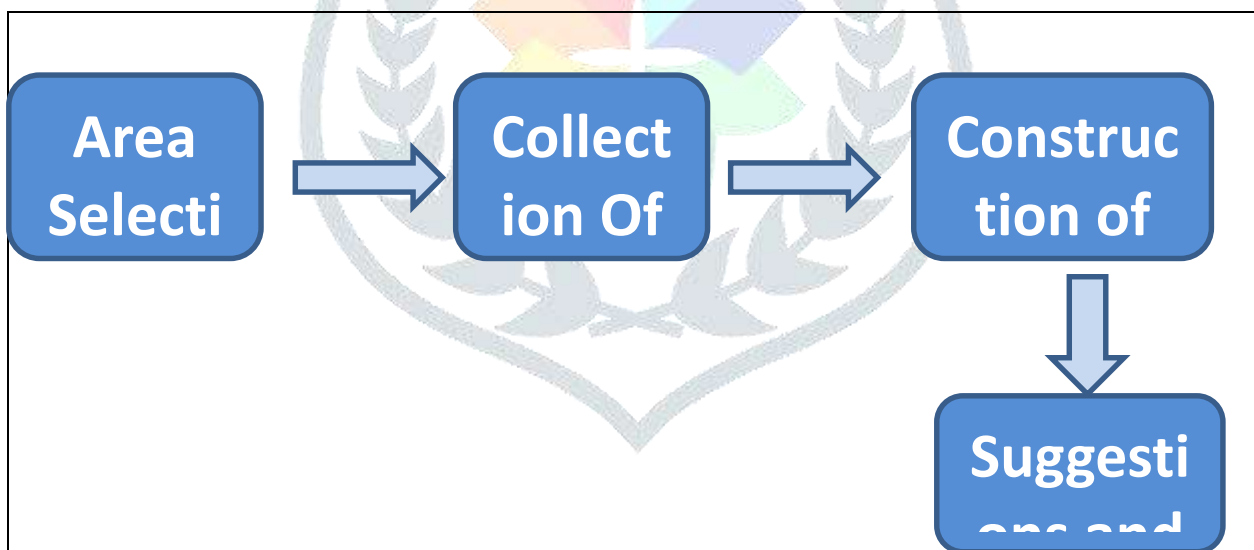

Figure.1 study area

II. METHODOLOGY:

Following steps are carried out to analyze the existing water distribution network using WaterGEMS

Step 1: Selection of study area

As discussed in section no.1.3 Study area is selected to fulfill the objectives.

Step 2: Collection of data

For hydraulic analysis in the WaterGEMS software, all the required data input data was collected from the water treatment plant, Nigadi. Pipe data such as pipe diameter (mm), C-value, and length (m) are assigned to the network.ESRs details such as capacity, elevation, demand, etc. Are assigned. Table 2.1 shows input data for ESRs, Figure 1 shows the existing network of water distribution network system of Ravet, Figure 2 shows the description of pipes used in network

Table 2.1: Input data for ESRs

Details	Units	ESR No.173	ESR NO.174
Capacity	ML	2	2.20
Elevation	M	584	585
Diameter	M	23.8	25
Max. Population serving	-	48733	53833
Max. serving demand	MLD	8.60	9.50

Figure 1. Existing network of water distribution system

Figure 2. Description of pipe

Step 3: Construction of Model and its run

Model is constructed using WaterGEMS software by giving all the necessary inputs as mentioned in step no.2.Figure 3 shows the constructed network of the water distribution system. Figure 3 shows the junction table it shows pressure, demand, hydraulic grade at the different junction.
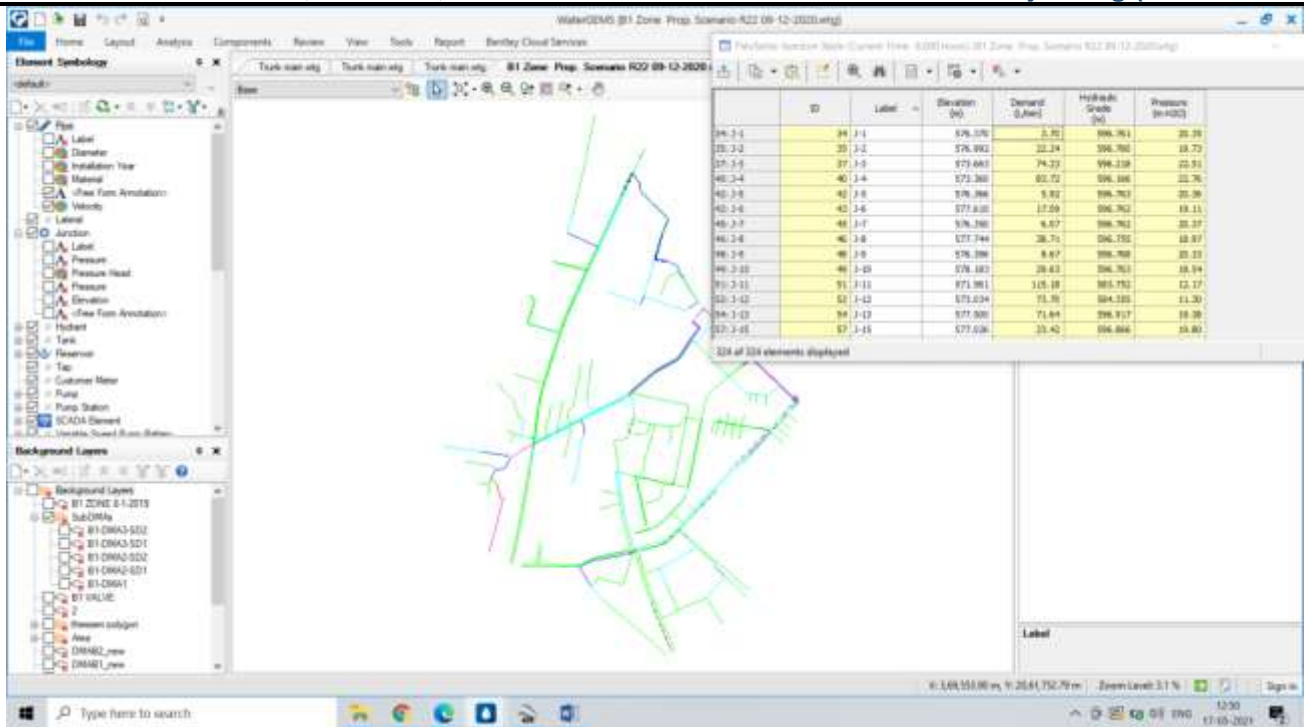
Figure 3. Pressure table for different junctions

Step 4: Suggestion

Additional storage will be required. Due to infrastructure development. Figure 4 shows a designed network that fulfills future demands.
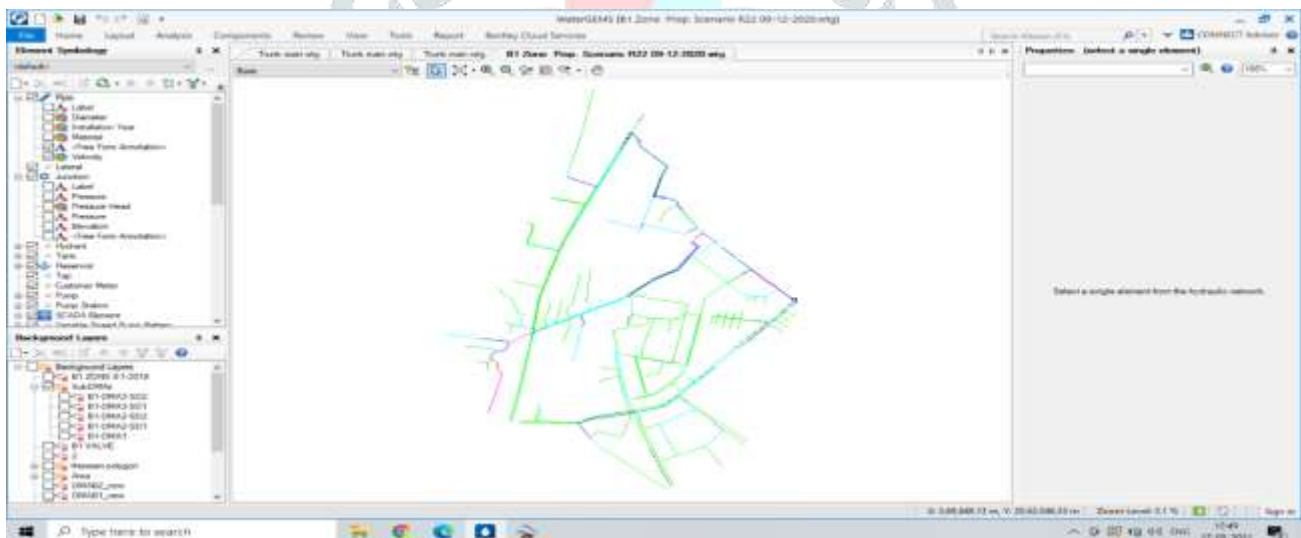

Figure 4. Designed water distribution network

III. RESULT:

1. This project is being implemented to improve the water supply system to minimize leakage and optimize the water availability to the consumer.
2. The existing system of water supply is facing problems like a higher rate of leakage, poor maintenance, poor customer service, and poor quality of water with differ.
3. The result obtained verified that the pressure at all junction and the flows with their velocities at all pipes are feasible enough to provide adequate water to network of study area.
4. From the above paper and data, we came to know about the basic knowledge of how to use WATERGEMS software and how it works. Almost all the author who works on the software gives the output as a comparison between already existing WDN and virtual WDN. If we are careful at giving the input data i.e. diameter, length, elevation, demand to the WDN in

the software and simulation will be successful and errors can be avoided as much as possible. Loop ends also want to kept in mind while designing the network. According to the location of the loop ends only the networks should be manipulated.

IV. Conclusion:

- The purpose of the present study is to analyze and optimization of a water distribution network for the Ravet zone of the PCMC area.

- After analysis, it was found that additional storage for the intermediate stage is required.

- In this study, it is observed that Watergems software is most suitable, easy to use, and accurate for the design and analysis of large water distribution systems.

- The software also gives different optimal design solutions considering pipe diameters and pipe materials.

- The Watergems software provides the required standard and economical environment for the design, analysis, and troubleshooting of new and existing supply networks with accuracy and minimum time duration.

- The software is also used for solving problems in the existing network and also in the expansion of the existing water supply network.

V. ACKNOWLEDGMENT:

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